



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 2023 Scheme)

Bachelor of Engineering (B.E)

in

COMPUTER SCIENCE AND ENGINEERING

S. S. Swamy

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

H. M. Rajeshwari Swam

Dean Academic
Global Academy of Technology,
Rajarajeshwarinagar, Bengaluru-560098

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.

S. S. Sharma

Document to be kept
in the library of the
Institution for reference
only.



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 2024-25)



III 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
1	BS	MAT23301A	Discrete Mathematics and Graph Theory	TD: MAT, PSB: MAT	2	2	0		03	50	50	100	3	
2	PCC	CSE23302	Data Structures	TD: CSE, PSB: CSE	3	0	0		03	50	50	100	3	
3	IPCC	CSE23303	Digital Logic Design and Computer Organization	TD: CSE, PSB: CSE	3	0	2		03	50	50	100	4	
4	PCC	CSE23304	Operating Systems	TD: CSE, PSB: CSE	3	0	0		03	50	50	100	3	
5	ESC/ ETC/ PLC	CSE23305x	ESC/ETC/PLC	TD: CSE, PSB: CSE	If the course is theory				03	50	50	100	3	
					3	0	0							
					If the course is lab									
					2	0	2							
6	MC	SCK23306	Social Connect and Responsibility	Any Department	0	0	2		03	100	-	100	1	
7	AEC	CSE23307x	Ability Enhancement Course/Skill Development Course - I	TD: CSE, PSB: CSE	1	0	2		03	50	50	100	2	
8	MC	NSK23308	National Service Scheme (NSS)	NSS coordinator	0	0	2		02	100	-	100	0	
		PEK23308	Physical Education (PE) (Sports and Athletics)	Physical Education Director										
		YOK23308	Yoga	Yoga Teacher										
9	PCCL	CSEL23309	Data Structures Lab	TD: CSE, PSB: CSE	0	0	2		03	50	50	100	1	
Total											550	350	900	20

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H. N. Rajarajeshwarinagar
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Rajarajeshwarinagar, Bengaluru-98

Engineering Science Course (ESC/ETC/PLC)			
CSE23305A	Object Oriented Programming with C++	CSE23305C	Julia
CSE23305B	Programming with Python	CSE23305D	Ethics and Public Policy for AI
Ability Enhancement Course – I			
CSE23307A	Data Analytics with Excel	CSE23307C	Introduction to Web Technologies
CSE23307B	Project Management with Git	CSE23307D	Scala
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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IV 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	BS	MAT23401A	Probability and Linear Algebra	TD: MAT, PSB: MAT	2	2	0		03	50	50	100	3					
2	PCC	CSE23402	Design and Analysis of Algorithms	TD: CSE, PSB: CSE	3	0	0		03	50	50	100	3					
3	IPCC	CSE23403	Object Oriented Programming with Java	TD: CSE, PSB: CSE	3	0	2		03	50	50	100	4					
4	PCC	CSE23404	Theory of Computation	TD: CSE, PSB: CSE	3	0	0		03	50	50	100	3					
5	ESC/ ETC/ PLC	CSE23405x	ESC/ETC/PLC	TD: CSE, PSB: CSE	If the course is theory				03	50	50	100	3					
					3	0	0											
					If the course is lab													
					2	0	2											
6	UHV	UHK23406	Universal Human Values	Any Department	1	0	0		03	50	50	100	1					
7	AEC	CSE23407x	Ability Enhancement Course/Skill Development Course - II	TD: CSE, PSB: CSE	1	0	2		03	50	50	100	2					
8	MC	NSK23408	National Service Scheme (NSS)	NSS coordinator	0	0	2		02	100	-	100	0					
		PEK23408	Physical Education (PE) (Sports and Athletics)	Physical Education Director														
		YOK23408	Yoga	Yoga Teacher														
9	PCCL	CSEL23409	Algorithms Laboratory	TD: CSE, PSB: CSE	0	0	2		03	50	50	100	1					
Total															500	400	900	20

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Engineering Science Course (ESC/ETC/PLC)			
CSE23405A	Unix Programming	CSE23405C	R Programming
CSE23405B	Game Theory	CSE23405D	Optimization Technique
Ability Enhancement Course – II			
CSE23407A	UX/UI	CSE23407C	LEX-A Tool for Lexical Analysis
CSE23407B	Full Stack Framework (Front End)	CSE23407D	Technical Writing using LATEX
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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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	CSE23501	Software Engineering and Project Management	TD: CSE, PSB: CSE	3	0	0		03	50	50	100	3
2	IPCC	CSE23502	Database Management Systems	TD: CSE, PSB: CSE	2	2	2		03	50	50	100	4
3	PCC	CSE23503	Computer Networks	TD: CSE, PSB: CSE	3	2	0		03	50	50	100	4
4	PCCL	CSE23504	Full Stack Framework (Back End)	TD: CSE, PSB: CSE	0	0	2		03	50	50	100	1
5	PEC	CSE23505x	Professional Elective - I	TD: CSE, PSB: CSE	3	0	0		03	50	50	100	3
6	PROJ	CSEP23506	Mini Project	TD: CSE, PSB: CSE	0	0	4		03	100	-	100	2
7	AEC	RMIK23507	Research Methodology and IPR	Any Department	2	2	0		03	50	50	100	3
8	MC	CIVK23508	Environmental Studies	TD: CV, PSB:CV	2	0	0		02	50	50	100	2
9	MC	NSK23509	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	-	100	0
		PEK23509	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		YOK23509	Yoga	Yoga Teacher									
Total										550	350	900	22

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Professional Elective Course - I			
CSE23505A	Computer Graphics	CSE23505C	Data Visualization
CSE23505B	Robotic Process Automation	CSE23505D	Distributed Systems
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.			
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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VI SEMESTER

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	
1	IPCC	CSE23601	Cloud Computing	TD: CSE PSB: CSE	2	2	2		03	50	50	100	4
2	PCC	CSE23602	Machine Learning	TD: CSE PSB: CSE	3	2	0		03	50	50	100	4
3	PEC	CSE23603x	Professional Elective - II	TD: CSE PSB: CSE	3	0	0		03	50	50	100	3
4	OEC	CSE23604x	Open Elective - I	TD: CSE PSB: CSE	3	0	0		03	50	50	100	3
5	PROJ	CSEP23605	Major Project Phase - I	TD: CSE PSB: CSE	0	0	4		03	100	--	100	2
6	PCCL	CSEL23606	Machine Learning Lab	TD: CSE PSB: CSE	0	0	2		03	50	50	100	1
7	AEC/ SDC	CSE23607x	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	NSK23608	National Service Scheme (NSS)	NSS coordinator	0	0	2		100	---	100	0	
		PEK23608	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		YOK23608	Yoga	Yoga Teacher									
9	IKS	IKSK23609	Indian Knowledge System		1	0	0		01	100	0	100	0
									Total	600	300	900	18

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Professional Elective Course			
CSE23603A	Blockchain Technology	CSE23603C	Computer Vision
CSE23603B	Compiler Design	CSE23603D	Advanced Java
Open Elective Course			
CSE23604A	Introduction to Data Structures	CSE23604C	Mobile Application Development
CSE23604B	Fundamentals of Operating Systems	CSE23604D	Introduction to AI
Ability Enhancement Course / Skill Enhancement Course - III			
CSE23607A	Android App Development	CSE23607C	Selenium Testing
CSE23607B	MongoDB	CSE23607D	DevOps
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. PROJ: Project Phase -I, OEC: Open 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.			
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)

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	CSE23701	Deep Learning	TD: CSE PSB: CSE	3	0	2		03	50	50	100	4
2	IPCC	CSE23702	Cryptography & Network Security	TD: CSE PSB: CSE	3	0	2		03	50	50	100	4
3	PCC	CSE23703	Internet of Things	TD: CSE PSB: CSE	3	2	0		03	50	50	100	4
4	PEC	CSE23704x	Professional Elective-III	TD: CSE PSB: CSE	3	0	0		03	50	50	100	3
5	OEC	CSE23705x	Open Elective- II	TD: PSB:	3	0	0		01	50	50	100	3
6	PROJ	CSEP23706	Major Project Phase-II	---	0	0	12		03	100	100	200	6
Total										400	300	700	24

Professional Elective Course

CSE23704A	Data Warehousing Techniques	CSE23704C	Augmented Reality and Virtual Reality
CSE23704B	Natural Language Processing	CSE23704D	Big Data Analytics

Open Elective Course

CSE23705A	Introduction to DBMS	CSE23705C	Software Engineering
CSE23705B	Introduction to Algorithms	CSE23705D	Introduction to Networks

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PCC: Professional Core Course, **PCCL:** Professional Core Course laboratory, **PEC:** Professional Elective Course, **OEC:** Open Elective Course **PR:** Project Work, **L:** Lecture, **T:** Tutorial, **P:** Practical **S= SDA:** Skill Development Activity, **CIE:** Continuous Internal Evaluation, **SEE:** Semester End Evaluation. **TD-** Teaching Department, **PSB:** Paper Setting department, **OEC:** Open Elective Course, **PEC:** Professional Elective Course. **PROJ:** Project work

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

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

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

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

Open Elective Courses:

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

PROJECT WORK: The objective of the Project work is

- (i) To encourage independent learning and the innovative attitude of the students.
- (ii) To develop interactive attitude, communication skills, organization, time management, and presentation skills.
- (iii) To impart flexibility and adaptability.
- (iv) To inspire team working.
- (v) To expand intellectual capacity, credibility, judgment and intuition.
- (vi) To adhere to punctuality, setting and meeting deadlines.
- (vii) To install responsibilities to oneself and others.
- (viii) To train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involve 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- VIIISEMESTER (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			
					Theor y	Tutorial	Practical / Drawin	Self-Study		Duration in hours	CIE Marks	SEE Marks	Total Marks
					L	T	P	S					
1	PEC	CSE23801x	Professional Elective -IV (Online Courses)	TD: CSE PSB: CSE	3	0	0			03	50	50	100
2	OEC	CSE23802x	Open Elective - III (Online Courses)	TD: CSE PSB: CSE	3	0	0			03	50	50	100
3	INT	CSEI23803	Internship (Industry/Research) (14 - 20 weeks)	---	0	0	12			03	100	100	200
Total											200	200	400

Professional Elective Course (Online courses)

CSE23801A	BOS will publish courses based on the availability	CSE23801C	BOS will publish courses based on the availability
CSE23801B	BOS will publish courses based on the availability	CSE23801D	BOS will publish courses based on the availability

Open Elective Courses (Online Courses)

CSE23802A	BOS will publish courses based on the availability	CSE23802C	BOS will publish courses based on the availability
CSE23802B	BOS will publish courses based on the availability	CSE23802D	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 upliftment.

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

With the consent of the internal guide and Principal of the Institution, students shall be allowed to carry out the internship at their hometown (**within or outside the state or abroad**), provided favorable facilities are available for the internship and the student remains regularly in contact with the internal guide. **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.

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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	
1	PCC	CSE23701	Deep Learning To be completed in 5th /6th semester	TD: CSE PSB: CSE	3	0	2		03	50	50	100	4
2	PCC	CSE23702	Cryptography & Network Security To be completed in 5th /6th semester	TD: CSE PSB: CSE	3	0	2		03	50	50	100	4
3	PCC	CSE23703	Internet of Things To be completed in 6th semester	TD: CSE PSB: CSE	4	0	0		03	50	50	100	4
4	PEC	CSE23714x	Professional Elective Course (MOOC Courses)	TD: CSE PSB: CSE	3	0	0		03	50	50	100	3
5	OEC	CSE23755x	Open Elective Courses (MOOC courses)	TD: CSE PSB: CSE	3	0	0		01	50	50	100	3
1	PEC	CSE23801x	Professional Elective -IV (Online Courses)	TD: CSE PSB: CSE	3	0	0		03	50	50	100	3
2	OEC	CSE23802x	Open Elective - III (Online Courses)	TD: CSE PSB: CSE	3	0	0		01	50	50	100	3
3	PROJ	CSEP23883	Project – Outcome of Training	TD: CSE PSB: CSE	0	0	12		03	100	100	200	8
4	INT	CSEI23804	Internship (Industry/Research) (02 semesters)	TD: CSE	0	0	12		03	100	100	200	10
Total									550	550	1100	42	

Signature

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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 and 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	
1	IPCC	CSE23601	Cloud Computing	TD: CSE PSB: CSE	3	0	2		03	50	50	100	3
2	PCC	CSE23602	Machine Learning	TD: CSE PSB: CSE	3	0	0		03	50	50	100	4
3	PEC	CSE23603x	Professional Elective - II	TD: CSE PSB: CSE	4	0	0		03	50	50	100	3
4	OEC	CSE23604x	Open Elective - I	TD: CSE PSB: CSE	3	0	0		03	50	50	100	3
5	PCCL	CSEL23605	Machine Learning Lab	TD: CSE PSB: CSE	0	0	2		01	50	50	100	1
6	AEC	CSEL23606X	Ability Enhancement Course/Skill Development Course V	TD: CSE PSB: CSE	If the course is offered as a Theory				03	50	50	100	2
					2	0	0						
					If course is offered as a practical								
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					01				
8	IKS	IKSK23608	Indian Knowledge System	Any Department	0	0	12		03	100	0	100	0
Total									500	300	800	16	

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SYLLABUS

III SEMESTER

Sk. Saam

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

DISCRETE MATHEMATICS AND GRAPH THEORY (MATHEMATICS FOR CSE STREAM)

Course Code	MAT23301A	CIE Marks	50
Hours/Week (L: T: P)	2:2:0	SEE Marks	50
Total Hours	40	Examination Hours	3 Hours
No. of Credits	3		

Course Objectives:

To enable students to apply the knowledge of Mathematics in fields of computer science and allied branches by making them to learn:

CLO1	Counting Principles
CLO2	Mathematical Logic and Set Theory
CLO3	Relations and Functions
CLO4	Graph Theory

CONTENTS	# of Hours
MODULE 1 The Rules of Sum and Product, The Pigeon-hole Principle, Permutations, Combinations, The Binomial Theorem, Combinations with Repetition.	08
MODULE 2 Sets and Subsets, Set operations and Laws of Set Theory. Counting and Venn Diagrams. Probability, Conditional probability and Bayes Theorem.	08
MODULE 3 Basic Connectives and Truth Tables, Logical Equivalence: The Laws of Logic, Logical Implications: Rules of Inference. Quantifiers, Definitions and the Proofs of Theorems.	08
MODULE 4 Relations and properties of relations, Representation of relations. Equivalence Relations and Partitions. Functions, Types of Functions, Function Composition and Inverse Functions.	08
MODULE 5 Graphs, Subgraphs, Complements, and Graph Isomorphism, Vertex Degree, Euler Trails and Circuits. Planar Graphs, Trees and Rooted Trees.	08

Text Books:

1. Ralph P. Grimaldi: Discrete and Combinatorial Mathematics, 5th Edition, Pearson Education. 2020.

Reference Books:

1. Kenneth H. Rosen: Discrete Mathematics and its Applications, 6th Edition, McGraw Hill, 2007

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Course Outcomes:

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

CO1	- Understand the fundamental principles of counting, including the rules of sum and product. - Use the Pigeon-hole principle to solve problems involving the distribution of objects - Apply permutations and combinations to solve counting problems - Derive the formula for the binomial coefficients and understand their properties
CO2	- Solve problems involving the application of set operations and the use of laws of set theory - Solve counting problems using Venn diagrams and set-theoretic techniques. - Solve problems involving the calculation of probabilities and conditional probabilities - Apply Bayes' theorem to calculate the posterior probability of an event given the prior probability and conditional probabilities
CO3	- Solve problems involving the evaluation of logical statements using truth tables. - Solve problems that involve the use of logical equivalence and the laws of logic. - Apply the rules of inference to draw valid conclusions from logical premises. - Solve problems that involve the use of quantifiers and the manipulation of quantified statement - Establish the validity of mathematical and logical statements using different methods of proofs
CO4	- Solve problems involving the manipulation and analysis of relations and their properties - Solve problems that involve the determination of equivalence relations and the corresponding partitions. - Perform operations on functions, including function composition and the determination of inverse functions.
CO5	- Solve problems involving the analysis and manipulation of graphs, subgraphs, and their complements. - Understand the concepts of degree of a vertex, Euler trails and Euler circuits - Understand the properties of Planar graphs and also determine whether a given graph is planar. - Understand the concept of a trees and rooted tree and its related terminologies.

Mapping of CO-PO:

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

Low-1: Medium-2: High-3

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DATA STRUCTURES
(Common to CSE /ISE/AD/AM/CI)

Course Code	CSE23302	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 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

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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

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DIGITAL LOGIC DESIGN AND COMPUTER ORGANIZATION

Course Code	CSE23303	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	3 Hours
No. of Credits	4		

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.
CLO4	Understand the working of Registers and counters.
CLO5	Understand the basic sub systems of a computer, their organization, structure and perform arithmetic operations on binary numbers.

CONTENTS	# of Hours
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.	08
MODULE 2 Data processing circuits: Adders, Subtractors, Code Converter, Magnitude Comparator, Multiplexers, Demultiplexers Encoders, Decoders, Programmable Array Logic, Programmable logic Arrays.	08
MODULE 3 Sequential Logic: Introduction to Flip-Flops, Types of Flip flops, Various Representation of Flip-Flops, JK Master-slave Flip-Flop, Flip-Flops Turning, Switch Contact Bounce Circuits.	08
MODULE 4 Registers: Types of Registers. Serial In - Serial Out, Serial In - Parallel out. Parallel In Serial Out, Parallel In - Parallel Out, Applications of Shift Registers. Counters: Asynchronous Counters, Synchronous Counters, Counter Design as a Synthesis problem.	08
MODULE 5 Machine Instructions and Programs: Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes, Assembly Language. Arithmetic: Numbers, Arithmetic Operations and Characters, Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed Operand Multiplication, Fast Multiplication- Bit-pair recoding of multipliers, Integer Division.	08

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Laboratory Component

Note:

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 ($n \leq 9$).
10. Design and implement a pseudo-random sequence generator using shift register IC7495.

Demonstration using virtual lab:

Website: <https://www.vlab.co.in/>

1. Representation of Integers and their Arithmetic
2. Floating Point Numbers Representation

Course Outcomes:

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

CO1	Illustrate the minimization of combinational logic expressions using K-map and Quine McCluskey methods
CO2	Interpret different combinational logic circuits like Adders, Subtractors, Multiplexers, Decoders and programmable Logic Arrays
CO3	Explain the working of Flip Flops
CO4	Implement the Registers and Counters
CO5	Explain the basic structure of computers, machine instructions & addressing modes and perform arithmetic operations on binary numbers

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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.

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:

Computer Organization & Architecture - William Stallings, <http://home.ustc.edu.cn/louwenqi/reference-books-%20William%20Stallings.pdf>

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	-	-	-	-	-	1	-	-	-	1
CO2	3	2	2	-	2	-	-	-	-	1	-	-	-	1
CO3	3	2	2	-	2	-	-	-	-	1	-	-	-	1
CO4	2	1	2	-	-	-	-	-	-	-	-	-	-	1
CO5	2	1	-	-	-	-	-	-	-	-	-	-	-	1
Average	3	2	2	1	2	-	-	-	-	1	-	-	-	1

Low-1: Medium-2: High-3

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OPERATING SYSTEMS

Course Code	CSE23304	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 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

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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

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OBJECT ORIENTED PROGRAMMING WITH C++

Course Code	CSE23305A	CIE Marks	50
Hours/Week (L: T: P)	2:0:2	SEE Marks	50
Total Hours	25+15	Examination Hours	3
No. of Credits	3		

Course Learning Objectives:

The course will enable students to:

CLO1	To understand object-oriented programming using C++ and Gain knowledge about the capability to store information together in an object
CLO2	To illustrate the capability of a class to rely upon another class and functions
CLO3	To Create and process data in files using file I/O functions
CLO4	To understand the generic programming features of C++ including Exception handling

CONTENTS	# of Hours
MODULE 1 An overview of C++: What is object-Oriented Programming? Introducing C++ Classes, The General Form of a C++ Program. Classes and Objects: Classes, Friend Functions, Friend Classes, Inline Functions, Parameterized Constructors, Static Class Members, When Constructors and Destructors are Executed, The Scope Resolution Operator, Passing Objects to functions, Returning Objects, Object Assignment	05
MODULE 2 Arrays, Pointers, References, and the Dynamic Allocation Operators: Arrays of Objects, Pointers to Objects, The this Pointer, Pointers to derived types, Pointers to class members. Functions Overloading, Copy Constructors: Functions Overloading, Overloading Constructor Functions. Copy Constructors, Default Function Arguments, Function Overloading and Ambiguity.	05
MODULE 3 Operator Overloading: Creating a Member Operator Function, Operator Overloading Using a Friend Function, Overloading new and delete Inheritance: Base-Class Access Control, Inheritance and Protected Members, Inheriting Multiple Base Classes, Constructors, Destructors and Inheritance, Granting Access, Virtual Base Classes	05
MODULE 4 Virtual Functions and Polymorphism: Virtual Functions, The Virtual Attribute is Inherited, Virtual Functions are Hierarchical, Pure Virtual Functions, Using Virtual Functions, Early vs Late Binding. Templates: Generic Functions, Applying Generic Functions, Generic Classes. The type name and export Keywords. The Power of Templates	05
MODULE 5 Exception Handling: Exception Handling Fundamentals, Handling Derived-Class Exceptions, Exception Handling Options, Applying Exception Handling. The C++ I/O System Basics: C++ Streams, The C++ Classes, Formatted I/O File I/O: and File Classes, Opening and Closing a File, Reading and Writing Text Files, Detecting EOF.	05

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Laboratory Component
List of Programs

Implement the following programs using DevC++

1	Develop a C++ program to find the largest of three numbers.
2	Develop a C++ program to sort the elements in ascending and descending order.
3	Develop a C++ program using classes to display student name, roll number, marks obtained in two subjects and total score of student.
4	Develop a C++ program for a bank employee to print name of the employee, account_no. & balance. Print invalid balance if amount.
5	Develop a C++ program to demonstrate function overloading for the following prototypes. add(int a, int b) add(double a, double b)
6	Develop a C++ program using Operator Overloading for overloading Unary minus operator.
7	Develop a C++ program to implement Multiple inheritance for performing arithmetic operation of two numbers.
8	Develop a C++ program using Constructor in Derived classes to initialize alpha, beta and gamma and display corresponding values.
9	Develop a C++ program to create a text file, check file created or not, if created it will write some text into the file and then read the text from the file.
10	Develop a C++ program to write and read time in/from binary file using fstream.
11	Develop a function which throws a division by zero exception and catch it in catch block. Write a C++ program to demonstrate usage of try, catch and throw to handle exception.
12	Develop a C++ program that handles array out of bounds exception using C++.

Course Outcomes:

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

CO1	Demonstrate the concepts of control structures through C++Programming
CO2	Implement C++ programs using functions and strings
CO3	Apply the concepts of file handling
CO4	Illustrate exception handling mechanism

Text Books:

1. Herbert Schildt, The Complete Reference C++, 4 th edition, TMH, 2005

Reference Books:

1. Balagurusamy E, Object Oriented Programming with C++, Tata McGraw Hill Education Pvt.Ltd., Sixth Edition 2016.
2. Bhawe , “ Object Oriented Programming With C++”, Pearson Education , 2004.
3. A K Sharma , “Object Oriented Programming with C++”, Pearson Education, 2014.

E-Books / Web References:

1. <https://www.py4e.com/lessons>
2. <https://python-3-patterns-idioms-test.readthedocs.io/en/latest/index.html>
3. <https://static.realpython.com/python-basics-sample-chapters.pdf>

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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	-	2	3	-
CO2	3	3	3	-	-	-	-	2	-	3	-	2	3	-
CO3	3	3	3	-	-	-	-	2	-	3	-	2	3	-
CO4	3	3	3	-	-	-	-	2	-	3	-	2	3	-
Average	3	3	3	-	-	-	-	2	-	3	-	2	3	-

Low-1: Medium-2: High-3

Sheswamy

PROGRAMMING WITH PYTHON

Course Code	CSE23305B	CIE Marks	50
Hours/Week (L: T: P)	2:0:2	SEE Marks	50
Total Hours	25+15	Examination Hours	3
No. of Credits	3		

Course Learning Objectives:

The course will enable students to:

CLO1	Learn the syntax and semantics of Python Programming Language
CLO2	Write Python functions to facilitate code reuse and manipulate strings
CLO3	Illustrate the process of structuring the data using lists, tuples and dictionaries
CLO4	Demonstrate the use of built-in functions in handling the files
CLO5	Use Python programming concepts to handle spreadsheet operations

CONTENTS	# of Hours
MODULE 1 Introduction, Python Basics: Entering Expressions into the Interactive Shell, The Integer, Floating-Point, and String Data Types, String Concatenation and Replication, Storing Values in Variables, Your First Program. Flow control: Boolean Values, Comparison Operators, Boolean Operators, Mixing Boolean and Comparison Operators, Elements of Flow Control, Program Execution, Flow Control Statements, Importing Modules, Ending a Program Early with sys.exit().	05
MODULE 2 Functions: def Statements with Parameters, Return Values and return Statements, The None Value, Exception Handling, A short program : Guess the Number. Lists: The List Data Type, Working with Lists, Augmented Assignment Operators, Methods.	05
MODULE 3 Dictionaries and Structuring Data: The Dictionary Data Type, Pretty Printing, Using Data Structures to Model Real-World Things. Manipulating Strings: Working with Strings, Useful String Methods, Project: Password Locker.	05
MODULE 4 Pattern Matching with Regular Expressions: Finding Patterns of Text without Regular Expressions, Finding Patterns of Text with Regular Expressions, More Pattern Matching with Regular Expressions, Greedy and Nongreedy Matching, The findall() Method, The Caret and Dollar Sign Characters, The Wildcard Character.	05
MODULE 5 Reading and Writing Files: Files and File Paths, The os.path Module, The File Reading/Writing Process, Saving Variables with the shelve Module. Working with Excel Spreadsheets: Excel Documents, Installing the openpyxl Module, Reading Excel Documents, Project: Reading Data from a Spreadsheet, Writing Excel Documents, Project: Updating a Spreadsheet, Setting the Font Style of Cells, Font Objects, Formulas, Adjusting Rows and Columns, Charts.	05

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Laboratory Component List of Programs

Implement the following programs using Pycharm

1	a) Krishna and his five friends have decided to go for an industrial visit by sharing the expenses of the fuel equally. Write a Python program to calculate the amount (in Rs) each of them needs to put in for the complete journey. The program should also display True, if the amount to be paid by each person is divisible by 3, otherwise it should display False. Hint: Use the relational operators in print statement. Assumptions: Assume that mileage of the vehicle, amount per liter of fuel and distance for one way are given. b) Write a Python program to input a number and count the number of digits in it using while loop.
2	Write a function named collatz() that has one parameter named number. If number is even, then collatz() should print number // 2 and return this value. If number is odd, then collatz() should print and return 3 * number + 1. Then write a program that lets the user type in an integer and that keeps calling collatz() on that number until the function returns the value 1.
3	Write a python program to guess a random number between 1 and 20 using function. The maximum number of trials is 5.
4	Given the following List. <pre>spam = ['apples', 'bananas', 'tofu', 'cats']</pre> Write a function in Python that takes a list value as an argument and returns a string with all the items separated by a comma and a space, with and inserted before the last item. For example, the function returns 'apples, bananas, tofu, and cats'. The function should be able to work with any list value passed to it.
5	1. The data structure to model the player's inventory is a dictionary where the keys are string values describing the item in the inventory and the value is an integer value detailing how many of that item the player has. An Example is as shown. <pre>stuff = {'rope': 1, 'torch': 6, 'gold coin': 42, 'dagger': 1, 'arrow': 12}</pre> means the player has 1 rope, 6 torches, 42 gold coins, and so on. Write a Python function named displayInventory() that would take any possible "inventory" and display it like the following: <pre>Inventory: 12 arrow 42 gold coin 1 rope 6 torch 1 dagger Total number of items: 62</pre> 2. Write a Python program to demonstrate pretty printing.
6	a) Write a Python program to find and print the longest word in the given string. The method split() can be used for the purpose. b) Write a Python program to add 'ing' at the end of a given string (length should be at least 3). If the given string already ends with 'ing' then add 'ly' instead. If the string length of the given string is less than 3, leave it unchanged.

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7	Write a Python program to validate Name of a person using Regular Expression. The format for entering name is as follow: • Mr. or Mrs. or Ms. (Either one) followed by a single space • First Name, followed by a single space • Middle Name(optional), followed by a single space • Last Name(optional)																																																												
8	Write a Python program to read contents from demo.txt, count and print the words which are starting with lowercase letter.																																																												
9	Write a Python program to create an excel file called test.xlsx with the following output. • A1 cell has the text 'Python Programming', font color is magenta (color code 'FF00FF'), font name is 'Arial', size is 18, make the text Bold, Italic and double Underline. • D2 cell has the text 'Working with spreadsheets', font color is blue (color code '0000FF'), font name is 'Calibri', size is 12, make the text Bold. • A5 cell has the text 'We need to import openpyxl to work with spreadsheets', font style is 'Cambria', size is 16, color is Red (color code 'FF0000'), make the statement bold.																																																												
10	Write a Python program to create a Barchart in Excel Spreadsheet. <table border="1"><thead><tr><th></th><th>A</th><th>B</th><th>C</th><th>D</th></tr></thead><tbody><tr><td>1</td><td>PID</td><td>Name</td><td>Cost</td><td>Qty</td></tr><tr><td>2</td><td></td><td>1 Pen</td><td>5</td><td>200</td></tr><tr><td>3</td><td></td><td>2 Pencil</td><td>4</td><td>200</td></tr><tr><td>4</td><td></td><td>3 Eraser</td><td>2</td><td>300</td></tr><tr><td>5</td><td></td><td>4 Sharpner</td><td>2</td><td>145</td></tr><tr><td>6</td><td></td><td>5 Files</td><td>25</td><td>77</td></tr><tr><td>7</td><td></td><td>6 A4 sheet</td><td>40</td><td>56</td></tr><tr><td>8</td><td></td><td>7 Pen box</td><td>80</td><td>60</td></tr><tr><td>9</td><td></td><td>8 Pencil box</td><td>60</td><td>230</td></tr><tr><td>10</td><td></td><td>9 Notebook</td><td>50</td><td>100</td></tr><tr><td>11</td><td></td><td>10 Marker</td><td>20</td><td>230</td></tr></tbody></table>		A	B	C	D	1	PID	Name	Cost	Qty	2		1 Pen	5	200	3		2 Pencil	4	200	4		3 Eraser	2	300	5		4 Sharpner	2	145	6		5 Files	25	77	7		6 A4 sheet	40	56	8		7 Pen box	80	60	9		8 Pencil box	60	230	10		9 Notebook	50	100	11		10 Marker	20	230
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5		4 Sharpner	2	145																																																									
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11		10 Marker	20	230																																																									

Course Outcomes:

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

CO1	Demonstrate the concepts of control structures through Python Programming
CO2	Implement Python programs using functions and strings
CO3	Implement methods to create and manipulate lists, tuples and dictionaries
CO4	Apply the concepts of file handling and regEx using packages
CO5	Illustrate the operations on spreadsheets through Python Programming

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Text Books:

1. Al Sweigart, "Automate the Boring Stuff with Python", William Pollock, 2015, ISBN: 978-1593275990.

Reference Books:

1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd Edition, Green Tea Press, 2015, ISBN: 978-9352134755.
2. Charles Dierbach, "Introduction to Computer Science Using Python", 1st Edition, Wiley India Pvt Ltd. ISBN-13: 978-8126556014.
3. Wesley J Chun, "Core Python Applications Programming", 3rd Edition, Pearson Education India, 2015. ISBN-13: 978-9332555365.
4. Roberto Tamassia, Michael H Goldwasser, Michael T Goodrich, "Data Structures and Algorithms in Python", 1st Edition, Wiley India Pvt Ltd, 2016. ISBN-13: 978-8126562176.

E-Books / Web References:

1. <https://www.py4e.com/lessons>
2. <https://python-3-patterns-idioms-test.readthedocs.io/en/latest/index.html>
3. <https://static.realpython.com/python-basics-sample-chapters.pdf>

MOOCs:

1. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0135784773973196803862_shared/overview
2. https://onlinecourses.nptel.ac.in/noc21_cs32/preview

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	3	-
CO2	3	3	3	-	-	-	-	2	-	3	-	2	3	-
CO3	3	3	3	-	-	-	-	2	-	3	-	2	3	-
CO4	3	3	3	-	-	-	-	2	-	3	-	2	3	-
CO5	3	3	3	-	-	-	-	2	-	3	-	2	3	-
Average	3	3	3	-	-	-	-	2	-	3	-	2	3	-

Low-1: Medium-2: High-3

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JULIA

Course Code	CSE23305C	CIE Marks	50
Hours/Week (L: T: P)	2:0:2	SEE Marks	50
Total Hours	25+15	Examination Hours	3
No. of Credits	3		

Course Learning Objectives:

The course will enable students to:

CLO1	To introduce the basics of Julia programming language
CLO2	To illustrate the data structures of Julia programming language
CLO3	To make use of built-in functions and packages

CONTENTS	# of Hours
MODULE 1 Overview: What is Julia Programming Language? History of Julia, Features of Julia, The Scope of Julia, Comparison with other languages. Julia Programming: Variables, Comments. Selection Logic: Introduction, Boolean Expressions, AND, && OR, NOT, !, The type Bool, The if Statement, Find the Sum of Two Lengths, The if...else Statement, Calculate Pay On Program Testing, Symbolic Constants, The if...elseif...else Statement, Print a Letter Grade, Classify a Triangle.	05
MODULE 2 The for and while Statements: Introduction, The for Statement, The Expressive Power of for, break/continue in for, Read Data From File, Find Largest Number, Nested for Statement, Read Data From File, Cont'd, The while Statement, Send Output to a File, Payroll, break/continue in while.	05
MODULE 3 Functions: Introduction, Function Basics, Function – Examples, Introduction to Recursion.	05
MODULE 4 Arrays: Introduction, Simple vs Array Variable, Array Declaration, Store Values in an Array, Average and Differences from Average, Array as Argument to a Function.	05
MODULE 5 Structures: The Need for Structures, How to Write a struct Declaration, Array of Structures, Nested Structures, Fractions	03

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Laboratory Component
List of Programs

1	a. Develop a Julia program to simulate a calculator (for integer and real numbers). b. Develop a Julia program to add, subtract, multiply and divide complex numbers. c. Develop a Julia program to evaluate expressions having mixed data types (integer, real, floating-point number and complex). [Refer Book 2: Chapter 3, 4]
2	a. Develop a Julia program for the following problem: A computer repair shop charges \$100 per hour for labour plus the cost of any parts used in the repair. However, the minimum charge for any job is \$150. Prompt for the number of hours worked and the cost of parts (which could be \$0) and print the charge for the job. b. Develop a Julia program to calculate a person's regular pay, overtime pay and gross pay based on the following: If hours worked is less than or equal to 40, regular pay is calculated by multiplying hours worked by rate of pay, and overtime pay is 0. If hours worked is greater than 40, regular pay is calculated by multiplying 40 by the rate of pay, and overtime pay is calculated by multiplying the hours in excess of 40 by the rate of pay by 1.5. Gross pay is calculated by adding regular pay and overtime pay. [Refer Book 1: Chapter 3]
3	a. An amount of money P (for principal) is put into an account which earns interest at r% per annum. So, at the end of one year, the amount becomes $P + P \times r/100$. This becomes the principal for the next year. Develop a Julia program to print the amount at the end of each year for the next 10 years. However, if the amount ever exceeds 2P, stop any further printing. Your program should prompt for the values of P and r. b. Develop a Julia program which reads numbers from a file (input.txt) and finds the largest number, smallest number, count, sum and average of numbers. [Refer Book 1: Chapter 4]
4	a. Develop a Julia program and two separate functions to calculate GCD and LCM. b. Develop a Julia program and a recursive function to calculate factorial of a number. c. Develop a Julia program and a recursive function to generate Fibonacci series. [Refer Book 1: Chapter 5]
5	a. Develop a Julia program which reads a string (word) and prints whether the word is palindrome. b. Develop a Julia program which reads and prints the words present in a file (input.txt) having Random Data in which words are dispersed randomly (Assumption: a word is a contiguous sequence of letters. A word is delimited by any non-letter character or end-of-line). [Refer Book 1: Chapter 6]
6	a. Develop a Julia program to determine and print the frequency with which each letter of the alphabet is used in a given line of text. b. A survey of 10 pop artists is made. Each person votes for an artist by specifying the number of the artist (a value from 1 to 10). Develop a Julia program to read the names of the artists, followed by the votes, and find out which artist is the most popular. [Refer Book 1: Chapter 7]

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7	a. Given a line of text as input, develop a Julia program to determine the frequency with which each letter of the alphabet is used (make use of dictionary) b. Develop a Julia program to fetch words from a file with arbitrary punctuation and keep track of all the different words found (make use of set and ignore the case of the letters: e.g. to and to are treated as the same word). [Refer Book 1: Chapter 10]
8	a. Develop a Julia program to evaluate expressions consisting of rational, irrational number and floating point numbers) b. Develop a Julia program to determine the following properties of a matrix: determinant, inverse, rank, upper & lower triangular matrix, diagonal elements, Euclidean norm and Square Root of a Matrix. [Refer Book 2: Chapter 5, 8]
9	a. Develop a Julia program to determine addition and subtraction of two matrices (element -wise). b. Develop a Julia program to perform multiplication operation on matrices: scalar multiplication, element-wise multiplication, dot product, cross product. [Refer Book 2: Chapter 8]
10	a. Develop a Julia program to generate a plot of (solid & dotted) a function: $y=x^2$ (use suitable data points for x). b. Develop a Julia program to generate a plot of mathematical equation: $y = \sin(x) + \sin(2x)$. c. Develop a Julia program to generate multiple plots of mathematical equations: $y = \sin(x) + \sin(2x)$ and $y = \sin(2x) + \sin(3x)$. [Refer Book 2: Chapter 13]

Course Outcomes:

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

CO1	Apply concepts of data-types, selection and looping constructs of Julia programming language.
CO2	Demonstrate the use of strings, functions, arrays and matrix operations in solving problems.
CO3	Develop programs involving data structures to handle multi-valued data items.
CO4	Make use of packages to generate plots of mathematical functions and equations.

Text Books:

1. Julia – Bit by Bit (Programming for Beginners), by Noel Kalicharan, Springer.
doi: <https://doi.org/10.1007/978-3-030-73936-2>, 2021.
2. Beginning Julia Programming (For Engineers and Scientists), by Sandeep Nagar, Apress-Springer, 2017.

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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	-	2	3	-
CO2	3	3	3	-	-	-	-	2	-	3	-	2	3	-
CO3	3	3	3	-	-	-	-	2	-	3	-	2	3	-
CO4	3	3	3	-	-	-	-	2	-	3	-	2	3	-
Average	3	3	3	-	-	-	-	2	-	3	-	2	3	-

Low-1: Medium-2: High-3

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ETHICS AND PUBLIC POLICY FOR AI

Course Code	CSE23305D	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
Total Hours	25+15	Examination Hours	3
No. of Credits	3		

Course Learning Objectives:

The course will enable students to:

CLO1	To understand Ethical Framework for a Good AI Society, establishing Rules for trustworthy AI
CLO2	To Designing ethics for good society
CLO3	To familiar with Tools, methods and practices for designing AI for social good
CLO4	To familiar with Innovation and future AI
CLO5	To understand the Case Study: Ai in health care, knowing Regulation and Governance of AI ethics

CONTENTS	# of Hours
MODULE 1 An Ethical Framework for a Good AI Society: opportunities, Risks, principles and Recommendations. Establishing the rules for building trustworthy AI	05
MODULE 2 Translating principles into practices of digital ethics: five risks of being Unethical The Ethics of Algorithms: Key problems and Solution How to Design AI for Social Good: Seven Essential Factors	05
MODULE 3 How to design AI for social good: seven essential factors From What to How: An Initial Review of publicly available AI Ethics tools, Methods and Research to Translate principles into Practices	05
MODULE 4 Innovating with Confidence: Embedding AI Governance and fairness in financial Services Risk management framework, What the near future of AI could be	05
MODULE 5 Human-AI Relationship, AI and Workforce, Autonomous Machines and Moral Decisions, AI in HealthCare: balancing Progress and Ethics, Regulation and Governance of AI Ethics	05

Course Outcomes:

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

CO1	Describe Ethical Framework for a Good AI Society, establishing Rules for trustworthy AI
CO2	Explain ethics for good society
CO3	Illustrate various Tools, methods and practices for designing AI for social good
CO4	Develop responsive designs for web pages using Bootstrap
CO5	Describe the Innovation and future AI
CO6	Illustrate Regulation and Governance of AI ethics in Healthcare domain.

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Learning Resources:

1. "Ethics, governance and Policies in Artificial Intelligence", Author-Editor : Luciano Floridi, Springer, 1st Edition 2021, vol 144, Oxford Internet Institute, University of Oxford, UK, ISSN 0921-8599, e-ISSN 2542- 8349 Philosophical Studies series, ISBN 978-3-030-81906-4 e-ISSN 978-3-030-81907-1, [://doi.orghttps/10.1007/978-3-030-81907-1](https://doi.org/10.1007/978-3-030-81907-1), 2021.
2. "Ethics and AI: Navigating the Moral Landscape of Digital Age", Author: Aaron Aboagye,

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	3	-	3	-	-	-	-	-	-	2	1	-
CO2	2	2	2	-	3	-	-	-	-	-	-	3	1	-
CO3	2	1	2	-	3	-	-	-	-	-	-	3	1	-
CO4	2	2	2	-	3	-	-	-	-	-	-	3	1	-
CO5	2	2	2	-	3	-	-	-	-	-	-	3	1	-
CO6	2	2	2	-	3	-	-	-	-	-	-	3	1	-
Average	2	1	2	-	3	-	-	-	-	-	-	3	1	-

Low-1: Medium-2: High-3

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SOCIAL CONNECT & RESPONSIBILITY

Course Code	SCK23306	CIE Marks	100
Hours/Week (L: T: P)	0:0:2	SEE Marks	-
No. of Credits	1		

Course Learning Objectives:

The course will enable students to:

1. Provide a formal platform for students to communicate and connect to the surroundings.
2. create a responsible connection with society.
3. Understand the community in general in which they work.
4. Identify the needs and problems of the community and involve them in problem –solving.
5. Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
6. Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes

General Instructions - Pedagogy : These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the activities will develop students' theoretical and applied social and cultural skills.
2. State the need for activities and its present relevance in the society and Provide real-life examples.
3. Support and guide the students for self-planned activities.
4. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.
5. Encourage the students for group work to improve their creative and analytical skills.

Contents :

The course is mainly activity-based that will offer a set of activities for the student that enables them to connect with fellow human beings, nature, society, and the world at large.

The course will engage students for interactive sessions, open mic, reading group, storytelling sessions, and semester-long activities conducted by faculty mentors.

In the following a set of activities planned for the course have been listed:

CONTENTS

MODULE 1

Part I: Plantation and adoption of a tree: Plantation of a tree that will be adopted for four years by a group of BE / B.Tech students. (ONE STUDENT ONE TREE) They will also make an excerpt either as a documentary or a photo blog describing the plant's origin, its usage in daily life, its appearance in folklore and literature

– Objectives, Visit, case study, report, outcomes.

Part II : Heritage walk and crafts corner: Heritage tour, knowing the history and culture of the city, connecting to people around through their history, knowing the city and its craftsman, photo blog and documentary on evolution and practice of various craft forms – Objectives, Visit, case study, report, outcomes.

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Part III : Organic farming and waste management: Usefulness of organic farming, wet waste management in neighboring villages, and implementation in the campus

– Objectives, Visit, case study, report, outcomes.

Part IV: Water conservation: Knowing the present practices in the surrounding villages and implementation in the campus, documentary or photoblog presenting the current practices

– Objectives, Visit, case study, report, outcomes.

Part V : Food walk: City's culinary practices, food lore, and indigenous materials of the region used in cooking

– Objectives, Visit, case study, report, outcomes.

Course Outcomes:

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

CO1	Communicate and connect to the surrounding
CO2	Create a responsible connection with the society
CO3	Involve in the community in general in which they work
CO4	Notice the needs and problems of the community and involve them in problem –solving
CO5	Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems
CO6	Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes

Activities:

Jamming session, open mic, and poetry: Platform to connect to others. Share the stories with others. Share the experience of Social Connect. Exhibit the talent like playing instruments, singing, one-act play, art-painting, and fine art.

Pedagogy:

The pedagogy will include interactive lectures, inspiring guest talks, field visits, social immersion, and a course project. Applying and synthesizing information from these sources to define the social problem to address and take up the solution as the course project, with your group. Social immersion with NGOs/social sections will be a key part of the course. Will all lead to the course project that will address the needs of the social sector?

Course Topics:

The course will introduce social context and various players in the social space, and present approaches to discovering and understanding social needs. Social immersion and inspiring conversational will culminate in developing an actual idea for problem-based intervention, based on an in-depth understanding of a key social problem.

Duration :

A total of 40 - 50 hrs engagement per semester is required for the 3rd semester of the B.E. /B.Tech. program. The students will be divided into groups. Each group will be handled by faculty mentor. Faculty mentor will design the activities (particularly Jamming sessions open mic ,and poetry) Faculty mentors has to design the evaluation system as per VTU guidelines of scheme & syllabus.

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Guideline for Assessment Process:

Continuous Internal Evaluation (CIE): After completion of the course, the student shall prepare, with daily diary as reference, a comprehensive report in consultation with the mentor/s to indicate what he has observed and learned in the social connect period. The report should be signed by the mentor. The report shall be evaluated on the basis of the following criteria and/or other relevant criteria pertaining to the activity completed. Marks allotted for the diary are out of 50. Planning and scheduling the social connect Information/Data collected during the social connect Analysis of the information/data and report writing Considering all above points allotting the marks as mentioned below

- Excellent: 80 to 100
- Good: 60 to 79
- Satisfactory: 40 to 59
- Unsatisfactory and fail: <39

Pedagogy – Guidelines : It may differ depending on local resources available for the study as well as environment and climatic differences, location and time of execution.

Sl. No	Topic	Group size	Location	Activity execution	Reporting	Evaluation Of the Topic
1	Plantation and adoption of a tree:	May be individual or team	Farmers land/ parks / Villages / roadside/ community area / College campus etc.....	Site selection /proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by Faculty
2	Heritage walk and crafts corner:	May be individual or team	Temples / monumental places / Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/ campus etc.....	Site selection /proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by Faculty
3	Organic farming and waste management:	May be individual or team	Farmers land / parks / Villages visits / roadside/ community area / College campus etc....	Group selection / proper consultation / Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by Faculty
4	Water conservation: & conservation techniques	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers / campus etc....	site selection / proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by Faculty

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5	Food walk: Practices in society	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc.....	Group selection / proper consultation / Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by Faculty
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Plan of Action (Execution of Activities)

Sl. No.	Practice Session Description
1	Lecture session in field to start activities
2	Students Presentation on Ideas
3	Commencement of activity and its progress
4	Execution of Activity
5	Execution of Activity
6	Execution of Activity
7	Execution of Activity
8	Case study based Assessment, Individual performance
9	Sector/ Team wise study and its consolidation
10	Video based seminar for 10 minutes by each student At the end of semester with Report.

Each student should do activities according to the scheme and syllabus.

- At the end of semester student performance has to be evaluated by the faculty for the assigned activity progress and its completion.
- At last consolidated report of all activities from 1st to 5th, compiled report should be submitted as per the instructions and scheme.

Assessment Details for CIE (both CIE and SEE)

Weightage	CIE 100%	
Field Visit, Plan, Discussion	10	• Implementation strategies of the project (NSS work). • The last report should be signed by NSS Officer, the HOD and principal. • At last report should be evaluated by the NSS officer of the institute. • Finally, the consolidated marks sheet should be sent to the university and also to be made available at LIC visit.
Commencement of activities and its progress	20	
Case study based Assessment Individual performance with report	20	
Sector wise study & its consolidation 5*5 = 25	25	
Video based seminar for 10 minutes by each student At the end of semester with Report. Activities 1 to 5, 5*5 = 25	25	
Total marks for the course in each semester	100	

For each activity, 20 marks CIE will be evaluated for IA marks at the end of semester, Report and assessment copy should be made available in the department.

Students should present the progress of the activities as per the schedule in the prescribed practical session in the field. There should be positive progress in the vertical order for the benefit of society in general through activities.

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DATA ANALYTICS WITH EXCEL

Course Code	CSE23307A	CIE Marks	50
Hours/Week (L: T: P)	1:0:2	SEE Marks	50
Total Hours	28	Examination Hours	3
No. of Credits	2		

Course Learning Objectives:

The course will enable students to:

CLO1	To Apply analysis techniques to datasets in Excel
CLO2	Learn how to use Pivot Tables and Pivot Charts to streamline your workflow in Excel
CLO3	Understand and identify the principles of data analysis
CLO4	Become adept at using Excel functions and techniques for analysis
CLO5	Build presentation ready dashboards in Excel

CONTENTS	# of Hours
MODULE 1 Introduction to Excel: About Excel & Microsoft, Uses of Excel, Excel software, Spreadsheet window pane, Title Bar, Menu Bar, Standard Toolbar, Formatting Toolbar, the Ribbon, File Tab and Backstage View, Formula Bar, Workbook Window, Status Bar, Task Pane, Workbook & sheets.	03
MODULE 2 Columns & Rows: Selecting Columns & Rows, Changing Column Width & Row Height, Autofitting Columns & Rows, Hiding/Unhiding Columns & Rows, Inserting & Deleting Columns & Rows, Cell, Address of a cell, Components of a cell – Format, value, formula, Use of paste and paste special.	03
MODULE 3 Functionality Using Ranges: Using Ranges, Selecting Ranges, Entering Information Into a Range, Using AutoFill. Creating Formulas: Using Formulas, Formula Functions – Sum, Average, if, Count, max, min, Proper, Upper, Lower, Using AutoSum.	03
MODULE 4 Spreadsheet Charts: Creating Charts, Different types of chart, Formatting Chart Objects, Changing the Chart Type, Showing and Hiding the Legend, Showing and Hiding the Data Table. Data Analysis: Sorting, Filter, Text to Column, Data Validation	03
MODULE 5 PivotTables: Creating PivotTables, Manipulating a PivotTable, Using the PivotTable Toolbar, Changing Data Field, Properties, Displaying a PivotChart, Setting PivotTable Options. Spreadsheet Tools: Moving between Spreadsheets, Selecting Multiple Spreadsheets, Inserting and Deleting Spreadsheets Renaming Spreadsheets, Splitting the Screen, Freezing Panes, Copying and Pasting Data between Spreadsheets, Hiding , Protecting worksheets.	03

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Laboratory Component
List of Programs

1	Getting Started with Excel: Creation of spread sheets, Insertion of rows and columns, Drag & Fill, use of Aggregate functions.
2	Working with Data: Importing data, Data Entry & Manipulation, Sorting & Filtering.
3	Working with Data: Data Validation, Pivot Tables & Pivot Charts.
4	Data Analysis Process: Conditional Formatting, What-If Analysis, Data Tables, Charts & Graphs.
5	Cleaning Data with Text Functions: use of UPPER and LOWER, TRIM function, Concatenate.
6	Cleaning Data Containing Date and Time Values: use of DATEVALUE function, DATEADD and DATEDIF, TIMEVALUE functions.
7	Conditional Formatting: formatting, parsing, and highlighting data in spreadsheets during data analysis.
8	Working with Multiple Sheets: work with multiple sheets within a workbook is crucial for organizing and managing data, perform complex calculations and create comprehensive reports.
9	Create worksheet with following fields: Empno, Ename, Basic Pay(BP), Travelling Allowance(TA), Dearness Allowance(DA), House Rent Allowance(HRA), Income Tax(IT), Provident Fund(PF), Net Pay(NP). Use appropriate formulas to calculate the above scenario. Analyse the data using appropriate chart and report the data.
10	Create worksheet on Inventory Management: Sheet should contain Product code, Product name, Product type, MRP, Cost after % of discount, Date of purchase. Use appropriate formulas to calculate the above scenario. Analyse the data using appropriate chart and report the data.
11	Create worksheet on Sales analysis of Merchandise Store: data consisting of Order ID, Customer ID, Gender, age, date of order, month, online platform, Category of product, size, quantity, amount, shipping city and other details. Use of formula to segregate different categories and perform a comparative study using pivot tables and different sort of charts.
12	Generation of report & presentation using Autofilter & macro.

Course Outcomes:

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

CO1	Use advanced functions and productivity tools to assist in developing worksheets
CO2	Manipulate data lists using Outline and PivotTables
CO3	Use Consolidation to summarize and report results from multiple worksheets
CO4	Apply Macros and Autofilter to solve the given real world scenario

Learning Resources:

1. Berk & Carey - Data Analysis with Microsoft® Excel: Updated for Office 2007®, Third Edition, © 2010 Brooks/Cole, Cengage Learning, ISBN-13: 978-0-495-39178-4
2. Wayne L. Winston - Microsoft Excel 2019: Data Analysis And Business Modeling, PHI, ISBN: 9789389347180
3. Aryan Gupta - Data Analysis in Excel: The Best Guide.
(<https://www.simplilearn.com/tutorials/excel-tutorial/data-analysis-excel>)

Shravya

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	3	-
CO2	3	3	3	-	-	-	-	2	-	3	-	2	3	-
CO3	3	3	3	-	-	-	-	2	-	3	-	2	3	-
CO4	3	3	3	-	-	-	-	2	-	3	-	2	3	-
Average	3	3	3	-	-	-	-	2	-	3	-	2	3	-

Low-1: Medium-2: High-3

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PROJECT MANAGEMENT WITH GIT

Course Code	CSE23307B	CIE Marks	50
Hours/Week (L: T: P)	1:0:2	SEE Marks	50
Total Hours	28	Examination Hours	3
No. of Credits	2		

Course Learning Objectives:

The course will enable students to:

CLO1	Be familiar with basic command of Git
CLO2	Create and manage branches
CLO3	Understand how to collaborate and work with Remote Repositories
CLO4	Be familiar with various controlling commands

CONTENTS	# of Hours
MODULE 1 Introduction: Introduction to Git, Introduction to GIT distributed version control system , About version control system , General overview of centralized VCS, Features of VCS.	03
MODULE 2 Installation and setup , Installation git on Mac/Windows/Linux , Git file lifecycle , Learn about github , Understanding basic git commands, Working with remote repositories , Learn Git buzzwords, How to work with remote repository ,Understanding Git pull ,How to fetch commands and use cases , Upstream and Downstream.	03
MODULE 3 Branching and Merging in Git :Intro to branching ,Switching between branches and different commits ,Difference between branching and tagging in Git.	03
MODULE 4 Git workflows : Types of workflows in Git, Real time Open source projects in Git, Walkthrough of commands.	03
MODULE 5 Git plugins with IDE :Installing Eclipse IDE ,Exploring Git hub UI options Conclusion.	03

Laboratory Component List of Programs

1	Setting Up and Basic Commands Initialize a new Git repository in a directory. Create a new file and add it to the staging area and commit the changes with an appropriate commit message.
2	Creating and Managing Branches Create a new branch named "feature-branch." Switch to the "master" branch. Merge the "feature-branch" into "master."
3	Creating and Managing Branches Write the commands to stash your changes, switch branches, and then apply the stashed changes.

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4	Collaboration and Remote Repositories Clone a remote Git repository to your local machine.
5	Collaboration and Remote Repositories Clone a remote Git repository to your local machine.
6	Collaboration and Remote Repositories Write the command to merge "feature-branch" into "master" while providing a custom commit message for the merge.
7	Git Tags and Releases Write the command to create a lightweight Git tag named "v1.0" for a commit in your local repository.
8	Advanced Git Operations Write the command to cherry-pick a range of commits from "source-branch" to the current branch.
9	Analysing and Changing Git History Given a commit ID, how would you use Git to view the details of that specific commit, including the author, date, and commit message?
10	Analysing and Changing Git History Write the command to list all commits made by the author "JohnDoe" between "2023-01-01" and "2023-12-31."
11	Analysing and Changing Git History Write the command to display the last five commits in the repository's history.
12	Analysing and Changing Git History Write the command to undo the changes introduced by the commit with the ID "abc123".

Course Outcomes:

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

CO1	Use the basics commands related to git repository
CO2	Create and manage the branches
CO3	Apply commands related to Collaboration and Remote Repositories
CO4	Use the commands related to Git Tags, Releases and advanced git operations
CO5	Analyze and change the git history

Learning Resources:

1. Version Control with Git, 3rd Edition, by Prem Kumar Ponuthorai, Jon Loeliger Released October 2022, Publisher(s): O'Reilly Media, Inc.
2. Pro Git book, written by Scott Chacon and Ben Straub and published by Apress,
<https://gitcm.com/book/en/v2>
3. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0130944433473699842782_shared/overview
4. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01330134712177459211926_shared/overview

Signature

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	3	-
CO2	3	3	3	-	-	-	-	2	-	3	-	2	3	-
CO3	3	3	3	-	-	-	-	2	-	3	-	2	3	-
CO4	3	3	3	-	-	-	-	2	-	3	-	2	3	-
CO5	3	3	3	-	-	-	-	2	-	3	-	2	3	-
Average	3	3	3	-	-	-	-	2	-	3	-	2	3	-

Low-1: Medium-2: High-3

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INTRODUCTION TO WEB TECHNOLOGIES

Course Code	CSE23307C	CIE Marks	50
Hours/Week (L: T: P)	1:0:2	SEE Marks	50
Total Hours	28	Examination Hours	3 Hours
No. of Credits	2		

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
MODULE 1 Introduction to HTML: HTML Syntax, Semantic Markup, Structure of HTML Documents, Quick Tour of HTML Elements, HTML5 Semantic Structure Elements.	03
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.	03
MODULE 3 HTML Tables and Forms: Introducing Tables, Styling Tables, Introducing Forms, Form Control Elements.	03
MODULE 4 Advanced CSS: Layout, Normal Flow, Positioning Elements, Floating Elements, Constructing Multicolumn Layouts.	03
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.	03

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Laboratory Component

- Students can execute the programs on Visual Studio Code.
- Bootstrap is used to get the compiled CSS and JavaScript source code.

List of Programs

1. Design a Travels webpage using HTML
 - Create a list of links like "Description", "Related Photos" and "Reviews".
 - In the "Description" section, briefly describe Conservatory Pond and create an external hyperlink to <http://www.centralpark.com>
 - Hyperlink an image of Central Park to display a magnified version of it.
 - Add social media logos.
 - In the "Related Photos" section, provide two images of central park.
 - In the "Reviews" section, provide two reviews separated by ruler.
 - Include a footer section that includes copyright and time tag.
2. Design an organized layout for a Conference webpage using HTML and CSS
 - Include a header section with the event title, date, and location.
 - Create a navigation bar with links to sections like "About", "Speakers", "Agenda", "Registration" and "Contact".
 - In the "About" section, briefly describe the Conference's theme and purpose.
 - Design a "Speakers" section that lists at least two keynote speakers with their names, titles and photos.

Note: Use semantic elements to structure this section.
3. Design a simple College webpage layout using CSS selectors
 - Apply CSS styles to change the font family, size and color of the text content.
 - Apply a background color to the entire layout using an element selector.
 - Use selectors to target specific headings and paragraphs.
 - Implement float option for an image.
 - Implement a hover effect that slightly increases the image's size.
 - Apply div to create a balanced layout.
4. Design a portfolio webpage to showcase your skills and projects
 - Design a header section with your name or a logo.
 - Design a navigation section containing 'About', 'Skills' and 'Projects'.
 - Add a brief introduction about yourself or your work.
 - Create a section to list your skills or areas of expertise.
 - Display a grid of project cards, each with a project name, image, and brief description.

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5. Develop an HTML table to display the weekly class timetable, spanning Monday through Friday.
 - Populate the table with precise class information, including course codes.
 - Utilize colspan or rowspan to merge cells horizontally or vertically, creating space for breaks or gaps in the schedule.
 - Implement distinct background colors for cells to differentiate days, timings and break Time.
6. Design a layout of a Calendar for a single month using HTML and CSS.

Note:

 - Add background image for the table.
 - Change the background color and font color of all Sundays.
 - Change background color and font color of all public holidays.
 - Indicate the names of all public holidays.
7. Design a Simple Calculator layout using HTML and CSS.
 - Implement distinct background colors as follows
 - Numbers: #0d0e0dda
 - AC and = symbol: #044138e5;
 - Arithmetic operators and (): #552504f5;
 - Keep the height of each button as 20px.
 - Make use of hover property.
8. Design a Workshop Registration Form
 - Include an appropriate image at the beginning of the Form.
 - Use div tag to include title, date and venue of the workshop.
 - Include fields for the attendee's Name, Email, Phone number, Organization, select button for workshop topics.
 - Include a "Submit" button to process the registration.
9. Design an application form using HTML and CSS
 - Include fields for Candidate Name, Date of Birth, Gender, Email, Phone, Address, Work Experience, preferred work location and Textarea for Reference.
 - Use an option to upload a resume as a document.
 - Include "Submit" and "Reset" buttons to process the registration.
10. Design a multicolumn layout using HTML and CSS
 - to position the main content on the left and the sidebar on the right.
 - to populate the main content area with headings, images, and text.
 - to populate the sidebar with a list of contents.

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11. Design a multicolumn layout using CSS positioning and z-index to achieve overlapping columns
 - Create an HTML structure for the multicolumn layout, including three columns.
 - Use CSS positioning properties to arrange the columns side by side.
 - Utilize z-index and CSS positioning to achieve an overlapping effect for the columns.
 - Ensure that the columns partially overlap each other while maintaining readability.
 - Populate each column with different content sections, including headings, paragraphs, and images.
 - Apply background colors or patterns to the columns to enhance their visual separation.
12. Design a portfolio webpage using Bootstrap to showcase your skills and projects
 - Design a header section with your name or a logo.
 - Use Bootstrap's navbar component to create a simple navigation bar.
 - Add a brief introduction about yourself or your work.
 - Utilize Bootstrap's typography classes for consistent styling.
 - Create a section to list your skills or areas of expertise.
 - Use Bootstrap's card component to present each skill.
 - Display a grid of project cards, each with a project name, image, and brief description.
13. Write a Bootstrap program to design a Signup form containing Name, Email, Password, Address, City. Also, demonstrate the use of the checkbox and Submit button. Keep the form center-aligned and width=25%.

Course Outcomes:

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

CO1	Adapt HTML and CSS syntax and semantics to build web pages
CO2	Construct and visually format tables and forms using HTML and CSS
CO3	Construct complex layouts to build web pages
CO4	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>

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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
CO1	2	2	3	-	3	-	-	-	-	-	-	2	1	-
CO2	2	2	2	-	3	-	-	-	-	-	-	3	1	-
CO3	2	1	2	-	3	-	-	-	-	-	-	3	1	-
CO4	2	2	2	-	3	-	-	-	-	-	-	3	1	-
Average	2	1	2	-	3	-	-	-	-	-	-	3	1	-

Low-1: Medium-2: High-3

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SCALA

Course Code	CSE23307D	CIE Marks	50
Hours/Week (L: T: P)	1:0:2	SEE Marks	50
Total Hours	28	Examination Hours	3
No. of Credits	2		

Course Learning Objectives:

The course will enable students to:

CLO1	Model data using algebraic data types, represented in Scala as families of sealed traits and case classes
CLO2	Use structural recursion and pattern matching to traverse and transform data
CLO3	Learn programming with the common data structures of Scala
CLO4	Learn object-oriented programming in Scala

CONTENTS	# of Hours
MODULE 1 Introduction: Installing the Scala Tools You Need, Building the Code Examples, Using sbt, Running the Scala Command-Line Tools Using sbt, A Taste of Scala, A Sample Application, Syntax, Optional Braces, Semicolons, Variable Declarations, Ranges.	03
MODULE 2 Functions: Partial Functions, Method Declarations, Method Default and Named Parameters, Methods with Multiple Parameter Lists, Nesting Method Definitions and Recursion.	03
MODULE 3 Defining Operators: Allowed Characters in Identifiers, Methods with Empty Parameter Lists, Operator Precedence Rules, Enumerations and Algebraic Data Types, Interpolated Strings, Scala Conditional Expressions, Conditional and Comparison Operators for Comprehensions for Loops, Expanded Scope and Value Definitions, Scala while Loops, Using try, catch, and finally Clauses, Call by Name, Call by Value, Lazy Values, Traits: Interfaces and Mixing in Scala.	03
MODULE 4 Pattern Matching: Safer Pattern Matching with Matchable, Values, Variables, and Types in Matches, Matching on Sequences, Pattern Matching on Repeated Parameters, Matching on Tuples, Parameter Untupling, Matching on Case Classes and Enums, Matching on Regular Expressions.	03
MODULE 5 Functional Programming in Scala: What Is Functional Programming, Functions in Mathematics, Functional Programming in Scala, Anonymous Functions, Lambdas, and Closures, Purity Inside Versus Outside, Recursion.	03

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Laboratory Component
List of Programs

1	a. Write a Scala program to compute the sum of the two given integer values. If the two values are the same, then return triples their sum. b. Write a Scala program to check two given integers and return true if one of them is 22 or if their sum is 32.
2	a. Write a Scala program to remove the character in a given position of a given string. The given position will be in the range 0...string length -1 inclusive. b. Write a Scala program to create a new string taking the first 5 characters of a given string and return the string with the 5 characters added at both the front and back.
3	a. Write a Scala program to print the multiplication table of a given number using a for loop. b. Write a Scala program to find the largest element in an array using pattern matching
4	a. Write a Scala function to calculate the product of digits in a given number b. Write a Scala function to check if a given number is a perfect square
5	a. Write a Scala program that creates a subclass Student that extends the Person class. Add a property called grade and implement methods to get and set it. b. Write a Scala program that creates a class Triangle with properties side1, side2, and side3. Implement a method is Equilateral to check if the triangle is equilateral.
6	a. Write a Scala program that creates an enum class Color with values for different colors. Use the enum class to represent an object's color. b. Write a Scala program that creates a class ContactInfo with properties name, email, and address. Create a class Customer that includes a ContactInfo object.
7	a. Write a Scala program to create a set and find the difference and intersection between two sets. b. Write a Scala program to create a set and find the second largest element in the set.
8	a. Write a Scala program to create a list in different ways. Note: Use Lisp style, Java style, Range list, Uniform list, Tabulate list b. Write a Scala program to flatten a given List of Lists, nested list structure.
9	a. Write a Scala program to add each element n times to a given list of integers. b. Write a Scala program to split a given list into two lists.
10	a. Write a Scala program to swap the elements of a tuple Further print no swapping required if elements are same. b. Write a Scala program to find non-unique elements in a tuple

Course Outcomes:

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

CO1	Get familiar with the Scala syntax and object-oriented principles
CO2	Learn advanced concepts - loops, expressions, inheritance, pattern matching
CO3	Learn to write clean and functional Scala codes and test it
CO4	Learn functional programming using Scala

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Learning Resources:

1. Programming Scala, Third Edition, O'Reilly Media.
2. Paul Chiusano, Rúnar Bjarnason, Functional Programming in Scala 1st Edition, Manning Publications
3. <https://docs.scala-lang.org/tutorials/scala-for-java-programmers.html>
4. <https://www.javatpoint.com/scala-tutorial>.

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	3	-
CO2	3	3	3	-	-	-	-	2	-	3	-	2	3	-
CO3	3	3	3	-	-	-	-	2	-	3	-	2	3	-
CO4	3	3	3	-	-	-	-	2	-	3	-	2	3	-
Average	3	3	3	-	-	-	-	2	-	3	-	2	3	-

Low-1: Medium-2: High-3*Sleswamy*

DATA STRUCTURES LABORATORY
(Common to CSE/ISE/AI/AM/CI)

Course Code	CSEL23309	CIE Marks	50
Hours/Week (L: T: P)	0:0:2	SEE Marks	50
No. of Credits	1	Examination Hours	3 Hours

Course Learning Objectives:

The course will enable students to:

CLO1	Understand elementary data structures with an emphasis on problem-solving.
CLO2	Develop skills to design and analyze simple linear and non-linear data structures.
CLO3	Strengthen the ability of the students to identify and apply the suitable data structure for the given real-world problem.
CLO4	Enables them to gain knowledge in practical applications of data structures.

Sl. No.	EXPERIMENTS
1	Develop 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
2	Develop 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
3	Develop and Implement a Program for evaluation of Stack Suffix expression with single digit operands and operators: +, -, *, /, %, ^.
4	Develop recursive program to i) To Find GCD of 2 numbers ii) To Solve the Tower of Hanoi Problem.
5	Develop a menu driven Program for the following operations on QUEUE of Characters (Array Implementation of QUEUE with maximum size MAX) a. Enqueue an Element on to Queue b. Dequeue an Element from Queue c. Demonstrate Overflow and Underflow situations on Queue d. Display the status of Queue e. Exit Support the program with appropriate functions for each of the above operations
6	Implement a program to multiply two polynomials using singly linked list.

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7	Design a doubly linked list to represent sparse matrix. Each node in the list can have the row and column index of the matrix element and the value of the element. Print the complete matrix as the output.
8	Write a program to create Binary Tree and to traverse the tree using In-order, Preorder and Post order.
9	Write a program to implement priority queue using Heap.
10	Write a program to implement Hashing using Linear probing. Implement insertion, deletion, search and display.

Course Outcomes:

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

CO1	Implement stack and queue operations using array
CO2	Demonstrate Recursive functions
CO3	Demonstrate working of linked lists
CO4	Implement Binary tree traversals, Priority queue and hashing

Text Books:

1. Ellis Horowitz, Sartaz Sahni, Fundamentals of Data Structures in C, Anderson, Freed, Second Edition, University press, 2008, Reprinted 2016
2. Seymour Lipschutz, Schaum's Outlines, Data Structures with C, McGraw Hill, Special Indian Edition, Thirteenth Reprint 2015.

Reference Books:

1. Aaron Tanenbaum, Yedidyah Langsam and Moshe Augenstein, Data Structures using C, Pearson, Thirteenth Impression, 2014. ISBN:978-81-317-0229-1
2. Richard F. Gilberg and Behrouz A. Forouzan, Data Structures A Pseudo code approach with C, Thomson, 2005. ISBN:978-81-315-0314-0

ASSESSMENT AND EVALUATION PATTERN		
	CIE	SEE
WEIGHTAGE	50%	50%
Record	10	50
Test	20	
Experiential Learning (Mini Project)	20	NIL
Total Marks for The Course	50	50

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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	-	-	2	-	2	-	2	2	-
CO2	3	3	3	-	2	-	-	2	-	2	-	2	2	-
CO3	3	3	3	-	2	-	-	2	-	2	-	2	2	-
CO4	3	3	3	-	2	-	-	2	-	2	-	2	2	-
Average	3	3	3	-	2	-	-	2	-	2	-	2	2	-

Low-1: Medium-2: High-3

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SYLLABUS

IV SEMESTER

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PROBABILITY AND LINEAR ALGEBRA (MATHEMATICS FOR CSE STREAM)

Course Code	MAT23401A	CIE Marks	50
Hours/Week (L: T: P)	2:2:0	SEE Marks	50
Total Hours	40	Examination Hours	3 Hours
No. of Credits	3		

Course Objectives:

To enable students to apply the knowledge of Mathematics in fields of computer science and allied branches by making them to learn:

CLO1	Probability and Random Variables
CLO2	System of linear equations and row reduction algorithm
CLO3	Vector spaces, linear transformations
CLO4	Eigenvalues, Eigenvectors, diagonalization and Singular value decomposition

CONTENTS	# of Hours
MODULE 1 Random Variable, Binomial, Poisson, Uniform, Exponential and Normal distributions. Joint distributions (both discrete and continuous), Expectation and Covariance.	08
MODULE 2 System of linear equations, row reduction and echelon form, vector equations, The matrix equation $AX = b$. Linear independence and introduction to linear transformations. Matrix of linear transformation, invertible matrix, inverse of a matrix by Gauss Jordan method.	08
MODULE 3 Vector space, subspaces, linearly independent sets, Bases. Coordinate systems, the dimensions of a vector space, Rank, Change of basis. Eigen vectors and Eigen values, diagonalization.	08
MODULE 4 Inner products; inner product spaces; orthogonal sets and projections; Gram-Schmidt process; QR-factorization.	08
MODULE 5 Least square solutions and fittings, diagonalization of symmetric matrices, quadratic forms, constrained optimization; Singular value decomposition.	08

Text Books:

- 1 T Veerarajan, Probability, Statistics and Random Processes for Engineers, Tata McGraw Hill, 3rd Edition, 2008
- 2 David C Lay, Linear Algebra and its applications, Pearson, 4th Edition, 2012.

Reference Books:

- 1 Richard H Williams, Probability, Statistics and Random Processes for Engineers, Cengage Learning, 1st Edition, 2003
- 2 Gilbert Strang, Linear Algebra and its Applications, Cengage Learning, 4th Edition, 2006
- 3 K. Hoffman and R. Kunze, Linear Algebra, Prentice Hall, 2nd Edition, 2004.

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Course Outcomes:

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

CO1	- Describe the properties and characteristics of random variables, including their probability distributions, probability mass/density functions, and cumulative distribution functions. - Solve problems using binomial, Poisson, exponential and normal distributions - Compute joint probabilities, marginal probabilities, and expectations and covariance using joint distributions.
CO2	- Solve matrix equations of the form $AX = b$ using row reduction algorithm - Analyze the properties and characteristics of linear transformations. - Compute the inverse of a matrix using the Gauss-Jordan elimination method.
CO3	- Determine if a set of vectors forms a subspace of a given vector space - Determine if a set of vectors is linearly independent and Construct bases for vector spaces and subspaces. - Represent vectors in different coordinate systems and understand the change of basis. - Diagonalize matrices using the eigen decomposition method.
CO4	- Compute inner products, norms, and distances between vectors in an inner product space. - Compute the projection of a vector onto a subspace and understand its geometric interpretation. - Implement the Gram-Schmidt process to convert a linearly independent set of vectors into an orthonormal set. - Compute the QR-factorization of a matrix and use it to solve systems of linear equations.
CO5	- Compute the least squares solution to an overdetermined system of linear equations. - Diagonalize symmetric matrices using the eigen decomposition method. - Utilize the properties of quadratic forms and diagonalization to solve constrained optimization problems. - Compute the Singular Value Decomposition of a matrix

Mapping of CO-PO:

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

Low-1: Medium-2: High-3

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DESIGN AND ANALYSIS OF ALGORITHMS
(Common to CSE/ISE/AD/AM/CI)

Course Code	CSE23402	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	To learn mathematical background for analysis of algorithm
CLO2	Analyze the asymptotic performance of algorithms.
CLO3	To understand the concept of designing an algorithm.
CLO4	Synthesize efficient algorithms in common engineering design situations.

CONTENTS	# of Hours
MODULE 1 Introduction: Notion of algorithm, Fundamentals of Algorithmic Problem Solving, Fundamentals of the Analysis of Algorithmic Efficiency: Analysis frame work, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non-recursive and Recursive Algorithms. Brute Force: Selection Sort and Bubble Sort.	08
MODULE 2 Divide and Conquer: Merge sort, Quicksort, Multiplication of long integers, Strassen's Matrix multiplication, Max-Min Problem Decrease and Conquer: Insertion Sort, Depth First Search, Breadth First Search, Topological Sorting, Applications of DFS and BFS.	08
MODULE 3 Transform and Conquer: Presorting, Heapsort, Problem reduction. Space and Time Tradeoffs: Sorting by Counting, Naive String Matching, Input Enhancement in String Matching: Horspool's and Boyer-Moore algorithm.	08
MODULE 4 Dynamic Programming: Computing a Binomial Coefficient, Warshall's and Floyd's Algorithms, The Knapsack Problem and Memory Functions. Greedy Technique: Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm, Huffman Trees and codes.	08
MODULE 5 Backtracking: N-Queen's Problem, Sum of Subset Problem. Branch-and-Bound: Travelling Sales Person problem, 0/1 Knapsack problem NP and NP-Complete Problems: Basic concepts, nondeterministic algorithms, P, NP, NP-Complete, and NP-Hard classes	08

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Course Outcomes:

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

CO1	Understand and explore the asymptotic runtime complexity of algorithms by using mathematical relations.
CO2	Analyze a problem and identify the computing requirements appropriate for a solution
CO3	Apply mathematical foundations, algorithmic principles, and computer science theory to the modeling, and evaluation of computer-based solutions.
CO4	Investigate and apply optimal design, development principles, skills and tools in the construction of software solutions of varying complexity.

Text Books:

1. Introduction to the Design and Analysis of Algorithms, Anany Levitin, University, 3rd Edition, 2012, Pearson, ISBN 13: 978-0-13-231681-1.
2. Introduction to Algorithms, Cormen T.H., Leiserson C.E., Rivest R.L., Stein C., 3rd Edition, 2010, PHI, ISBN:9780262033848.

Reference Books:

1. Computer Algorithms, Horowitz E., Sahani S., Rajasekharan S., 2nd Edition, 2006, Galgotia Publications, ISBN:9780716783169.

E-Books / Web References:

1. <http://www.facweb.iitkgp.ac.in/~sourav/daa.html>
2. <https://freevidelectures.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
CO1	3	3	3	-	3	-	-	-	-	-	-	2	3	-
CO2	3	3	3	-	3	-	-	-	-	-	-	2	3	-
CO3	3	3	3	-	3	-	-	-	-	-	-	2	3	-
CO4	3	3	3	-	3	-	-	-	-	-	-	2	3	-
Average	3	3	3	-	3	-	-	-	-	-	-	2	3	-

Low-1: Medium-2: High-3

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OBJECT ORIENTED PROGRAMMING WITH JAVA

Course Code	CSE23403	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	3 Hours
No. of Credits	4		

Course 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
MODULE 1 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, A second short 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.	08
MODULE 2 Introducing Classes: Classes fundamentals; Declaring objects; Introducing methods, Constructors, the This keyword, garbage collection. Inheritance: Inheritance basics, using super, creating a Multilevel hierarchy, method overriding, Dynamic Method dispatch, Using Abstract classes.	08
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, nested try statements, throw, throws, finally, Java builtin exceptions.	08
MODULE 4 Multithreaded Programming: The Java Thread Model, The Main Thread, Creating a Thread, creating multiple threads, using isAlive() and join(), Thread priorities, Synchronization. Regular Expressions: Regular Expression processing, Pattern, Matcher, Regular Expression Syntax, Demonstrating Pattern matching, Two-pattern matching options, Exploring Regular Expressions.	08

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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.	08

Laboratory Component List of Programs

1. Write a Java program to simulate a simple calculator using switch statement. The program must continue executing until the user presses the key 'E'.
2. Write 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. Write 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. Write 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. Write a Java program that uses the concept of Interface to find the area of Rectangle and Triangle.
6. Write 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. Write a Java program to input N no. of strings, count the number of vowels and digits in each string using Regular Expressions.
8. Write a Java program to validate USN and email ID of N students using Regular Expressions.
9. Write a Java program to replace all instances of a substring with another within a string.
10. Write 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

CO1	Apply the fundamental constructs of Java Programming to create, debug and run programs with modern tools.
CO2	Illustrate the concepts of Object-Oriented Programming using Java Programs.
CO3	Write reusable Java programs using Interfaces and Packages.
CO4	Implement Exception handling mechanism and thread synchronization.
CO5	Use Regular Expressions to validate the input data in Java program.
CO6	Write Java programs using String handling functions.

Text Books:

1. Java the Complete Reference, Herbert Schildt, 11th Edition, McGraw-Hill Education, ISBN-13: 978-1260440232, 2019.

Reference Books:

1. Programming with Java, E Balaguruswamy, 6th Edition, McGraw-Hill Education, ISBN-13: 978-9353162344, 2019
2. A Textbook of Java Programming, Surbhi Kakar, ISBN-13: 978-9389520910, Dreamtech Press, 2019
3. Core Java: An Integrated Approach, R. Nageswara Rao, ISBN-13: 978-9351199250, Dreamtech Press, 2016

E-Books / Web References:

1. <http://java.sun.com/docs/books/tutorial/>
2. <http://www.onlinecomputerbooks.com/free-java-books.php>

MOOCs:

1. www.udemy.com
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	-	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
CO6	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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THEORY OF COMPUTATION

Course Code	CSE23404	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.	8
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

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UNIX PROGRAMMING

Course Code	CSE23405A	CIE Marks	50
Hours/Week (L: T: P)	2:0:2	SEE Marks	50
Total Hours	25+15	Examination Hours	3 Hours
No. of Credits	3		

Course Objectives:

The course will enable students to:

CLO1	Understand the features and architecture of UNIX and its commands.
CLO2	Discuss different UNIX files and permissions
CLO3	Understand essential facts of shell programming in order solve the shell script problems
CLO4	Understand use of signals and Daemon process & its characteristics

CONTENTS	# of Hours
MODULE 1 UNIX Architecture and Command Usage: Unix Architecture, Features of UNIX, POSIX and the Single UNIX Specification, Internal and External Commands, Command Structure, Flexibility of Command Usage, Man Browsing the manual pages online. General-Purpose Utilities: cal, date, echo, printf, bc, script, passwd, who, uname, tty, stty. The File System: The Parent-Child Relationship, the HOME variable, pwd, cd, mkdir, rmdir, Absolute Pathnames, Relative Pathnames	05
MODULE 2 Handling Ordinary Files: cat, cp, rm, mv, more, file, wc, od, 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. Simple Filters: The sample database, pr, head, tail, cut, paste, sort, uniq, tr & 8 AP Filters using Regular Expressions: grep, BRE introduction.	05
MODULE 3 Essential Shell Programming: Shell Scripts, read, Using command line arguments, exit and exit status of command, the logical operators && and - conditional execution, the if conditional, using test and [] to evaluate expressions, the case conditional, expr, \$0, while, for Introduction: UNIX and ANSI Standards: The ANSI C Standard, The ANSI/ISO C++ Standards, Difference between ANSI C and C++, The POSIX Standards, UNIX and POSIX APIs: The POSIX APIs, The UNIX and POSIX Development Environment, API Common Characteristics.	05
MODULE 4 UNIX FILE APIS: General File APIs, File and Record Locking, Directory File APIs, Device File APIs, FIFO File APIs, Symbolic Link File APIs. UNIX PROCESSES: The Environment of a UNIX Process: Introduction, main function, Process Termination, Command-Line Arguments, Environment List, Memory Layout of a C Program, Shared Libraries, Memory Allocation.	05

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MODULE 5	
PROCESS CONTROL: Introduction, Process Identifiers, fork, vfork, exit, wait, waitpid, wait3, wait4 Functions, Race Conditions, exec Functions, Changing User IDs and Group IDs	05
SIGNALS AND DAEMON PROCESSES: Signals: The UNIX Kernel Support for Signals, Daemon Processes: Introduction, Daemon Characteristics, Coding Rules, Error Logging, Client-Server Model.	

Laboratory Component

List of Programs

Part-A

Execution of Shell commands

Part-B

1. Design, develop, and execute the following programs 1. Write a C/C++ POSIX compliant program to check the following limits: (i) No. of clock ticks (ii) Max. no. of child processes (iii) Max. path length (iv) Max. no. of characters in a file name (v) Max. no. of open files/ process.
2. Write a C/C++ POSIX compliant program that prints the POSIX defined configuration options supported on any given system using feature test macros.
3. Consider the last 100 bytes as a region. Write a C/C++ program to check whether the region is locked or not. If the region is locked, print pid of the process which has locked. If the region is not locked, lock the region with an exclusive lock, read the last 50 bytes and unlock the region.
4. Write a C/C++ program which demonstrates interprocess communication between a reader process and a writer process. Use mkfifo, open, read, write and close APIs in your program.
5. Write a C/C++ program that outputs the contents of its Environment list
6. Write a C/C++ program to illustrate the race condition.
7. Write a C/C++ program that creates a zombie and then calls system to execute the **ps** command to verify that the process is zombie.
8. Write a C / C++ program to emulate the unix **ln** command.

Course Outcomes:

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

CO1	Explain the fundamental concepts of UNIX Operating system along with the working of various commands.
CO2	Illustrate various filters to solve variety of applications and use of regular expression with pattern matching utilities.
CO3	Write Shell scripts
CO4	Describe the ANSCI standards and understand the UNIX file APIs to write system programs.
CO5	Understand the concept of process control and Signals

Text Books :

1. UNIX Concepts and Applications., Sumitabha Das., 4 th Edition., Tata McGraw Hill, Third Reprint 2007.
2. UNIX System Programming Using C++, Terrence Chan: Prentice Hall India, 1999.

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Reference Books:

1. M.G. Venkatesh Murthy: UNIX & Shell Programming, Second Impression, Pearson Education.
2. Richard Blum, Christine Bresnahan: Linux Command Line and Shell Scripting Bible, 2nd Edition, Wiley, 2014.
3. The Complete Reference UNIX, Kenneth Rosen, Douglas Host, Rachel Klee, James Farber, Richard Rosinski, Second Edition, 6th Reprint, Tata McGRAW- HILL Edition, 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.html>

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	-	-	-	-	1	-	1	-	2
CO2	3	3	2	-	1	-	-	-	-	1	-	1	-	2
CO3	3	3	2	-	1	-	-	-	-	1	-	1	-	2
CO4	3	3	2	-	1	-	-	-	-	1	-	1	-	2
CO5	3	3	2	-	1	-	-	-	-	1	-	1	-	2
Average	3	3	2	-	1	-	-	-	-	1	-	1	-	2

Low-1: Medium-2: High-3

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GAME THEORY

Course Code	CSE23405B	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	Comprehend the basics of strategic gaming and mixed strategic equilibrium
CLO2	Enable students to develop skills on extensive gaming strategies.
CLO3	Analyze and discuss various gaming models.
CLO4	Illustrate some real-time situations.

CONTENTS	# of Hours
MODULE 1 Introduction to Strategic Games: What is game theory? The theory of rational choice, Strategic games; Examples: The prisoner's dilemma, Bach or Stravinsky, Matching pennies; Nash equilibrium; Examples of Nash equilibrium; Best response functions; Dominated actions.	08
MODULE 2 Introduction; Strategic games in which players may randomize; Mixed strategy Nash equilibrium; Dominated actions; Pure equilibrium when randomization is allowed. Illustration: Expert Diagnosis; Equilibrium in a single population.	08
MODULE 3 Extensive games with perfect information: Strategies and outcomes; Nash equilibrium; Subgame perfect equilibrium; Finding sub-game perfect equilibria of finite horizon games: Backward induction; Illustrations: The ultimatum game, Stackelberg's model of duopoly.	08
MODULE 4 Bayesian Games, Motivational examples: General definitions; Two examples concerning information; Illustrations: Cournot's duopoly game with imperfect information, Providing a public good; Auctions: Auctions with an arbitrary distribution of valuations.	08
MODULE 5 Competitive Games: Strictly competitive games and maximization. Repeated games: The main idea; Preferences; Repeated games; Finitely and infinitely repeated Prisoner's dilemma; Strategies in an infinitely repeated Prisoner's dilemma; Nash equilibrium of an infinitely repeated Prisoner's dilemma, Nash equilibrium payoffs of an infinitely repeated Prisoner's dilemma.	08

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Course Outcomes:

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

CO1	Interpret the basics of strategic gaming and extensive games.
CO2	Analyze gaming strategies on real-time incidence.
CO3	Develop the models of gaming on real-time incidence.
CO4	Apply game theory in the real world problems

Text Books :

1. Martin Osborne: "An Introduction to Game Theory", Oxford University Press, First Indian Edition, 2009, 7th impression, ISBN – 0195128958.

Reference Books:

1. Roger B. Myerson: "Analysis of Conflict Game Theory", Re-print Edition, Harvard University Press, 2008, ISBN – 978-0674341166.
2. Frederick S. Hillier and Gerald J. Lieberman: "Introduction to Operations Research, Concepts and Cases", 9th Edition; Tata McGraw Hill, 2010, ISBN – 0073376299.
3. Joel Watson: "An Introduction to Game Theory" Strategy, 2nd Edition, W.W. Norton & Company, 2007, ISBN – 9780393929348.

E-Books / Web References:

1. <http://nptel.ac.in/courses.php?disciplineID=111>
2. [http://www.class-central.com/subject/math\(MOOCs\)](http://www.class-central.com/subject/math(MOOCs))
3. <http://academicearth.org/>

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	-	-	-	-	1	-	1	-	2
CO2	3	3	2	-	1	-	-	-	-	1	-	1	-	2
CO3	3	3	2	-	1	-	-	-	-	1	-	1	-	2
CO4	3	3	2	-	1	-	-	-	-	1	-	1	-	2
Average	3	3	2	-	1	-	-	-	-	1	-	1	-	2

Low-1: Medium-2: High-3

Shewamy

R PROGRAMMING

Course Code	CSE23405C	CIE Marks	50
Hours/Week (L: T: P)	2:0:2	SEE Marks	50
Total Hours	25+15	Examination Hours	3 Hours
No. of Credits	3		

Course Objectives:

The course will enable students to:

CLO1	To explore and understand how R and R Studio interactive environment.
CLO2	To understand the different data Structures, data types in R
CLO3	To learn and practice programming techniques using R programming.
CLO4	To import data into R from various data sources and generate visualizations.
CLO5	To draw insights from datasets using data analytics techniques.

CONTENTS	# of Hours
MODULE 1 Introduction, how to run R, R Sessions and Functions, Basic Math, Variables, Data Types, Vectors, Conclusion, Advanced Data Structures, Data Frames, Lists, Matrices, Arrays, Classes.	05
MODULE 2 R Programming Structures, Control Statements, Loops, -Looping Over Nonvector Sets, -If-Else, Arithmetic and Boolean Operators and values, Default Values for Argument, Return Values, Deciding Whether to explicitly call return-Returning Complex Objects, Functions are Objective, No Pointers in R, Recursion, A Quicksort Implementation-Extended Extended Example: A Binary Search Tree.	05
MODULE 3 Doing Math and Simulation in R, Math Function, Extended Example Calculating Probability-Cumulative Sums and Products-Minima and Maxima-Calculus, Functions for Statistical Distribution, Sorting, Linear Algebra Operation on Vectors and Matrices, Extended Example: Vector cross Product-Extended Example: Finding Stationary Distribution of Markov Chains, Set Operation, Input /output, Accessing the Keyboard and Monitor, Reading and writer Files.	05
MODULE 4 Graphics, Creating Graphs, The Workhorse of R Base Graphics, the plot () Function – Customizing Graphs, Saving Graphs to Files.	05
MODULE 5 Probability Distributions, Normal Distribution-Binomial Distribution-Poisson Distributions Other Distribution, Basic Statistics, Correlation and Covariance, T-Tests, -ANOVA. Linear Models, Simple Linear Regression, -Multiple Regression Generalized Linear Models, Logistic Regression, Poisson Regression-other Generalized Linear Models-Survival Analysis, Nonlinear Models, Splines-Decision-Random Forests.	05

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Laboratory Component

1	Demonstrate the steps for installation of R and R Studio. Perform the following: a) Assign different type of values to variables and display the type of variable. Assign different types such as Double, Integer, Logical, Complex and Character and understand the difference between each data type. b) Demonstrate Arithmetic and Logical Operations with simple examples. c) Demonstrate generation of sequences and creation of vectors. d) Demonstrate Creation of Matrices e) Demonstrate the Creation of Matrices from Vectors using Binding Function. f) Demonstrate element extraction from vectors, matrices and arrays
2	Assess the Financial Statement of an Organization being supplied with 2 vectors of data: Monthly Revenue and Monthly Expenses for the Financial Year. You can create your own sample data vector for this experiment) . Calculate the following financial metrics: a. Profit for each month. b. Profit after tax for each month (Tax Rate is 30%). c. Profit margin for each month equals to profit after tax divided by revenue. d. Good Months – where the profit after tax was greater than the mean for the year. e. Bad Months – where the profit after tax was less than the mean for the year. f. The best month – where the profit after tax was max for the year. g. The worst month – where the profit after tax was min for the year. Note: a. All Results need to be presented as vectors b. Results for Dollar values need to be calculated with \$0.01 precision, but need to be presented in Units of \$1000 (i.e 1k) with no decimal points c. Results for the profit margin ratio need to be presented in units of % with no decimal point. d. It is okay for tax to be negative for any given month (deferred tax asset) e. Generate CSV file for the data.
3	Develop a program to create two 3 X 3 matrices A and B and perform the following operations a) Transpose of the matrix b) addition c) subtraction d) multiplication
4	Develop a program to find the factorial of given number using recursive function calls.
5	Develop an R Program using functions to find all the prime numbers up to a specified number by the method of Sieve of Eratosthenes.
6	The built-in data set mammals contain data on body weight versus brain weight. Develop R commands to: a) Find the Pearson and Spearman correlation coefficients. Are they similar? b) Plot the data using the plot command. c) Plot the logarithm (log) of each variable and see if that makes a difference.

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7	Develop R program to create a Data Frame with following details and do the following operations. <table border="1"><thead><tr><th>itemCode</th><th>itemCategory</th><th>itemPrice</th></tr></thead><tbody><tr><td>1001</td><td>Electronics</td><td>700</td></tr><tr><td>1002</td><td>Desktop supplies</td><td>300</td></tr><tr><td>1003</td><td>Office supplies</td><td>350</td></tr><tr><td>1004</td><td>USB</td><td>400</td></tr><tr><td>1005</td><td>CD Drive</td><td>800</td></tr></tbody></table> a) Subset the Data frame and display the details of only those items whose price is greater than or equal to 350. b) Subset the Data frame and display only the items where the category is either “Office Supplies” or “Desktop Supplies” c) Create another Data Frame called “item-details” with three different fields itemCode, ItemQtyonHand and ItemReorderLvl and merge the two frames	itemCode	itemCategory	itemPrice	1001	Electronics	700	1002	Desktop supplies	300	1003	Office supplies	350	1004	USB	400	1005	CD Drive	800
itemCode	itemCategory	itemPrice																	
1001	Electronics	700																	
1002	Desktop supplies	300																	
1003	Office supplies	350																	
1004	USB	400																	
1005	CD Drive	800																	
8	Let us use the built-in dataset air quality which has Daily air quality measurements in New York, May to September 1973. Develop R program to generate histogram by using appropriate arguments for the following statements. a) Assigning names, using the air quality data set. b) Change colors of the Histogram c) Remove Axis and Add labels to Histogram d) Change Axis limits of a Histogram e) Add Density curve to the histogram																		
9	Design a data frame in R for storing about 20 employee details. Create a CSV file named “input.csv” that defines all the required information about the employee such as id, name, salary, start_date, dept. Import into R and do the following analysis. a) Find the total number rows & columns b) Find the maximum salary c) Retrieve the details of the employee with maximum salary d) Retrieve all the employees working in the IT Department. e) Retrieve the employees in the IT Department whose salary is greater than 20000 and write these details into another file “output.csv”																		

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10	Using the built in dataset mtcars which is a popular dataset consisting of the design and fuel consumption patterns of 32 different automobiles. The data was extracted from the 1974 Motor Trend US magazine, and comprises fuel consumption and 10 aspects of automobile design and performance for 32 automobiles (1973-74 models). Format A data frame with 32 observations on 11 variables : [1] mpg Miles/(US) gallon, [2] cyl Number of cylinders [3] disp Displacement (cu.in.), [4] hp Gross horsepower [5] drat Rear axle ratio,[6] wt Weight (lb/1000) [7] qsec 1/4 mile time, [8] vs V/S, [9] am Transmission (0 = automatic, 1 = manual), [10] gear Number of forward gears, [11] carb Number of carburetors. Develop R program, to solve the following: - What is the total number of observations and variables in the dataset? - Find the car with the largest hp and the least hp using suitable functions - Plot histogram / density for each variable and determine whether continuous variables are normally distributed or not. If not, what is their skewness? - What is the average difference of gross horse power(hp) between automobiles with 3 and 4 number of cylinders(cyl)? Also determine the difference in their standard deviations. - Which pair of variables has the highest Pearson correlation?
11	Demonstrate the progression of salary with years of experience using a suitable data set (You can create your own dataset). Plot the graph visualizing the best fit line on the plot of the given data points. Plot a curve of Actual Values vs. Predicted values to show their correlation and performance of the model. Interpret the meaning of the slope and y-intercept of the line with respect to the given data. Implement using lm function. Save the graphs and coefficients in files. Attach the predicted values of salaries as a new column to the original data set and save the data as a new CSV file.

Course Outcomes:

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

CO1	Explain the fundamental syntax of R data types, expressions and the usage of the R-Studio IDE
CO2	Develop a program in R with programming constructs: conditionals, looping and functions.
CO3	Apply the list and data frame structure of the R programming language.
CO4	Use visualization packages and file handlers for data analysis.

Text Books :

1. Cotton, R. (2013). Learning R: A Step by Step Function Guide to Data Analysis. 1st ed. O'Reilly Media Inc.

Reference Books:

1. Jones, O., Maillardet. R. and Robinson, A. (2014). Introduction to Scientific Programming and Simulation Using R. Chapman & Hall/CRC, The R Series.
2. Davies, T.M. (2016) The Book of R: A First Course in Programming and Statistics. No Starch Press.

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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	2	-	1	-	-	-	-	1	-	1	-	2
CO2	3	3	2	-	1	-	-	-	-	1	-	1	-	2
CO3	3	3	2	-	1	-	-	-	-	1	-	1	-	2
CO4	3	3	2	-	1	-	-	-	-	1	-	1	-	2
Average	3	3	2	-	1	-	-	-	-	1	-	1	-	2

Low-1: Medium-2: High-3

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OPTIMIZATION TECHNIQUES

Course Code	CSE23405D	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	Appreciate the importance of linear algebra in computer science and allied engineering science.
CLO2	Gain the knowledge of linear algebra tools and concepts to implement them in their core domain.
CLO3	Improve their mathematical thinking and acquire skills required for sustained lifelong learning.

CONTENTS	# of Hours
Vector Calculus: Functions of several variables, Differentiation and partial differentials, gradients of vector valued functions, gradients of matrices, useful identities for computing gradients, linearization and multivariate Taylor series	08
MODULE 2	
Applications of Vector Calculus: Backpropagation and automatic differentiation, gradients in a deep network, The Gradient of Quadratic Cost, Descending the Gradient of Cost, The Gradient of Mean Squared Error.	08
MODULE 3	
Convex Optimization-1: Local and global optima, convex sets and functions separating hyperplanes, application of Hessian matrix in optimization, Optimization using gradient descent, Sequential search 3-point search and Fibonacci search.	08
MODULE 4	
Convex Optimization-2: Unconstrained optimization -Method of steepest ascent/descent, NR method, Gradient descent, Mini batch gradient descent, Stochastic gradient descent	08
MODULE 5	
Advanced Optimization: Momentum-based gradient descent methods: Adagrad, RMS prop and Adam. Non-Convex Optimization: Convergence to Critical Points, Saddle-Point methods.	08

Course Outcomes:

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

CO1	Apply the concepts of vector calculus to solve the given problem.
CO2	Apply the concepts of partial differentiation in machine learning and deep neural networks.
CO3	Analyze the convex optimization algorithms and their importance in computer science & engineering.
CO4	Apply the optimization algorithms to solve the problem.
CO5	Analyze the advanced optimization algorithms for machine learning.

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Text Books :

1. Mathematics for Machine learning, Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, 2020, Cambridge University Press.
2. S. Bubeck, Convex Optimization: Algorithms and Complexity, Foundations and Trends in Optimization, 2015.
3. S. Boyd, N. Parikh, and E. Chu, "Distributed optimization and statistical learning via the alternating direction method of multipliers", Foundations and Trends in Machine Learning, Now Publishers Inc.

Reference Books:

1. Linear Algebra and Optimization for Machine Learning, Charu C. Aggarwal, Springer, 2020.
2. A. Beck, First-Order Methods in Optimization, MOS-SIAM Series on Optimization, 2017.
3. F. Bach, "Learning with Submodular Functions: A Convex Optimization Perspective", Foundations and Trends in Machine Learning, Now Publishers Inc.

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	3	3	2	-	1	-	-	-	-	1	-	1	-	2
CO2	3	3	2	-	1	-	-	-	-	1	-	1	-	2
CO3	3	3	2	-	1	-	-	-	-	1	-	1	-	2
CO4	3	3	2	-	1	-	-	-	-	1	-	1	-	2
CO5	3	3	2	-	1	-	-	-	-	1	-	1	-	2
Average	3	3	2	-	1	-	-	-	-	1	-	1	-	2

Low-1: Medium-2: High-3

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UNIVERSAL HUMAN VALUES

Course Code	UHK23406	CIE Marks	50
Hours/Week (L: T: P)	1:0:0	SEE Marks	50
Total Hours	15	Examination Hours	1 Hour
No. of Credits	1		

Course Learning Objectives:

CLO1	To create an awareness on Engineering Ethics and Human Values.
CLO2	To understand social responsibility of an engineer.
CLO3	To appreciate ethical dilemma while discharging duties in professional life.

CONTENTS	#No. of Hours
Module 1 Introduction to Value Education - Value Education, Definition, Concept and Need for Value Education. - The Content and Process of Value Education. - Basic Guidelines for Value Education. - Self-exploration as a means of Value Education. - Happiness and Prosperity as parts of Value Education.	03
Module 2 Harmony in the Human Being - Human Being is more than just the Body. - Harmony of the Self ('I') with the Body. - Understanding Myself as Co-existence of the Self and the Body. - Understanding Needs of the Self and the needs of the Body. - Understanding the activities in the Self and the activities in the Body.	03
Module 3 Harmony in the Family and Society and Harmony in the Nature - Family as a basic unit of Human Interaction and Values in Relationships. - The Basics for Respect and today's Crisis: Affection, e, Guidance, Reverence, Glory, Gratitude and Love. - Comprehensive Human Goal: The Five Dimensions of Human Endeavour. - Harmony in Nature: The Four Orders in Nature. - The Holistic Perception of Harmony in Existence.	03
Module 4 Social Ethics - The Basics for Ethical Human Conduct. - Defects in Ethical Human Conduct. - Holistic Alternative and Universal Order. - Universal Human Order and Ethical Conduct. - Human Rights violation and Social Disparities.	03

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Module 5	
Professional Ethics - Value based Life and Profession. - Professional Ethics and Right Understanding. - Competence in Professional Ethics. - Issues in Professional Ethics – The Current Scenario. - Vision for Holistic Technologies, Production System and Management Models.	03

Course Outcomes:

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

CO1	Understand the significance of value inputs in a classroom and start applying them in their life and profession
CO2	Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.
CO3	Understand the role of a human being in ensuring harmony in society and nature.
CO4	Distinguish between ethical and unethical practices and start working out the strategy to actualize a harmonious environment wherever they work.

Text Books:

- 1.A.N Tripathy, New Age International Publishers, 2003.
- 2.Bajpai. B. L, New Royal Book Co, Lucknow, Reprinted, 2004
- 3.Bertrand Russell Human Society in Ethics & Politics

Reference Books:

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. Corliss Lamont, Philosophy of Humanism.
4. Gaur. R.R. , Sangal. R, Bagari G.P, A Foundation Course in Value Education, Excel Books, 2009.
5. Gaur. R.R. , Sangal R , Bagaria G.P, Teachers Manual, Excel Books, 2009.
6. I.C. Sharma, Ethical Philosophy of India, Nagin & co, Julundhar
7. William Lilly- Introduction to Ethics -Allied Publisher

Mapping of CO-PO:

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

Low-1: Medium-2: High-3

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UI/UX

Course Code	CSE23407A	CIE Marks	50
Hours/Week (L: T: P)	1:0:2	SEE Marks	50
Total Hours	28	Examination Hours	3 Hours
No. of Credits	2		

Course Objectives:

The course will enable students to:

CLO1	Understand user experience design requirements, with design goals, metrics and targets.
CLO2	Explore different prototyping methods, UX design principles with case examples.
CLO3	Understand the role of design thinking concepts and mental models in UX design

CONTENTS	# of Hours
MODULE 1 Introduction: Usability to user experience, Emotional impact as part of user experience, User experience needs a business case. Extracting Interaction Design Requirements: Needs & Requirements, Formal requirement extraction, Methods for requirement extraction.	03
MODULE 2 Design Thinking, Ideation, and Sketching: Design Thinking, Design Perspectives, User Personas, Ideation, Sketching. Mental Models and Conceptual Design: Storyboards, Design influencing user behaviour.	03
MODULE 3 Design Production: Detailed Design, Wireframes. UX Goals, Metrics and Targets: UX Goals, UX Measures, Measurement instruments, UX Metrics.	03
MODULE 4 Prototyping: Depth & breadth of a prototype, Fidelity of prototypes, Paper prototypes. Connections with Software Engineering: Foundations for success in SE-UX development, The challenge of connecting SE and UX.	03
MODULE 5 UX Design Guidelines: Using and interpreting design guidelines, Human memory limitations, UX design guidelines & examples, Planning, Translation, Physical action, Outcomes, Assessment.	03

Laboratory Components

1	Design a responsive layout for a societal application.
2	Explore various UI interaction patterns.
3	Develop an Interface with Proper UI Style Guides.
4	Develop wireflow diagram for application using open-source software.
5	Explore various open-source collaborative interface Platform.
6	Create a Sample Pattern Library for the product (Mood board, Fonts, Colors based on UI principles).
7	Conduct end-to-end user research - User research, creating personas, Ideation process (User stories, Scenarios), Flow diagrams, Flow Mapping.
8	Design with popular tool and build a prototype and perform usability testing and identify improvements.

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Course Outcomes:

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

CO1	Explain the user experience design requirements.
CO2	Relate design thinking concepts and mental models to UX design.
CO3	Illustrate UX design in line with design goals, metrics and targets.
CO4	Demonstrate different prototyping in relation with software engineering
CO5	Explain UX design principles with case examples.

Text Books:

- 1 REX HARTSON and PARDHA S. PYLA, The UX Book-Process and Guidelines for Ensuring a Quality User Experience, Morgan Kaufmann, Elsevier, 2012.

E-Books / Web References:

1. <https://www.freecodecamp.org/news/ui-ux-design-tutorial-from-zero-to-hero-with-wireframe-prototype-figma/>
2. <https://www.edureka.co/blog/ui-ux-design-tutorial/>
3. <https://www.udemy.com/course/introtoux/>

Mapping of CO-PO:

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

Low-1: Medium-2: High-3

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FULL STACK FRAMEWORK (FRONTEND)

Course Code	CSE23407B	CIE Marks	50
Hours/Week (L: T: P)	1:0:2	SEE Marks	50
Total Hours	28	Examination Hours	3 Hours
No. of Credits	2		

Course 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 React JS

CONTENTS	# of Hours
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, Arrays, and Functions.	03
MODULE 2 JavaScript and HTML Documents: The JavaScript 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.	03
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.	03
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.	03
MODULE 5 React Fragments, Forms in React, Styling in React, CSS in React, React Class Components.	03

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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 Programs

1a	Develop a JavaScript program that employs a function to display a number in reverse order. The program should prompt the user to enter a number, utilize a function to reverse the digits of the number, and then display the reversed number. Ensure your program includes appropriate error handling and clear instructions for the user.
1b	Develop a JavaScript program to utilize library methods to reverse the input value. Additionally, implement a check to determine if the input value is a palindrome.
2	Develop a JavaScript program to determine the position of the left-most vowel in a provided string. The program should prompt the user to input a string, and then utilize a function to identify the position (index) of the first vowel encountered from the left side of the string. Ensure your program accounts for cases where no vowels are present in the string and provide clear instructions for the user.
3	Develop a JavaScript program that displays the text 'TEXT-GROWING' with increasing font size every 300 milliseconds, shown in red color. When the font size reaches 50pt, the text should change to 'TEXT-SHRINKING' displayed in blue color, followed by decreasing the font size until it reaches 5pt."
4	Develop a JavaScript program to simulate a basic calculator that performs addition, subtraction, multiplication, and division operations. The calculator should utilize the onclick event to trigger the operations. Additionally, ensure that the program includes validation checks for handling invalid inputs to ensure proper functionality.
5	Develop a JavaScript program that contains three short paragraphs of text, stacked on top of each other, with only enough of each showing so that the mouse cursor can be placed over some part of them. When the cursor is placed over the exposed part of any paragraph, it should rise to the top to become completely visible.
6	Develop a JavaScript program that implements a fading effect for a division element upon clicking. The program should allow users to click on a button, triggering a smooth fade-out transition.
7	Develop a JavaScript program to create a web page with four divisions, each having a different background color. Implement interactivity such that when you hover over each division: • The width of the division increases to 100%. • The background color name of the respective division is displayed within the division. • Once the mouse is moved away, the displayed text disappears, and the division returns to its original width.
8	Develop a JavaScript program to handle various transformations (translation, rotation, scaling and skewing) using user-triggered events.
9	Develop a JavaScript program to dynamically create multiple divisions and enable drag-and-drop functionality for images onto these divisions using events.

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10	Use ReactJS to develop a program that displays a list of books. The program should utilize React components to display the books by extracting the respective keys. Provide clear instructions for setting up the project, creating the necessary components, and rendering the book list.
11	Design a program to build a simple search filter functionality using ReactJS. The program should allow users to enter a search query, and dynamically display a filtered list based on the entered query. Provide clear instructions for setting up the React project, creating the necessary components (such as a search bar component and a list component), and implementing the search functionality.
12	Design a program to create a simple counter application using ReactJS. The counter should start at 0 and allow users to increment, decrement, and reset its value. Provide clear instructions for setting up the React project, creating the necessary components (such as Counter and Button components), and implementing the counter functionality.
13	Use ReactJS to create a simple login form that must include fields for email and password. Implement a submit button to handle form submission. Provide clear instructions for setting up the React project, creating the necessary components, and implementing form validation.

Course Outcomes:

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

CO1	Apply the concepts of JavaScript and pre-defined objects, properties and methods to design web pages
CO2	Develop applications using event handling in JavaScript
CO3	Analyze the dynamic documents with JavaScript
CO4	Apply the fundamentals of ReactJS to design webpages
CO5	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>

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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>
3. 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
CO1	2	3	3	-	3	-	-	-	3	-	-	-	2	-
CO2	2	3	3	-	3	-	-	-	3	-	-	-	2	-
CO3	2	3	3	3	3	-	-	-	3	-	-	-	2	-
CO4	2	3	3	3	3	-	-	-	3	-	-	-	2	-
CO5	2	3	3	3	3	-	-	-	3	-	-	-	2	-
Average	2	3	3	3	3	-	-	-	3	-	-	-	2	-

Low-1: Medium-2: High-3

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LEX - A TOOL FOR LEXICAL ANALYSIS

Course Code	CSE23407C	CIE Marks	50
Hours/Week (L: T: P)	1:0:2	SEE Marks	50
Total Hours	28	Examination Hours	3 Hours
No. of Credits	2		

Course Objectives:

The course will enable students to:

CLO1	Understand the different phases of compiler
CLO2	Implement the Lexical Analysis phase using LEX tool

CONTENTS	# of Hours
MODULE 1 Introduction to Compiler, Overview of the Translation Process- A Simple Compiler, Difference between interpreter, assembler and compiler, The Phases of a Compiler.	03
MODULE 2 Introduction to Lexical Analyzer, Input Buffering, Specification of Tokens, Recognition of Tokens A Language for Specifying Lexical Analyzers.	03
MODULE 3 Finite Automata From a Regular Expression, Design of a Lexical Analyzer Generator, Optimization of DFA, Error recovery in Lexical Analyzer.	03
MODULE 4 The Simplest Lex Program, Grammars, Parser-Lexer Communication, The Rules Section, Running LEX, LEX and Hand- Written Lexers.	03
MODULE 5 Using LEX - Regular Expression, Examples of Regular Expressions, A Word Counting Program.	03

Laboratory Components

Programs can be executed on Linux platform.

1	Write a LEX program to count the number of characters, words, spaces and lines in a given input file.
2	Write a LEX program count total number of tokens.
3	Write a LEX program to count the numbers of comment lines in a given C program. Also eliminate them and copy the resulting program into separate file.
4	Write a LEX program to recognize a valid arithmetic expression and to recognize the identifiers and operators present. Print them separately.
5	Write a LEX program to recognize whether a given sentence is simple or compound.
6	Write a LEX program to recognize and count the number of identifiers in a given input file.
7	Write a LEX program to check valid Mobile Number.
8	Write a LEX program to add line numbers to a given file.
9	Write a LEX program to take input from file and remove multiple spaces, lines and tabs.
10	Write a LEX program to check if characters other than alphabets occur in a string.

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Course Outcomes:

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

CO1	Apply the knowledge of lexical analysis to define different tokens and context free grammars for a particular language.
CO2	Analyze the usage of regular expressions slightly to provide token definition for different language constructs.
CO3	Apply the knowledge of Lex tool to validate tokens of a particular language.

Text Books:

1. John R Levine, Tonny Mason & Doug Brown, "Lex and YaCC", O'Reilly, 2nd Edition.

Mapping of CO-PO:

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

Low-1: Medium-2: High-3

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TECHNICAL WRITING USING LATEX

Course Code	CSE23407D	CIE Marks	50
Hours/Week (L: T: P)	2:0:2	SEE Marks	50
Total Hours	28	Examination Hours	3 Hours
No. of Credits	2		

Course Objectives:

The course will enable students to:

CLO1	To introduce the basic syntax and semantics of the LaTeX scripting language
CLO2	To understand the presentation of tables and figures in the document
CLO3	To illustrate the LaTeX syntax to represent the theorems and mathematical equations
CLO4	To make use of the libraries (Tikz, algorithm) to design the diagram and algorithms in the document

CONTENTS	# of Hours
MODULE 1 Installation of MikeTeX, Online Overleaf access, TEX and its offspring, Creating a Title, Sections, Command names, and arguments, Labelling Table of Contents, Font Effects, Coloured Text, Font Sizes, Comments & Spacing Special Characters, Line breaking.	03
MODULE 2 Lists, Tables, Figures - List of figures, Equations: Inserting Equations and Mathematical Symbols	03
MODULE 3 Inserting References: Inserting the Bibliography Styles, Technical Report: Writing Thesis/project/report, Classes: article, book, report, beamer, slides. IEEtran.	03
MODULE 4 Document Layout and Organization- Page Layout – Titles, Abstract Chapters, Sections, References, Equation References, citation. List-making environments, Table of contents, Generating new commands	03
MODULE 5 Figure handling numbering, Generating index, Loading packages. Parts of the document: Abstract, Chapters, Appendix, Customized head and foot lines, Page numbering, Paragraph formatting, Single and double column pages	03

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Laboratory Components

1	Develop a LaTeX script to create a simple document that consists of 2 sections [Section1, Section2], and a paragraph with dummy text in each section. And also include header [title of document] and footer [institute name, page number] in the document.																											
2	Develop a LaTeX script to create a document that displays the sample Abstract/Summary																											
3	Develop a LaTeX script to create a simple title page of the VTU project Report [Use suitable Logos and text formatting]																											
4	Develop a LaTeX script to create the Certificate Page of the Report [Use suitable commands to leave the blank spaces for user entry]																											
5	Develop a LaTeX script to create a document that contains the following table with proper labels. <table><tr><th rowspan="2">Sl. No</th><th rowspan="2">USN</th><th rowspan="2">Student Name</th><th colspan="3">Marks</th></tr><tr><th>Subject1</th><th>Subject2</th><th>Subject3</th></tr><tr><td>1</td><td>4XX22XX001</td><td>Name 1</td><td>89</td><td>60</td><td>90</td></tr><tr><td>2</td><td>4XX22XX002</td><td>Name 2</td><td>78</td><td>45</td><td>98</td></tr><tr><td>3</td><td>4XX22XX003</td><td>Name 3</td><td>67</td><td>55</td><td>59</td></tr></table>	Sl. No	USN	Student Name	Marks			Subject1	Subject2	Subject3	1	4XX22XX001	Name 1	89	60	90	2	4XX22XX002	Name 2	78	45	98	3	4XX22XX003	Name 3	67	55	59
Sl. No	USN				Student Name	Marks																						
		Subject1	Subject2	Subject3																								
1	4XX22XX001	Name 1	89	60	90																							
2	4XX22XX002	Name 2	78	45	98																							
3	4XX22XX003	Name 3	67	55	59																							
6	Develop a LaTeX script to include the side-by-side graphics/pictures/figures in the document by using the subgraph concept																											
7	Develop a LaTeX script to create a document that consists of the following two mathematical equations $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$= \frac{-2 \pm \sqrt{2^2 - 4 \cdot (1) \cdot (-8)}}{2 \cdot 1}$$= \frac{-2 \pm \sqrt{4 + 32}}{2}$ $\varphi_{\sigma}^{\lambda} A_t = \sum_{\pi \in C_t} \text{sgn}(\pi) \varphi_{\sigma}^{\lambda} \varphi_{\pi}^{\lambda}$$= \sum_{\tau \in C_{\sigma t}} \text{sgn}(\sigma^{-1} \tau \sigma) \varphi_{\sigma}^{\lambda} \varphi_{\sigma^{-1} \tau \sigma}^{\lambda}$$= A_{\sigma t} \varphi_{\sigma}^{\lambda}$																											
8	Develop a LaTeX script to demonstrate the presentation of Numbered theorems, definitions, corollaries, and lemmas in the document																											
9	Develop a LaTeX script to create a document that consists of two paragraphs with a minimum of 10 citations in it and display the reference in the section																											
10	Develop a LaTeX script to design a simple tree diagram or hierarchical structure in the document with appropriate labels using the Tikz library																											
11	Develop a LaTeX script to present an algorithm in the document using algorithm/algorithmic/algorithm2e library																											
12	Develop a LaTeX script to create a simple report and article by using suitable commands and formats of user choice.																											

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Course Outcomes:

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

CO1	Apply basic LaTeX command to develop simple document
CO2	Develop LaTeX script to present the tables and figures in the document
CO3	Illustrate LaTeX script to present theorems and mathematical equations in the document
CO4	Develop programs to generate the complete report with citations and a bibliography
CO5	Illustrate the use of Tikz and algorithm libraries to design graphics and algorithms in the

Text Books:

1. A Short Introduction to LaTeX BY FIRUZA KARMAI (AIBARA), A book for beginners, 2019
2. Formatting Information: A Beginner's Introduction to Typesetting with LaTeX, BY PETER FLYNN, Comprehensive TeX Archive Network (2005)

E-Books / Web References:

1. LaTeX TUTORIAL: [<https://latex-tutorial.com/tutorials/>]
2. LaTeX TUTORIAL: [<https://www.javatpoint.com/latex>]

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	2	3	3	-	3	-	-	-	3	-	-	-	2	-
CO2	2	3	3	-	3	-	-	-	3	-	-	-	2	-
CO3	2	3	3	3	3	-	-	-	3	-	-	-	2	-
CO4	2	3	3	3	3	-	-	-	3	-	-	-	2	-
CO5	2	3	3	3	3	-	-	-	3	-	-	-	2	-
Average	2	3	3	3	3	-	-	-	3	-	-	-	2	-

Low-1: Medium-2: High-3

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ALGORITHMS LABORATORY
(Common to CSE/ISE/AD/AM/CI)

Course Code:	CSEL23409	CIE Marks	50
Hours/Week (L: T: P)	0:0:2	SEE Marks	50
No. of Credits	1	Examination Hours	3

Sl. No.	Experiments/Programs
1	a. Implement naïve String matching algorithm using Brute Force Approach b. Implement and analyze iterative and recursive binary search algorithm using divide and conquer method .
2	Sort a given set of n integer elements using Merge Sort method and compute its time complexity. Demonstrate this algorithm using Divide-and-Conquer method.
3	Sort a given set of n integer elements using Quick Sort method and compute its time complexity. Demonstrate this algorithm using Divide-and-Conquer method.
4	a. Incorporate the array data structure and demonstrate whether a given unweighted graph is connected or not using DFS method. b. Implement the graph traversal technique using BFS method to print all the nodes reachable from a given starting node in an unweighted graph.
5	Demonstrate how to obtain the Topological ordering of vertices in a given digraph.
6	Implement Horspool's String matching algorithm.
7	Compute the Transitive Closure for a given directed graph using Warshalls algorithm.
8	For a given weighted graph, construct an All-Pairs Shortest Path using Floyds algorithm .
9	Implement 0/1 Knapsack problem using Dynamic Programming Memory Functions technique.
10	Find Minimum Cost Spanning Tree for a given weighted graph using Prims and Kruskal's algorithm.
11	From a given vertex in a weighted connected graph, determine the Single Source Shortest Paths using Dijkstra's algorithm
12	Demonstrate the working of back tracking approach for solving N-Queen's problem.
Open Ended Programs	
1	Implement Fractional Knapsack problem using Greedy Method.
2	Implementation of Travelling Salesman problem using Dynamic programming
3	Mini project proposal should be submitted, and Implementation should be done based on the problem stated in the proposal

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Course Outcomes:

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

CO1	Interpret the brute-force, divide-and-conquer paradigms
CO2	Recognize the design techniques for graph traversal and String Matching problems using representative algorithms
CO3	Demonstrate the greedy technique, dynamic programming paradigm as to when an algorithmic design situation calls for it
CO4	Illustrate the Backtracking algorithm design paradigms

Text Books:

1. Introduction to the Design and Analysis of Algorithms, Anany Levitin, University, 3rd Edition, 2012, Pearson, ISBN 13: 978-0-13-231681-1.
2. Introduction to Algorithms, Cormen T.H., Leiserson C.E., Rivest R.L., Stein C., 3rd Edition, 2010, PHI, ISBN:9780262033848.

Reference Books:

1. Computer Algorithms, Horowitz E., Sahani S., Rajasekharan S., 2nd Edition, 2006, Galgotia Publications, ISBN:9780716783169.

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	3	-
CO2	3	3	3	-	3	-	-	-	-	-	-	2	3	-
CO3	3	3	3	-	3	-	-	-	-	-	-	2	3	-
CO4	3	3	3	-	3	-	-	-	-	-	-	2	3	-
Average	3	3	3	-	3	-	-	-	-	-	-	2	3	-

Low-1: Medium-2: High-3

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SYLLABUS

V SEMESTER

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10/10/2022

SOFTWARE ENGINEERING AND PROJECT MANAGEMENT

Course Code:	CSE23501	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. Identify ethical and professional issues and explain why they are of concern to Software Engineers.
CLO2	Describe the process of requirement gathering, requirement classification, requirement specification and requirements validation.
CLO3	Recognize the importance of Project Management with its methods and methodologies.
CLO4	Identify software quality parameters and quantify software using measurements and metrics. List software quality standards and outline the practices involved.

CONTENTS	# of Hours
MODULE 1 Software and Software Engineering: The nature of Software, The unique nature of WebApps, Software Engineering, The software Process, Software Engineering Practice, Software Myths. Process Models: A generic process model, Process assessment and improvement, Prescriptive process models: Waterfall model, Incremental process models, Evolutionary process models, Concurrent models, Specialized process models. Unified Process, Personal and Team process models.	08
MODULE 2 Understanding Requirements: Requirements Engineering, Establishing the ground work, Eliciting Requirements, Developing use cases, Building the requirements model, Negotiating Requirements, Validating Requirements. Requirements Modeling Scenarios, Information and Analysis classes: Requirement Analysis, Scenario based modeling, UML models that supplement the Use Case, Data modeling Concepts, Class-Based Modeling. Requirement Modeling Strategies : Flow oriented Modeling, Behavioral Modeling	08
MODULE 3 Agile Development: What is Agility?, Agility and the cost of change. What is an agile Process?, Extreme Programming (XP), Other Agile Process Models, A tool set for Agile process. Principles that guide practice: Software Engineering Knowledge, Core principles, Principles that guide each framework activity.	08
MODULE 4 Introduction to Project Management: Introduction, Project and Importance of Project Management, Contract Management, Activities Covered by Software Project Management, Plans, Methods and Methodologies, Some ways of categorizing Software Projects, Stakeholders, Setting Objectives, Business Case, Project Success and Failure, Management and Management Control, Project Management life cycle, Traditional versus Modern Project Management Practices. Project Evaluation: Evaluation of	08

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Individual projects, Cost–benefit Evaluation Techniques, Risk Evaluation.	
MODULE 5 Software Quality: Introduction, The place of software quality in project planning, Importance of software quality, Defining software quality, Software quality models, product versus process quality management. Software Project Estimation: Observations on Estimation, Decomposition Techniques, Empirical Estimation Models.	08

Course Outcomes:

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

CO1	Differentiate process models to judge which process model has to be adopted for the given scenarios
CO2	Derive both functional and nonfunctional requirements from the case study.
CO3	Analyze the importance of various software testing methods and agile methodology.
CO4	Illustrate the role of project planning and quality management in software development.
CO5	Identify appropriate techniques to enhance software quality.

Text Books:

1. Roger S. Pressman: Software Engineering-A Practitioners approach, 7th Edition, Tata McGraw Hill.
2. Bob Hughes, Mike Cotterell, Rajib Mall: Software Project Management, 6th Edition, McGraw Hill Education, 2018.

Reference Books:

1. Pankaj Jalote: An Integrated Approach to Software Engineering, Wiley India.
2. Hans van Vliet ,Software Engineering: Principles and Practice , Wiley India, 3rd Edition, 2010.

MOOCs:

1. https://onlinecourses.nptel.ac.in/noc20_cs68/preview
2. https://onlinecourses.nptel.ac.in/noc24_mg01/preview

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

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DATABASE MANAGEMENT SYSTEMS

Course Code:	CSE23502	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 <i>for</i> 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. <i>Trigger</i> 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.

Sheela

	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><tr><td>BASIC</td><td>DA</td><td>HRA</td></tr><tr><td>15000</td><td>12%</td><td>8%</td></tr><tr><td>12000</td><td>10%</td><td>6%</td></tr><tr><td>9000</td><td>7%</td><td>4%</td></tr><tr><td>OTHERS</td><td>5%</td><td>200/-</td></tr></table> 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.	BASIC	DA	HRA	15000	12%	8%	12000	10%	6%	9000	7%	4%	OTHERS	5%	200/-
BASIC	DA	HRA														
15000	12%	8%														
12000	10%	6%														
9000	7%	4%														
OTHERS	5%	200/-														
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.															

Sleepy

	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.
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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/>

Shashank

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

Sheswamy

COMPUTER NETWORKS

Course Code:	CSE23503	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 Bruce 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](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

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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	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

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FULL STACK FRAMEWORK (BACK END)

Course Code:	CSE23504	CIE Marks	50
Hours/Week (L: T: P)	0:0:2	SEE Marks	50
Total Hours	15	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.

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:

- Install Node.js on your machine. Verify the installation by checking the versions of Node.js and npm (node -v and npm -v).
- Create a new directory for your project and initialize it with npm init -y to generate a package.json file.
- Install Express using npm.

2. Create Your First Node.js Script:

- Create a file named hello.js that prints "Hello, Node.js!" to the console.
- Run the script using node hello.js.

3. Set Up an Express Server:

- Create a file named app.js that sets up an Express server listening on port 3000.
- Implement a route that responds with "Hello, Express!" when accessing the root URL (/).

4. Serving HTML and JSON:

- **HTML:**
 - Create a public directory.
 - Inside the public directory, create an index.html file with a basic HTML structure and a welcome message.
- **JSON:**

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- 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:**
- Inside the public directory, create the following subdirectories:
 - css for your CSS file.
 - js for your JavaScript file.
 - images for an image file.
 - 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).
 - 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:**

- Initialize a new Node.js project and install express, mongoose, and body-parser.
- 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:**

- 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:**

- 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:**

- **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.
- **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.
- **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.
- **Resource Deleting Endpoints:**
 - Create a DELETE endpoint (/api/items/:id) to delete a specific item by its ObjectID.

5. **Testing with Postman:**

- 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.

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3. Create a Node.js application with Express that demonstrates secure API authentication and user management 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.

2. **Securely Storing Passwords:**

- **Password Hashing:**

- Implement password hashing using a library like bcrypt to securely store user passwords in your MongoDB database.

- **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:**

- **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.

- **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:**

- **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.

- **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:**

- **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.

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- 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
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

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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:	CSE23505A	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 Display Devices, 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 Warren Carithers: 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	PS01	PS02
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

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ROBOTIC PROCESS AUTOMATION

Course Code:	CSE23505B	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- OCR-Databases-APIs- AI-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 OCR available- How to use OCR- 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

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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'auli, The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems, 2020, ISBN-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'lo 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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DATA VISUALIZATION

Course Code	CSE23505C	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 Learning Objectives:

The course will enable students to:

CLO1	Demonstrate basic data visualization principles and techniques
CLO2	Understand the concepts of Numpy and Pandas for data wrangling
CLO3	Understand the basic and advanced statistics for data science
CLO4	Implement Visualization techniques using Python programming and Tableau

CONTENTS	# of Hours
MODULE 1 NumPy Basics: Arrays and vectorized Computation: The NumPy ndarray: A Multidimensional Array Object, Creating ndarrays, Data Types for ndarrays, Arithmetic with NumPy Arrays, Basic Indexing and Slicing, Boolean Indexing, Fancy Indexing, Transposing Arrays and Swapping Axes, Universal Functions: Fast Element-Wise Array Functions, Array-Oriented Programming with Arrays, Expressing Conditional Logic as Array Operations, Mathematical and Statistical Methods, Methods for Boolean Arrays, Sorting.	10
MODULE 2 Getting Started with Pandas: Introduction to Pandas Data Structures, Series, DataFrame, Index Objects, Essential Functionality, Reindexing, Dropping Entries from an Axis, Indexing, Selection, and Filtering, Integer Indexes, Arithmetic and Data Alignment, Function Application and Mapping, Sorting and Ranking, Axis Indexes with Duplicate Labels.	08
MODULE 3 Data Visualization fundamentals: Introduction to Data Visualization, Importance of Data Visualization, Data Visualization Tools, Four Pillars of Visualization, Principles of Chart design. Plotting and Visualization: A Brief matplotlib API Primer, Figures and Subplots, Colors, Markers, and Line Styles, Ticks, Labels, and Legends, Annotations and Drawing on a Subplot, Saving Plots to File, matplotlib Configuration, Plotting Functions in pandas, Line Plots, Bar Plots, Histograms, and Density Plots, Scatter Plots, Box plots.	08
MODULE 4 Tableau: Introduction, Features of Tableau, Tools of Tableau, Tableau Desktop Workspace, Connecting to a data source, Data Types and Data Aggregation in Tableau, Visualization using Charts and Maps, Filtering the data.	08
MODULE 5 Data connection: Extracting data, Joining, Blending, Splits, Sorting, Fields operations. Tableau calculations: Operators, Functions, Numeric, string, date, table calculations, Level of Details expressions.	06

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DISTRIBUTED SYSTEMS

Course Code:	CSE23505D	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

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Course Outcomes:

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

CO1	Implement Array operations using NumPy
CO2	Illustrate Data Frames using Pandas
CO3	Implement the Data Visualization using Matplotlib
CO4	Apply Filtering concepts in visualization using Tableau
CO5	Apply various functions and calculated fields in Tableau

Text Books:

1. Wes McKinney, "Python for Data Analysis" 2nd Edition O'Reilly, 2017.
2. Jake Vander Plas, "Python Data Science Handbook: Essential Tools for Working with Data", Oreilly, 1st Edition, 2016

Reference Books:

1. Dr. Bharti Motwani, "Data Analytics using Python", Wiley, 2020, ISBN: 978-8126502950
2. Phuong Vo.T.H, Martin Czygan, Ashish Kumar, Kirthi Raman, "Python: Data Analytics and Visualization", Packt Publishing Limited, 2017, ISBN :9781788290098.
3. Davy Cielen, Arno D. B. Meysman, Mohamed Ali, "Introducing Data Science", Manning Publications 2016.

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	-	-	3	-	-	3	-	-	-	-	3	-
CO4	3	3	-	-	3	-	-	3	-	-	-	-	3	-
CO5	3	3	-	-	3	-	-	3	-	-	-	-	3	-
Average	3	3	-	-	3	-	-	3	-	-	-	-	3	-

Low-1: Medium-2: High-3

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MINI PROJECT

Course Code	CSEP23506	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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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

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RESEARCH METHODOLOGY AND IPR

Course Code:	RMIK23507	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	10
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 and	08

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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.	06

Course Outcomes:

Upon 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

Text Books:

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	-
Average	3	3	2	-	3	-	-	3	-	-	-	-	3	-

Low-1: Medium-2: High-3

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SEMESTER – V

Course: Environmental Studies

Course Code	CIVK23508	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,	6 Hours L2

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functional elements of SWM, Biomedical Waste Management - Sources, 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:

CIVK23508.1	Analyze ecosystem dynamics to formulate strategies for addressing sustainability challenges and implementing the SDGs.
CIVK23508.2	Evaluate energy technologies to design effective resource management strategies.
CIVK23508.3	Evaluate the impacts of pollution to develop effective waste management strategies.
CIVK23508.4	Evaluate global environmental issues to design solutions for sustainable management.
CIVK23508.5	Interpret environmental laws and regulations for sustainable management practices.
CIVK23508.6	Understand e-waste management in a global scenario.

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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:

1. <https://www.hzu.edu.in/bed/E%20V%20S.pdf>
2. https://onlinecourses.nptel.ac.in/noc23_hs155/preview
3. https://onlinecourses.swayam2.ac.in/cec19_bt03/preview
4. <https://sdgs.un.org/goals>
5. <https://kspcb.karnataka.gov.in/waste-management/biomedical-waste> E Waste (Management) Rules, 2022:
6. <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.

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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
CIVK23508.1	2					1	1	1				2			3
CIVK23508.2	2	2	2			1	3	1				1			3
CIVK23508.3		2	2	2		1	3	1							2
CIVK23508.4		2	2	2		1	3	1				1			2
CIVK23508.5	1	2	2	2		1	2	1						1	2
CIVK23508.6	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

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CLOUD COMPUTING

Subject Code	CSE23601	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

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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 present in 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

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Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	3	2	1	1	2	-	-	-	-	-	-	2	2	-
C02	3	2	1	1	2	-	-	-	-	-	-	2	2	-
C03	3	2	1	1	2	-	-	-	-	-	-	2	2	-
C04	3	2	1	1	2	-	-	-	-	-	-	2	2	-
C05	3	2	1	1	2	-	-	-	-	-	-	2	2	-
Average	3	2	1	1	2	-	-	-	-	-	-	2	2	-

Low-1: Medium-2: High-3

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MACHINE LEARNING

Subject Code	CSE23602	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, Massachusetts 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>

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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	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

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BLOCKCHAIN TECHNOLOGY

Subject Code	CSE23603A	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 Decentralized Applications (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 & Patricia 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 Ethereum: Introduction, EVM, Working of Ethereum, Components of Ethereum 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

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COMPILER DESIGN

Subject Code	CSE23603B	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.

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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 Loudon, "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-yccscs1-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

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COMPUTER VISION

Subject Code	CSE23603C	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 Stereopsis, Binocular Fusion, Using More Cameras, Segmentation by Clustering: What Is Segmentation?, Human Vision: Grouping and Gestalt, 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

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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	
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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

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ADVANCED JAVA

Subject Code	CSE23603D	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, A Simple 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

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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>

Signature

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

Sk Sharma

MACHINE LEARNING LABORATORY

Subject Code	CSEL23606	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.

Signature

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	-
Average	3	3	3	-	2	-	-	2	2	2	-	2	3	-

Low-1: Medium-2: High-3

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OPEN ELECTIVES

VI SEMESTER

Skiswamy

INTRODUCTION TO DATA STRUCTURES

Subject Code	CSE23604A	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

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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

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FUNDAMENTALS OF OPERATING SYSTEMS

Subject Code	CSE23604B	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

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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

SpkNamy

MOBILE APPLICATION DEVELOPMENT

Subject Code	CSE23604C	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

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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	PS01	PS02
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

Skishwary

INTRODUCTION TO AI

Subject Code	CSE23604D	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, Feature Scaling and 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

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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 Approach, by Stuart J. Russell and Peter Norvig, 3rd Edition Pearson 2015.
2. Artificial Intelligence - E. Rich and Knight, 3rd Edition, McGraw Hill International, 2016.
3. Data preprocessing in Data Mining - Salvador García, Julián Luengo Francisco Herrera, Springer.

Reference Books:

1. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, 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

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**Ability / Skill
Enhancement Course**

VI SEMESTER

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ANDROID APP DEVELOPMENT

Subject Code	CSE23607A	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	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.

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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

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MONGODB

Subject Code	CSE23607B	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

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Course Outcomes:

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

CO1	Make use of MongoDB 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

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SELENIUM TESTING

Subject Code	CSE23607C	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

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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

Skewany

DEVOPS

Subject Code	CSE23607D	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	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 content Conduct 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 Edition 2020

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

Sleswamy

INDIAN KNOWLEDGE SYSTEM

Course Code	IKSK23609	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: Linguistics, 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

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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	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	3	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	3	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	3	-	-	-	-	-	-	-	-
Average	-	-	-	-	-	3	-	-	-	-	-	-	-	-

Low-1: Medium-2: High-3

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SYLLABUS

VII SEMESTER

Slattery

DEEP LEARNING

Subject Code	CSE23701	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

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Laboratory Component

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

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	-
Average	3	3	3	1	3	1	-	-	1	-	-	1	2	-

Low-1: Medium-2: High-3

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CRYPTOGRAPHY AND NETWORK SECURITY

Subject Code	CSE23702	CIE Marks	50
Hours/Week (L: T: P)	3:0:2	SEE Marks	50
Total Hours	40	Examination Hours	3
No. of Credits: 4			

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. Behrouz A. 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/>

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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	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

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INTERNET OF THINGS

Subject Code	CSE23703	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	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

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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 Learning 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

Shekhar

DATA WAREHOUSING TECHNIQUES

Subject Code	CSE23704A	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

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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
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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. Introduction to Data Mining, Pang-Ning Tan, Vipin Kumar, Michael Steinbach, Pearson Hall, 1st Edition
2. George M. Marakas Modern Data Warehousing, Mining, and Visualization: Core Concepts, Prentice 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

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NATURAL LANGUAGE PROCESSING

Subject Code	CSE23704B	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 Automatic document separation: Introduction, related work, data preparation, document separation as a sequence mapping problem	08
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, research corpora	08

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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-natural-language-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

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AUGMENTED REALITY AND VIRTUAL REALITY

Subject Code	CSE23704C	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

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BIG DATA ANALYTICS

Subject Code	CSE23704D	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", 1st Edition, 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", 1st Edition, Wrox Press, 2014 ISBN-13: 978-8126551071
3. Eric Sammer, "Hadoop Operations: A Guide for Developers and Administrators", 1st Edition, O'Reilly Media, 2012. ISBN-13: 978-9350239261

E-Books / Web References :

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

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OPEN ELECTIVES

VII SEMESTER

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INTRODUCTION TO DBMS

Course Code:	CSE23705A	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 <i>for</i> 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

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://amirmsvt.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/>

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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	-	-	-	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

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INTRODUCTION TO ALGORITHMS

Subject Code	CSE23705B	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

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SOFTWARE ENGINEERING

Subject Code	CSE23705C	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/scruprimer/scruprimer20.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.

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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

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INTRODUCTION TO NETWORKS

Subject Code	CSE23705D	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	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/>

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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

Skarmy

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 Global Academy of Technology
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