SCHEME AND SYLLABUS

Department of Computer Science and Engineering (AI&ML)

2023 SCHEME

Computer Science and Engineering (AI&ML)

III – VIII Semester

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.

HEAD OF THE DEPARTMENT
Dept. of Computer Science & Engineering (AI &ML)
Global Academy of Technology
Bangalore- 560 098

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Global Academy of Technology,
Rajarajeshwarinagar, Benga -98

III-VIII

SCHEME

Global Academy of Technology

(An Autonomous Institution, affiliated to VTU, Belagavi, recognized by Karnataka and Approved by AICTE, New Delhi.)

B.E. in Computer Science and Engineering(AI&ML)Engineering Scheme of Teaching and Examinations 2023

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

(Effective from the academic year 2023-24)

III SEMESTER

Sl. No.	Course and Course Code		Course Title	Teaching Department (TD)and Question Paper Setting Board (PSB)	Teaching Hours/Week			Examination			CREDITS
					L	T	P	CIE	SEE	Total	
1	BS	MAT23301A	Discrete Mathematics and Graph Theory	MAT	2	2	0	50	50	100	3
2	PCC	CSE23302	Data Structures	TD:CI PSB: CSE	3	0	0	50	50	100	3
3	IPCC	CML23303	Fundamentals of Python Programming	TD:CI PSB: CI	3	0	2	50	50	100	4
4	PCC	CML23304	Operating Systems		3	0	0	50	50	100	3
5	ESC/ETC/PLC	CML23305X	ESC/ETC/PLC		2	0	2	50	50	100	3
6	UHV	SCK23306	Social Connect and Responsibility	Any department	0	0	2	100	—	100	1
7	AEC	CML23307X	Ability Enhancement Course -I (Theory)	TD:CI PSB: CI	2	0	0	50	50	100	2
			OR		OR						
			Ability Enhancement Course -I (Integrated)		1	0	2	50	50	100	2
8	MC	NSK23308	National Service Scheme (NSS)	NSS coordinator	0	0	2	100	—	100	0
		PEK23308	Physical Education (PE) (Sports and Athletics)	Physical Education Director							
		YOK23308	Yoga	Yoga Teacher							
9	PCCL	CSEL23309	Data Structures Laboratory	TD:CI PSB: CSE	0	0	2	50	50	100	1
								550	**350**	**900**	**20**

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PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**:Semester End Evaluation.K :This letter in the course code indicates common to all the stream of engineering. ESC: Engineering Science Course, ETC: Emerging
Technology Course, PLC: Programming Language Course

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Engineering Science Course (ESC/ETC/PLC)		
CML23305A	Introduction to Web Technologies	
CML23305B	Data Analytics with R	
Ability Enhancement Course – I		
CML23307A	Computer Organization and Architecture	
CML23307B	Ethics and Public Policy for AI	

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

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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(Effective from the academic year 2023-24)

IV SEMESTER

Sl. No.	Course and Course Code		Course Title	Teaching Department (TD)and Question Paper Setting Board (PSB)	Teaching Hours/Week			Examination			CREDITS
					L	T	P	CIE	SEE	Total	
1	BS	MAT23401A	Probability and Linear Algebra	MAT	2	2	0	50	50	100	3
2	PCC	CSE23402	Design and Analysis of Algorithms	TD:CI PSB: CSE	3	0	0	50	50	100	3
3	IPCC	CML23403	Database Management Systems	TD:CI PSB: CI	3	0	2	50	50	100	4
4	PCC	CML23404	Software Engineering	TD:CI PSB: CI	3	0	0	50	50	100	3
5	ESC/ETC/PLC	CML23405X	ESC/ETC/PLC	TD:CI PSB: CI	2	2	0	50	50	100	3
6	UHV	UHK23406	Universal Human Values	Any department	0	0	2	50	50	100	1
7	AEC	CML23407X	Ability Enhancement Course-II (Theory)	TD:CI PSB: CI	2	0	0	50	50	100	2
			OR		OR						
			Ability Enhancement Course -II (Integrated)		1	0	2	50	50	100	
8	MC	NSK23408	National Service Scheme (NSS)	NSS coordinator	0	0	2	100	---	100	0
		PEK23408	Physical Education (PE) (Sports and Athletics)	Physical Education Director							
		YOK23408	Yoga	Yoga Teacher							
9	PCCL	CSEL23409	Algorithms Laboratory	TD:CI PSB: CSE	0	0	2	50	50	100	1
								500	**400**	**900**	**20**

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

Engineering Science Course (ESC/ETC/PLC)

CML23405A	Unix System Programming	CML23405C	Theory of Computation
CML23405B	Metric Spaces		

Ability Enhancement Course / Skill Enhancement Course – II

CML23407A	Advanced Python	CML23407C	Object Oriented Programming With C++
CML23407B	Object Oriented Programming With Java		

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National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses 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 inhours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	HSMS	CML23501	Management, Economics and Finance for IT Engineers	TD: CI PSB: CI	3	0	0		03	50	50	100	3
2	IPCC	CML23502	Computer Networks	TD: CI PSB: CI	3	0	2		03	50	50	100	4
3	PCC	CML23503	Fundamentals of MachineLearning	TD: CI PSB: CI	4	0	0		03	50	50	100	4
4	PCCL	CMLL23504	Fundamentals of MachineLearning Laboratory	TD: CI PSB: CI	0	0	2		03	50	50	100	1
5	PEC	CML23505X	Professional Elective – I	TD: CI PSB: CI	3	0	0		03	50	50	100	3
6	PROJ	CMLP23506	Mini Project	TD: CI PSB: CI	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/Env/Chem PSB:CV	2	0	0		03	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			
CML23505A	Enterprise Java Programming	CML23505C	Fundamentals of Internet of Things
CML23505B	Cryptography & Network security	CML23505D	Data mining & Data warehousing

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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.) 2023-23

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

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 inhours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	CML23601	Cloud Computing	TD: CI PSB: CI	3	0	2		03	50	50	100	4
2	PCC	CML23602	Advanced Machine learning	TD: CI PSB: CI	4	0	0		03	50	50	100	4
3	PEC	CML23603X	Professional Elective – II	TD: CI PSB: CI	3	0	0		03	50	50	100	3
4	OEC	CML23604X	Open Elective -I	TD: CI PSB: CI	3	0	0		03	50	50	100	3
5	PROJ	CMLP23605	Major Project Phase – I	TD: CI PSB: CI	0	0	4		03	100	–	100	2
6	PCCL	CMLL23606	Advanced Machine learning LAB	TD: CI PSB: CI	0	0	2		03	50	50	100	1
7	AEC/ SDC	CML23607X	Ability Enhancement Course/ SkillDevelopment Course – IV	TD: CI PSB: CI	0	0	2		01	50	50	100	1
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	PSB:HSS TD:CI	1	0	0		01	50	50	100	0
									Total	**550**	**350**	**900**	**18**

Professional Elective Course

CML23603A	Server side Scripting	CML23603C	Networking And Data Analysis In Iot

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CML23603B	Fundamentals of Cyber security	CML23603D	Fundamentals of Data Science
Open Elective Course			
CML23604A	Chat GPT-AI Learning models	CML23604C	Introduction to Machine Learning
CML23604B	Scala Programming	CML23604D	Mobile Application Development
Ability Enhancement Course / Skill Enhancement Course – IV			
CML23607A	MongoDB		
CML23607B	Data Visualization		

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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.) 2023-23

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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(Effective from the academic year 2023-24)

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 inhours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	CML23701	Natural Language Processing	TD: CI PSB: CI	3	0	2		03	50	50	100	4
2	IPCC	CML23702	Deep Learning	TD: CI PSB: CI	3	0	2		03	50	50	100	4
3	PCC	CML23703	Computer vision and image processing	TD: CI PSB: CI	3	2	0		03	50	50	100	4
4	PEC	CML23704x	**Professional Elective-III**	TD: CI PSB: CI	3	0	0		03	50	50	100	3
5	OEC	CML23705x	**Open Elective- II**	TD: CI PSB: CI	3	0	0		01	50	50	100	3
6	PROJ	CMLP23706	**Major Project Phase-II**	TD:CI PSB: CI	0	0	12		03	100	100	200	6
									Total	**350**	**350**	**700**	**24**

Professional Elective Course

CML23704A	Framework for Application Deployment	CML23704C	Industrial IOT
CML23704B	Ethical Hacking	CML23704D	Business Intelligence & Analytics

Open Elective Course

CML23705A	R Programming	CML23705C	Fundamentals of IOT
CML23705B	Java Programming	CML23705D	Digital Image Processing

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

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

(i) To encourage independent learning and the innovative attitude of the students.
(ii) To develop interactive attitude, communication skills, organization, time management, and presentation skills.
(iii) To impart flexibility and adaptability.
(iv) To inspire team working.
(v) To expand intellectual capacity, credibility, judgment and intuition.
(vi) To adhere to punctuality, setting and meeting deadlines.
(vii) To install responsibilities to oneself and others.
(viii) To train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involve ingroup discussion to present and exchange ideas.

CIE procedure for Project Work:
(1) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.
The CIE marks awarded for the project work, shall be based on the evaluation of the project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.
(2) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.
SEE procedure for Project Work: SEE for project work will be conducted by the two examiners appointed by the University. The SEE marks awarded for the project work shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25.

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

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lectur	Tutorial	Practical / Drawing	Self -Study	Duration inhours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PEC	CML23801x	**Professional Elective -IV (Online Courses)**	TD: CI PSB: CI	3	0	0		03	50	50	100	3
2	OEC	CML23802x	**Open Elective - III (Online Courses)**	TD: CI PSB: CI	3	0	0		03	50	50	100	3
3	INT	CMLI23803	**Internship (Industry/Research) (14 - 20 weeks)**		0	0	12		03	100	100	200	10
									Total	**200**	**200**	**400**	**16**

Professional Elective Course (Online courses)

CML23801A	Parametrized Algorithm	CML23801C	Google Cloud Computing Foundation
CML23801B	Blockchain and its Applications	CML23801D	Social Network Analysis

Open Elective Courses (Online Courses)

CML23802A	Cyber Security and Privacy	CML23802C	BIG DATA computing
CML23802B	Computer Vision	CML23802D	Responsible and Safe AI sytems

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 programSwapping 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.

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(Effective from the academic year 2023-24)

Scheme B- 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 inhours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	CML23701	Natural Language Processing (To be Completed in 5th/6th Semester)	TD: CI PSB: CI	3	0	2		03	50	50	100	4
2	IPCC	CML23702	Deep Learning (To be Completed in 5th/6th Semeste)r	TD: CI PSB: CI	3	0	2		03	50	50	100	4
3	PCC	CML23703	Computer vision and image processing (To be Completed in 5th/6th Semester)	TD: CI PSB: CI	3	2	0		03	50	50	100	4
4	PEC	CML23704x	**Professional Elective-III** (To be Completed in 5th/6th Semester)	TD: CI PSB: CI	3	0	0		03	50	50	100	3
5	OEC	CML23705x	**Open Elective- II** (To be Completed in 5th/6th Semester)	TD: CI PSB: CI	3	0	0		01	50	50	100	3
6	PROJ	CMLP23706	**Major Project Phase-II**	TD:CI PSB: CI	0	0	12		03	100	100	200	6
									Total	**350**	**350**	**700**	**24**

Professional Elective Course

CML23704A	Framework for Application Deployment	CML23704C	Industrial IOT
CML23704B	Ethical Hacking	CML23704D	Business Intelligence & Analytics

Open Elective Course

CML23705A	R Programming	CML23705C	Fundamentals of IOT
CML23705B	Java Programming	CML23705D	Digital Image Processing

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

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Note: VII and VIII semesters of IV years of the program
(1) Institutions can swap the VII and VIII Semester Schemes of Teaching and Examinations to accommodate research internships/ industry internships after the VI semester.
(2) Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether the VII or VIII semesters is completed during the beginning of the IV year or the later part of IV years of the program.

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

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

(ix) To encourage independent learning and the innovative attitude of the students.
(x) To develop interactive attitude, communication skills, organization, time management, and presentation skills.
(xi) To impart flexibility and adaptability.
(xii) To inspire team working.
(xiii) To expand intellectual capacity, credibility, judgment and intuition.
(xiv) To adhere to punctuality, setting and meeting deadlines.
(xv) To install responsibilities to oneself and others.
(xvi) 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:
(3) 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.
(4) 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 B- VIII SEMESTER (Swappable VII and VIII SEMESTER)

SL No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lectur	Tutorial	Practical / Drawing	Self-Study	Duration inhours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PEC	CML23801x	**Professional Elective -IV (Online Courses)**	TD: CI PSB: CI	3	0	0		03	50	50	100	3
2	OEC	CML23802x	**Open Elective - III (Online Courses)**	TD: CI PSB: CI	3	0	0		03	50	50	100	3
3	INT	CMLI23803	**Internship (Industry/Research) (14 - 20 weeks)**		0	0	12		03	100	100	200	10
									Total	**200**	**200**	**400**	**16**

Professional Elective Course (Online courses)

CML23801A	Parametrized Algorithm	CML23801C	Google Cloud Computing Foundation
CML23801B	Blockchain and its Applications	CML23801D	Social Network Analysis

Open Elective Courses (Online Courses)

CML23802A	Cyber Security and Privacy	CML23802C	BIG DATA computing
CML23802B	Computer Vision	CML23802D	Responsible and Safe AI sytems

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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 programSwapping 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.
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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.

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III-VIII

SYLLABUS

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III SEMESTER

Sl. No.	Course and Course Code		Course Title	Teaching Department (TD)and Question Paper Setting Board (PSB)	Teaching Hours/Week			Examination			CREDITS
					L	T	P	CIE	SEE	Total	
1	BS	MAT23301A	Discrete Mathematics and Graph Theory	MAT	2	2	0	50	50	100	3
2	PCC	CSE23302	Data Structures	TD:CI PSB: CSE	3	0	0	50	50	100	3
3	IPCC	CML23303	Fundamentals of Python Programming	TD:CI PSB: CI	3	0	2	50	50	100	4
4	PCC	CML23304	Operating Systems		3	0	0	50	50	100	3
5	ESC/ETC/PLC	CML23305X	ESC/ETC/PLC		2	0	2	50	50	100	3
6	UHV	SCK23306	**Social Connect and Responsibility**	Any department	0	0	2	100	---	100	1
7	AEC	CML23307X	Ability Enhancement Course -I (Theory)	TD:CI PSB: CI	2	0	0	50	50	100	2
			OR		OR						
			Ability Enhancement Course -I (Integrated)		1	0	2	50	50	100	
8	MC	NSK23308	National Service Scheme (NSS)	NSS coordinator	0	0	2	100	---	100	0
		PEK23308	Physical Education (PE) (Sports and Athletics)	Physical Education Director							
		YOK23308	Yoga	Yoga Teacher							
9	PCCL	CSEL23309	Data Structures Laboratory	TD:CI PSB: CSE	0	0	2	50	50	100	1
								550	**350**	**900**	**20**

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Technology Course, PLC: Programming Language Course

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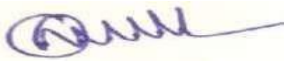
Engineering Science Course (ESC/ETC/PLC)		
CML23305A	Introduction to Web Technologies	
CML23305B	Data Analytics with R	

Ability Enhancement Course		
CML23307A	Computer Organization and Architecture	
CML23307B	Ethics and Public Policy for AI	

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

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
					L	T	P	CIE	SEE	Total	
1	BS	MAT23401A	Probability and Linear Algebra	MAT	2	2	0	50	50	100	3
2	PCC	CSE23402	Design and Analysis of Algorithms	TD:CI PSB: CSE	3	0	0	50	50	100	3
3	IPCC	CML23403	Database Management Systems	TD:CI PSB: CI	3	0	2	50	50	100	4
4	PCC	CML23404	Software Engineering		3	0	0	50	50	100	3
5	ESC/ETC/ PLC	CML23405X	ESC/ETC/PLC		2	2	0	50	50	100	3
6	UHV	UHK23406	Universal Human Values	Any department	1	0	0	50	50	100	1
7	AEC	CML23407X	Ability Enhancement Course-II (Theory)	TD:CI PSB: CI	2	0	0	50	50	100	2
			OR		OR						
			Ability Enhancement Course -II (Integrated)		1	0	2	50	50	100	
8	MC	NSK23408	National Service Scheme (NSS)	NSS coordinator	0	0	2	100	---	100	0
		PEK23408	Physical Education (PE) (Sports and Athletics)	Physical EducationDirector							
		YOK23408	Yoga	Yoga Teacher							
9	PCCL	CSEL23409	Algorithms Laboratory	TD:CI PSB: CSE	0	0	2	50	50	100	1
								500	**400**	**900**	**20**

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Engineering Science Course (ESC/ETC/PLC)

CML23405A	Unix System Programming	CML23405C	Theory of Computation
CML23405B	Metric Spaces		

Ability Enhancement Course

CML23407A	Advanced Python	CML23407C	Object Oriented Programming With C++
CML23407B	Object Oriented Programming With Java		

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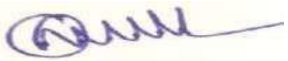


SEMESTER – III

Course: 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**
No. of Credits	**3**	**Examination Hours**	**03**

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

Content	No. of Hours/ RBT levels
Module 1 The Rules of Sum and Product, The Pigeon-hole Principle, Permutations, Combinations, The Binomial Theorem, Combinations with Repetition.	**08 Hours L2, L3**
Module 2 Sets and Subsets, Set operations and Laws of Set Theory. Counting and Venn Diagrams. Probability, Conditional probability and Bayes Theorem.	**08 Hours L2, L3**
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 Hours L2, L3**
Module 4 Relations and properties of relations, Representation of relations. Equivalence Relations and Partitions. Functions, Types of Functions, Function Composition and Inverse Functions.	**08 Hours L2, L3**
Module 5 Graphs, Subgraphs, Complements, and Graph Isomorphism, Vertex Degree, Euler Trails and Circuits. Planar Graphs, Trees and Rooted Trees.	**08 Hours L2, L3**

Textbooks:

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

COURSE OUTCOMES:

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

CO301.1	• 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
CO301.2	• 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
CO301.3	• 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
CO301.4	• 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.
CO301.5	• 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.

Scheme of Examination:

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

Continuous Internal Evaluation (CIE):
Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. **Some possible AATs:** seminar/assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

Typical Evaluation pattern for regular courses is shown in Table 2.

Table 2: 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**	
	Assignments	**10**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

CO/PO	PO1	PO2	PO3	PO12
CO301.1	3	2	1	3
CO301.2	3	2	1	3
CO301.3	3	2	1	3
CO301.4	3	2	1	3
CO301.5	3	2	1	3
Average	3	2	1	3

Low-1: Medium-2: High-3

SEMESTER – III

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**

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, ComputerScience 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

SEMESTER III

SUBJECT: FUNDAMENTALS OF PYTHON PROGRAMMING

Subject Code	**CML23303**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:2**	**SEE Marks**	**50**
Total Hours	**50**	**Examination Hours**	**3**
No. of Credits: 04			

Course Learning Objectives:

The course will enable students to:

CLO1	Learn the syntax and semantics of the Python programming language.
CLO2	Illustrate the process of structuring the data using lists, tuples
CLO3	Write python functions to facilitate code reuse and optimization
CLO4	Demonstrate the use of built in functions related to regular expressions, strings and to navigate the file systems
CLO5	Appraise the need for working with documents like Excel

CONTENTS	# of Hours / RBT Levels
MODULE 1 **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, Dissecting Your 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(), **Textbook 1 : Chapter 1, 2**	**10** **L3**
MODULE 2 **Functions**: def Statements with Parameters, Return Values and return Statements, The None Value, Keyword Arguments and print(), Local and Global Scope, The global Statement, Exception Handling, A Short Program: Guess the Number **Lists:** The List Data Type, Working with Lists, Augmented Assignment Operators, Methods, Example Program: Magic 8 Ball with a List, List-like Types: Strings and Tuples, References **Textbook 1 : Chapter 3,4**	**10** **L3**
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 **Textbook 1 : Chapter 5, 6**	**10** **L3**
MODULE 4	**10** **L3**

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, Character Classes, Making Your Own Character Classes, The Caret and Dollar Sign Characters, The Wildcard Character, Review of Regex Symbols, Case-Insensitive Matching, Substituting Strings with the sub() Method, Managing Complex Regexes, Combining re.IGNORECASE, re.DOTALL, and re.VERBOSE **Reading and Writing Files:** Files and File Paths, The os.path Module, The File Reading/Writing Process, Saving Variables with the shelve Module,Saving Variables with the print.format() Function **Textbook 1 : Chapter 7, 8**	
MODULE 5 **Organizing Files:** The shutil Module, Walking a Directory Tree, Compressing Files with the zipfile 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. **Textbook 1 : Chapter 9, 12**	**10** **L3**

Laboratory Component.
List of Experiments

1. Programs on data types,string concatenation and replication
2. Programs on operators and flow control
3. Programs on loops
4. Programs on functions
5. Programs on list and tuples
6. Programs on dictionaries
7. Programs on string manipulation functions
8. Programs on pattern matching with regular expression
9. Programs on file handling
10. Programs on excel

Note : The course instructor is given a liberty to ask any kind of questions in the laboratory on the specific topic and encourage students to write programs by themselves

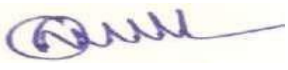
Course Outcomes:

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

CO303.1	Experiment with the concepts of data types, operators and flow control statements of python
CO303.2	Write programs using functions and strings
CO303.3	Make use of methods to create and manipulate lists, tuples and dictionaries
CO303.4	Develop programs for pattern matching and file handling using python packages
CO303.5	Utilize python packages to work on spreadsheets

Text Books:

1. Al Sweigart, "Automate the Boring Stuff with Python",1 st Edition, No Starch Press, 2015.
2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2 nd Edition, Green Tea Press, 2015.



Reference Books:

1. Martin C Brown "Python : The Complete reference", Fourth Edition, Mc GrawHill, 2018

E-Books / Web References:

1. https://edu.anarchocopy.org/Programming%20Languages/Python/Automat%20the%20Boring%20Stuff%20with%20Python.pdf
2. https://www.learnbyexample.org/python/

MOOC:

1. **Programming for Everybody (Getting Started with Python) -** https://www.coursera.org/learn/python
2. **Programming in Python -** https://onlinecourses.swayam2.ac.in/cec22_cs20/preview

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO303.1	3	3	2	2	3							2	2	
CO303.2	3	3	2	2	3							2	2	
CO303.3	3	3	2	2	3							2	2	
CO303.4	3	3	2	2	3							2	2	
CO303.5	3	3	2	2	3							2	2	
Average	3	3	2	2	3							2	2	

Low-1: Medium-2: High-3

Scheme of Evaluation: (Integrated courses)

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 four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. The average of the three tests are taken for computation of CIE on a scale of 30, the CIE would also include laboratory evaluation for 20 marks. The laboratory marks of 20 would comprise of 10 marks for regular laboratory assessment to include lab record and observation. 10 marks would be exclusive for laboratory internal assessment test to be conducted at the end of the semester.

Table: Distribution of weightage for CIE & SEE of Integrated courses

	Component	Marks	Total Marks
CIE	CIE Test-1	**30**	**50**
	CIE Test-2	**30**	
	CIE Test-3	**30**	
	Lab	**20**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

SEMESTER III

SUBJECT: OPERATING SYSTEMS

Course Code	**CML23304**	**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	Know Deadlock handling mechanism
CLO4	Understand Operations in Memory Management
CLO5	Study the Virtual memory and mass storage Concepts

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

Course Outcomes:

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

CO304.1	Discuss the basic concepts of operating systems and concept of processes and threads
CO304.2	Explain the process management, CPU scheduling and synchronization tools
CO304.3	Explain the deadlock handling methods
CO304.4	Describe memory management mechanisms
CO304.5	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, PearsonEducation, 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- systems2.

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
CO304.1	3	3	3	-	-	-	-	-	-	-	-	3	1	-
CO304.2	3	3	3	-	-	-	-	-	-	-	-	3	1	-
CO304.3	3	3	3	-	-	-	-	-	-	-	-	3	1	-
CO304.4	3	3	3	-	-	-	-	-	-	-	-	3	1	-
CO304.5	3	3	3	-	-	-	-	-	-	-	-	3	1	-
Average	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**1**	**-**

Low-1: Medium-2: High-3

Scheme of Evaluation:

Semester End Examination (SEE):

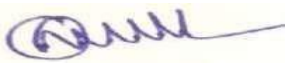
SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full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

Continuous Internal Evaluation (CIE):

Three tests are to be conducted for 40 marks each. Average of all three tests marks is added to the test component. In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the Alternative Assessment Tool (AAT). The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices. Possible AATs are – seminar / assignments / term paper / open ended experiments / mini-projects/group activity or any other.

Table: Distribution of weightage for CIE & SEE

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	AAT	**5**	
	AAT	**5**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**



SEMESTER III

SUBJECT: INTRODUCTION TO WEB TECHNOLOGIES

Subject Code	**CML23305A**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:0:2**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**3**
No. of Credits: 3			

Course Learning Objectives:

The course will enable students to:

CLO1	Illustrate the Semantic Structure of HTML and CSS
CLO2	Compose forms and tables using HTML and CSS
CLO3	Understand different approaches for creating page layouts
CLO4	To build dynamic web pages using JavaScript.
CLO5	Understand Responsive Web Design with the help of the Bootstrap framework

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Introduction to HTML:** What is HTML and Where did it come from?, HTML Syntax, Semantic Markup, Structure of HTML Documents, Quick Tour of HTML Elements, HTML5 Semantic Structure Elements. **Introduction to CSS**: What is CSS, CSS Syntax, Location of Styles, Selectors **Text book:1 Chapter 2, 3 (till selectors)**	**8** **L3**
MODULE 2 **The Cascade**: How Styles Interact, The Box Model, CSS Text Styling. **HTML Tables and Forms:** Introducing Tables, Styling Tables, Introducing Forms, Form Control Elements, Table and Form Accessibility, Microformats **Text book:1 Chapter 3, 4**	**8** **L3**
MODULE 3 **Advanced CSS:** Layout, Normal Flow, Positioning Elements, Floating Elements, Constructing Multicolumn Layouts, Approaches to CSS Layout, Responsive Design, CSS Frameworks **Text book:1 Chapter 5**	**8** **L3**
MODULE 4 **JavaScript:** Client-Side Scripting, What is JavaScript and What can it do?, JavaScript Design Principles, Where does JavaScript Go?, Syntax, JavaScript Objects, The Document Object Model (DOM), JavaScript Events, Forms, Examples **Text book:1 Chapter 6**	**8** **L3**

MODULE 5	8
Bootstrap: What is bootstrap?, Bootstrap File structure,Default Grid system, Fluid Grid system,Container Layouts; **Bootstrap CSS:** Typography, Tables,Forms, Buttons, Images,icons; **Bootstrap Layout components:** Dropdown Menus, Button Groups,Buttons with dropdowns, Navigation elements, Navbar, Breadcrumps, Pagination, Typographic elements **Text book: 2 Chapter 1,2,3**	**L3**

Lab Programs

1. Develop a webpage that gives information about travel experience using the following HTML5 Semantic tags- <article>, <aside>, <figcaption>,<figure>, <footer>, <header>, <main>, <nav>, <section>
2. Build a clean and organized layout for the webpage using HTML.
   a. Include a header section with the event title, date, and location.
   b. Create a navigation bar with links to sections like "About," "Speakers," "Agenda," "Registration," and "Contact."
   c. In the "About" section, provide a brief description of the conference's theme and purpose.
   d. Design a "Speakers" section that lists at least three keynote speakers with their names, titles, and photos.
   Note: Use semantic elements to structure this section and apply suitable CSS.
3. Demonstrate a simple webpage layout containing text and an image using CSS selectors
   a. Apply CSS styles to change the font family, size, color, and line height of the text content.
   b. Use selectors to target specific headings and paragraphs.
   c. Select the image using an element selector and apply a border with a defined width and color.
   d. Implement a hover effect that slightly increases the image's size
   e. Use class selectors to adjust the text alignment and spacing within paragraphs.
   f. Apply margin and padding to create a balanced layout.
   g. Apply a background color to the entire layout using an element selector.

4. Develop an HTML table to display the weekly class timetable, spanning Monday through Friday.
   a. Populate the table with precise class information, including course codes
   b. Utilize colspan or rowspan to merge cells horizontally or vertically, creating space for breaks or gaps in the schedule.
   c. Implement distinct background colors for cells to differentiate between different subjects and breaks.
5. Develop a student registration form
   a. Include fields for the student's name, USN, email id, address, radio button for gender and a checkbox for subject preferences (Web, Java, Python).
   b. option to upload photo and dropdown list for payment method
   c. Include a "Submit" button to process the registration
6. Build a multicolumn layout using float element in HTML. Create an HTML structure that includes a main content area and a sidebar. Use CSS floats to position the main content on the left and the sidebar on the right. Populate the main content area with blog articles, including headings, images, and text. Populate the sidebar with widgets such as recent posts, categories, and social media links.

7. Write a JavaScript to design a simple calculator to perform the following operations: sum, product, difference and quotient.
8. Write a JavaScript code that displays text "TEXT GROWING" with increasing font size in the interval of 100ms in RED color, when the font size reaches 50pt it displays "TEXT SHRINKING" in BLUE color. Then font size decreases to 5pt.
9. Develop a webpage containing 3 overlapping images using HTML, CSS and JS. Further when the

mouse is over any image, it should be on the top and fully displayed.

10. Demonstrate a simple portfolio webpage using bootstrap to showcase your skills and projects

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

CO305A.1	Adapt HTML and CSS syntax and semantics to build web pages
CO305A.2	Construct and visually format tables and forms using HTML and CSS
CO305A.3	Build web pages using multicolumn layouts
CO305A.4	Develop client side scripting using javascript and analyze the Document Object Model
CO305A.5	Develop responsive designs for web pages using Bootstrap

Textbooks:

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/html/html5_intro.asp
3. https://www.w3schools.com/css/
4. https://www.w3schools.com/jS/default.asp
5. https://www.w3schools.com/bootstrap/default.asp
6. https://getbootstrap.com/

MOOCs

1. NPTEL: https://nptel.ac.in/courses/106105084
2. Udemy: 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
CO305A.1	2	2	2	-	3	-	-	-	-	-	-	2	2	1
CO305A.2	2	2	2	-	3	-	-	-	-	-	-	2	2	1
CO305A.3	2	2	2	-	3	-	-	-	-	-	-	2	2	1
CO305A.4	2	2	2	-	3	-	-	-	-	-	-	2	2	1
CO305A.5	2	2	2	-	3	-	-	-	-	-	-	2	2	1
Average	**2**	**2**	**2**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	1

Low-1: Medium-2: High-3

Scheme of Evaluation: (Integrated courses)

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 four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. The average of the three tests are taken for computation of CIE on a scale of 30, the CIE would also include laboratory evaluation for 20 marks. The laboratory marks of 20 would comprise of 10 marks for regular laboratory assessment to include lab record and observation. 10 marks would be exclusive for laboratory internal assessment test to be conducted at the end of the semester.

Table: Distribution of weightage for CIE & SEE of Integrated courses

	Component	Marks	Total Marks
CIE	CIE Test-1	**30**	**50**
	CIE Test-2	**30**	
	CIE Test-3	**30**	
	Lab	**20**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

SEMESTER III

SUBJECT: DATA ANALYTICS WITH R

Subject Code	**CML23305B**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:0:2**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**3**
No. of Credits: 3			

Course Learning Objectives:

The course will enable students to:

CLO1	Gain the knowledge of R Programming Concepts
CLO2	Explain the concepts of Data Visualization
CLO3	Explain the concept of Statistics in R.
CLO4	Work with R charts and Graphs

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Basics of R** Introducing R, Initiating R, Packages in R, Environments and Functions, Flow Controls, Loops,Basic Data Types in R, Vectors **Text book:1** Chapter 1: 1.1 to 1.7 Chapter 2: 2.1,2.2	**8** **L3**
MODULE 2 **Basics of R Continued** Matrices and Arrays, Lists, Data Frames, Factors, Strings, Dates and TimesChapter 2: 2.3,2.4,2.5,2.6,2.7.2.8.1,2.8.2	**8** **L3**
MODULE 3 Datasets, Importing and exporting files, Accessing databases, Data Cleaning and Transformation **Text book1:** Chapter 3: 3.1,3.2,3.3,3.4	**8** **L3**
MODULE 4 **Graphics using R** Exploratory Data Analysis, Main Graphical Packages, Pie Charts, Scatter Plots, Line Plots,Histograms, Box Plots, Bar Plots, Other Graphical packages **Text book:1** Chapter 4: 4.1 to 4.9	**8** **L3**
MODULE 5 **Statistical Analysis using R** Basic Statistical Measures, Normal distribution, Binomial distribution, Correlation Analysis,Regression Analysis-Linear Regression Analysis of Variance **Text book: 1** Chapter 5: 5.1, 5.3, 5.4, 5.5, 5.6.1, 5.7	**8** **L3**

Lab Programs

<table>
<tr><th>Sl.NO</th><th>Experiments</th></tr>
<tr><td>1</td><td>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</td></tr>
<tr><td>2</td><td>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.</td></tr>
<tr><td>3</td><td>Develop a program to create two 3 X 3 matrices A and B and perform the following operations a) Transposeof the matrix b) addition c) subtraction d) multiplication</td></tr>
<tr><td>4</td><td>Develop a program to find the factorial of given number using recursive function calls.</td></tr>
<tr><td>5</td><td>Develop an R Program using functions to find all the prime numbers up to a specified number by the method of Sieve of Eratosthenes.</td></tr>
<tr><td>6</td><td>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.</td></tr>
<tr><td>7</td><td>Develop R program to create a Data Frame with following details and do the following operations.</td></tr>
</table>

itemCode	itemCategory	itemPrice
1001	Electronics	700
1002	Desktop Supplies	300
1003	Office Supplies	350
1004	USB	400
1005	CD Drive	800

	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, ItemQtyonHandand ItemReorderLvl and merge the two frames
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. Importinto 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"
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, andcomprises 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: a) What is the total number of observations and variables in the dataset? b) Find the car with the largest hp and the least hp using suitable functions c) Plot histogram / density for each variable and determine whether continuous variables arenormally distributed or not. If not, what is their skewness? d) What is the average difference of gross horse power(hp) between automobiles with 3 and 4number of cylinders(cyl)? Also determine the difference in their standard deviations. e) 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

CO305B.1	Describe the structures of R Programming.
CO305B.2	Illustrate the basics of Data Preparation with real world examples.
CO305B.3	Apply the Graphical Packages of R for visualization.
CO305B.4	Apply various Statistical Analysis methods for data analytics.

Textbooks:

1. R Programming: An Approach to Data Analytics, G. Sudhamathy and C. Jothi Venkateswaran, MJP Publishers, 2019

Reference Books:

1. An Introduction to R, Notes on R: A Programming Environment for Data Analysis andGraphics. W. N. Venables, D.M. Smith and the R Development Core Team. Version 3.0.1 (2013-05-16)
2. Cotton, R. (2013). Learning R: A Step by Step Function Guide to Data Analysis. 1st ed. O'Reilly Media Inc

E-Books / Web References

1. https://cran.r-project.org/doc/manuals/r-release/R-intro.pdf
2. http://www.tutorialspoint.com/r/r_tutorial.pdf
3. https://users.phhp.ufl.edu/rlp176/Courses/PHC6089/R_notes/intro.html
4. https://cran.r-project.org/web/packages/explore/vignettes/explore_mtcars.html
5. https://www.w3schools.com/r/r_stat_data_set.asp
6. https://rpubs.com/BillB/217355

MOOCs

1. https://www.coursera.org/learn/introduction-to-data-analytics
2. https://www.udemy.com/course/data-analysis-with-pandas/?couponCode=NVDIN35

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO305B.1	2	3	3	-	3	-	-	-	-	-	-	2	2	1
CO305B.2	2	2	3	-	3	-	-	-	-	-	-	2	2	1
CO305B.3	2	3	2	-	3	-	-	-	-	-	-	2	2	1
CO305B.4	2	3	3	-	3	-	-	-	-	-	-	2	2	1
Average	**2**	**2**	**2**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	1

Low-1: Medium-2: High-3

Scheme of Evaluation: (Integrated courses)

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 four sub questions) from each module carrying 20

marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. The average of the three tests are taken for computation of CIE on a scale of 30, the CIE would also include laboratory evaluation for 20 marks. The laboratory marks of 20 would comprise of 10 marks for regular laboratory assessment to include lab record and observation. 10 marks would be exclusive for laboratory internal assessment test to be conducted at the end of the semester.

Table: Distribution of weightage for CIE & SEE of Integrated courses

	Component	Marks	Total Marks
CIE	CIE Test-1	**30**	**50**
	CIE Test-2	**30**	
	CIE Test-3	**30**	
	Lab	**20**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

SCK306 – Social Connect & Responsibility		Semester	3rd
Course Code	SCK23306	CIE Marks	100
Teaching Hours/Week (L:T:P: S)	0:0:3:1	SEE Marks	------
Total Hours of Pedagogy	40 hour Practical Session +15 hour Planning	Total Marks	100
Examination nature (No SEE – Only CIE)	For CIE Assessment - Activities Report Evaluation by College NSS Officer / HOD / Sports Dept / Any Dept.		
Credits	01 - Credit		

Course objectives: The course will enable the students to:

1. Provide a formal platform for students to communicate and connect to the surrounding.
2. create a responsible connection with the 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:

Social Connect & Responsibility - Contents

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.

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 (Course Skill Set):

At the end of the course, the 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 knowledgein 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 withothers. 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 immersionwith NGOs/social sections will be a key part of the course. Will all leadto 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 conversional will culminate in developing an actual, idea for problem-based intervention, basedon 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 ofscheme & syllabus.

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 shallbe 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 socialconnect 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 59Unsatisfactory and fail : <39

Special Note :

NO SEE – Semester End Exam – Completely Practical and activities based evaluation

Pedagogy – Guidelines :

It may differ depending on local resources available for the study as well as environment andclimatic 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
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

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%**	• 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.
Field Visit, Plan, Discussion	10 Marks	
Commencement of activities and its progress	20 Marks	
Case study based Assessment Individual performance with report	20 Marks	
Sector wise study & its consolidation 5*5 = 25	25 Marks	
Video based seminar for 10 minutes by each student At the end of semester with Report. **Activities 1 to 5, 5*5 = 25**	25 Marks	
Total marks for the course in each semester	**100 Marks**	
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.		

SEMESTER III

SUBJECT: COMPUTER ORGANIZATION AND ARCHITECTURE

Subject Code	**CML23307A**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:0:0**	**SEE Marks**	**50**
Total Hours	**30**	**Examination Hours**	**03**
No. of Credits: 2			

Course Learning Objectives

The course will enable students to

CLO1	Explain the basic sub systems of a computer, their organization and Illustrate the concept of programs as sequences of machine instructions.
CLO2	Illustrate the role of various addressing modes
CLO3	Demonstrate different ways of communicating with I/O devices and standard I/O Interfaces
CLO4	Describe memory hierarchy and concept of virtual memory
CLO5	Describe arithmetic and logical operations with integer and floating-point operands

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Basic Structure of Computers**: Computer Types, Functional Units, Basic Operational Concepts, Bus Structures, Software, Performance – Processor Clock, Basic Performance Equation. **Machine Instructions and Programs**: Numbers, Arithmetic Operations and Characters, IEEE standard for Floating point Numbers, Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing **TextBook: T1- Chapter 1 (1.1-1.6.2), Chapter 2 (2.1-2.4)**	**06** **L2**
MODULE 2 Addressing Modes, Assembly Language, Basic Input and Output Operations, Stacks and Queues, Subroutines, Additional Instructions, Encoding of Machine Instructions **TextBook: T1- Chapter 2 (2.5-2.10, 2.12)**	**06** **L3**
MODULE 3 **Input/Output Organization**: Accessing I/O Devices, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Controlling Device Requests, Direct Memory Access**(upto 4.2.4 and 4.4 except 4.4.1 of Chap 4 of Text).**	**06** **L3**
MODULE 4 **Memory System**: Basic Concepts, Semiconductor RAM Memories, Read Only Memories, Speed, Size, and Cost, Cache Memories. **Text book 1: Chapter5 – 5.1 to 5.4, 5.5 (5.5.1)**	**06** **L2**
MODULE 5	

Arithmetic: Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed-operand Multiplication, Fast Multiplication till Bit-pair Recording of Multipliers. **Text book 1: Chapter 6 (6.1-6.5.1)**	**06** **L3**

Course Outcomes:

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

CO307A.1	Interpret the basic organization of a computer system and the machine instructions.
CO307A.2	Make use of different addressing modes
CO307A.3	Demonstrate the organization of I\O devices
CO307A.4	Understand the different memory systems and to apply the replacement algorithms
CO307A.5	Apply simple arithmetic operations

Textbooks:

1. Carl Hamacher, ZvonkoVranesic, SafwatZaky: Computer Organization, 5th Edition, Tata McGraw Hill, 2002.

Reference Books:

1. David A. Patterson, John L. Hennessy: Computer Organization and Design – The Hardware / Software Interface ARM Edition, 4th Edition, Elsevier, 2009.
2. William Stallings: Computer Organization & Architecture, 7th Edition, PHI, 2006
3. Vincent P. Heuring& Harry F. Jordan: Computer Systems Design and Architecture, 2nd Edition, Pearson Education, 2004

E-Books / Web References

1. https://theswissbay.ch/pdf/Gentoomen%20Library/Computer%20Architecture/Computer_Organization_5th_Edition

MOOCs

1. Computer architecture and organization - https://onlinecourses.nptel.ac.in/noc21_cs61/preview
2. Computer Organization and Architecture 2024 - https://www.udemy.com/course/computer-organization-and-architecture-2024

Mapping of CO-PO:

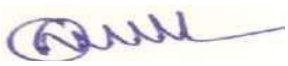
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO307A.1	3	3	2	-	-	-	-	-	-	-	-	2	1	-
CO307A.2	3	3	2	-	-	-	-	-	-	-	-	2	1	-
CO307A.3	3	3	2	-	-	-	-	-	-	-	-	2	1	-
CO307A.4	3	3	2	-	-	-	-	-	-	-	-	2	1	-
CO307A.5	3	3	2	-	-	-	-	-	-	-	-	2	1	-
Average	**3**	**3**	**2**	**-**	-	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**1**	**-**

Low-1: Medium-2: High-3

Scheme of Evaluation:

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 four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three tests are to be conducted for 40 marks each. Average of all three tests marks is added to the test component. In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the Alternative Assessment Tool (AAT). The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices. Possible AATs are – seminar / assignments / term paper / open ended experiments / mini-projects/group activity or any other.

Table: Distribution of weightage for CIE & SEE

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	AAT	**5**	
	AAT	**5**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

SEMESTER III

SUBJECT: Ethics and Public Policy for AI

Subject Code	**CML23307B**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:0:0**	**SEE Marks**	**50**
Total Hours	**30**	**Examination Hours**	**3**
No. of Credits: 2			

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 AIethics

CONTENTS	# of Hours / RBT Levels
MODULE 1 **The importance of an ethics-first approach, five principles for AI in society** **An Ethical Framework for a Good AI Society:** opportunities, Risks, principles and Recommendations. **Establishing the rules for building trustworthy AI** Textbook1: Chapter 1,2,3,4	**6** **L2**
MODULE 2 **Analysis of policy,ethics and regulation,** **Translating principles into practices of digital ethics:** five risks of being Unethical **The Ethics of Algorithms: Key problems** **and Solution** Textbook1: Chapter 5,6,8	**6** **L2**
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 Textbook1: Chapter 9, Chapter 10	**6** **L2**
MODULE 4 **Artificial agents and their normal nature,** **Innovating with Confidence**: Embedding AI Governance and fairness in financial Services Riskmanagement framework, **What the near future of AI could be.**	**6** **L2**

Textbook1: Chapter 11, 20,22	
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 Textbook2 : Chapter 5,Chapter 8, Chapter 9	**6** **L2**

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

CO307B.1	Describe Ethical Framework for a Good AI Society, establishing Rules for trustworthy AI
CO307B.2	Explain ethics for good society
CO307B.3	Illustrate various Tools, methods and practices for designing AI for social good
CO307B.4	Describe the Innovation and future AI
CO307B.5	Illustrate Regulation and Governance of AI ethics in Healthcare domain.

Textbooks:

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

E-Books / Web References

MOOCs

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO307B.1	1	2	1	-		-	-	3	-	-	-	2		1
CO307B.2	1	2	1	-		-	-	3	-	-	-	2		1
CO307B.3	1	2	-	-		-	-	3	-	-	-	2		1
CO307B.4	1	2	-	-		-	-	3	-	-	-	2		1
CO307B.5	1	2	-	-		-	-	3	-	-	-	2		1
Average	**1**	**2**	**1**	-		-	-	**3**	-	-	-	**2**		1

Low-1: Medium-2: High-3

Scheme of Evaluation: (Integrated courses)

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 four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. The average of the three tests are taken for computation of CIE on a scale of 30, the CIE would also include laboratory evaluation for 20 marks. The laboratory marks of 20 would comprise of 10 marks for regular laboratory assessment to include lab record and observation. 10 marks would be exclusive for laboratory internal assessment test to be conducted at the end of the semester.

Table: Distribution of weightage for CIE & SEE of Integrated courses

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	Assignment	**10**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

National Service Scheme (NSS)		Semester	3rd to 6th
Course Code	**NSK23308/408/509/608**	CIE Marks	**25*4 = 100**
Teaching Hours/Week (L:T:P: S)	0:0:2:0	SEE Marks	------
Total Hours of Pedagogy	40hour Practical Session +15hour Planning	Total Marks	**25*4 = 100**
Examination nature (SEE)	Activities Report Evaluation by College NSS Officer at the end of every semester (3rd to 6th semester)		
Credits	NCMC – Non-Credit Mandatory Course (Completion of the course shall be mandatory for the award of degree)		

Course objectives: National Service Scheme (NSS) will enable the students to:

1. Understand the community in general in which they work.
2. Identify the needs and problems of the community and involve them in problem –solving.
3. Develop among themselves a sense of social & civic responsibility & utilize their knowledgein finding practical solutions to individual and community problems.
4. Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.
5. Develop capacity to meet emergencies and natural disasters & practice national integrationand social harmony in general.

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 thatthe activities will develop students' theoretical and applied social and cultural skills.
2. State the need for NSS 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 documentingstudents' progress in real activities in the field.
5. Encourage the students for group work to improve their creative and analytical skills.

National Service Scheme (NSS) – Contents

1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.
2. Waste management– Public, Private and Govt organization, 5 R's.
3. Setting of the information imparting club for women leading to contribution in social andeconomic issues.
4. Water conservation techniques – Role of different stakeholders– Implementation.
5. Preparing an actionable business proposal for enhancing the village income and approach forimplementation.
6. Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.

7. Developing Sustainable Water management system for rural areas and implementation approaches.
8. Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swatch Bharat,Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.

Spreading public awareness under rural outreach programs (minimum5 programs).

1. Social connect and responsibilities.
2. Plantation and adoption of plants. Know your plants.
3. Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs).
4. Govt. school Rejuvenation and helping them to achieve good infrastructure.

NOTE:

- Student/s in individual or in a group Should select any one activity in the beginning of each semester till end of thatrespective semester for successful completion as per the instructions of NSS officer with the consent of HOD of thedepartment.
- At the end of every semester, activity report should be submitted for evaluation.

Distribution of Activities - Semester wise from 3rd to 6th semester

Sem	Topics / Activities to be Covered
3rd Sem for 25 Marks	1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity formarketing. 2. Waste management– Public, Private and Govt organization, 5 R's. 3. Setting of the information imparting club for women leading to contribution in social andeconomic issues.
4th Sem for 25 Marks	4. Water conservation techniques – Role of different stakeholders– Implementation. 5. Preparing an actionable business proposal for enhancing the village income and approach forimplementation. 6. Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.
5th Sem for 25 Marks	7. Developing Sustainable Water management system for rural areas and implementationapproaches. 8. Contribution to any national level initiative of Government of India. Foreg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill developmentprograms etc. 9. Spreading public awareness under rural outreach programs.(minimum5 programs). 10. Social connect and responsibilities.
6th Sem for 25 Marks	11. Plantation and adoption of plants. Know your plants. 12. Organize National integration and social harmony events /workshops /seminars. (Minimum 02programs). 13. Govt. school Rejuvenation and helping them to achieve good infrastructure.

Pedagogy – Guidelines, it may differ depending on local resources available for the studyas 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.	Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.	May be individual or team	Farmers land/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 NSS officer
2.	Waste management– Public, Private and Govt organization, 5 R's.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Governme nt 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 NSS officer
3.	Setting of the information imparting club for women leading to contributionin social and economic issues.	May be individual or team	Women empowerment groups/ Consulting NGOs & Govt Teams / 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 NSS officer
4.	Water conservation techniques – Role of different stakeholders– Implementation.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Governme nt 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 NSS officer
5.	Preparing an actionable business proposal for enhancing the village income and approach for implementation.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Governme nt 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 NSS officer

6.	Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.	May be individual or team	Local government / private/ aided schools/Government Schemes officers/ etc…..	School 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 NSS officer
7.	Developing Sustainable Water management system for rural areas and implementation approaches.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Governme nt 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 NSS officer
8.	Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme,Skill development programs etc.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Governme nt 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 NSS officer
9.	Spreading public awareness under rural outreach programs.(minimum5 programs). ///// Social connect and responsibilities.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Governme nt 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 NSS officer
10.	Plantation and adoption of plants. Know your plants.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Governme nt Schemes officers/ campus etc…..	Place 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 NSS officer

11.	Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs).	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Place 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 NSS officer
12.	Govt. school Rejuvenation and helping them to achieve good infrastructure.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Place 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 NSS officer

Plan of Action (Execution of Activities For Each Semester)

Sl.NO	Practice Session Description
1	**Lecture session by NSS Officer**
2	**Students Presentation on Topics**
3	**Presentation - 1 , Selection of topic, PHASE - 1**
4	**Commencement of activity and its progress - PHASE - 2**
5	**Execution of Activity**
6	**Execution of Activity**
7	**Execution of Activity**
8	**Execution of Activity**
9	**Execution of Activity**
10	**Case study based Assessment, Individual performance**
11	**Sector wise study and its consolidation**
12	**Video based seminar for 10 minutes by each student At the end of semester with Report.**

- In every semester from 3rd semester to 6th semester, Each student should do activities according to the scheme and syllabus.
- At the end of every semester student performance has to be evaluated by the NSS officer for the assigned activity progress and its completion.
- At last in 6th semester consolidated report of all activities from 3rd to 6th semester, compiled report should be submitted as per the instructions.

Course outcomes (Course Skill Set):

At the end of the course, the student will be able to:

CO1: Understand the importance of his / her responsibilities towards society.

CO2: Analyse the environmental and societal problems/issues and will be able to design solutions for the same.CO3: Evaluate the existing system and to propose practical solutions for the same for sustainable development.CO4: Implement government or self-driven projects effectively in the field.

CO5: Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

Assessment Details for CIE (both CIE and SEE)

Weightage	**CIE – 100%**	• Implementation strategies of the project (NSSwork). • The last report should be signed by NSS Officer, the HOD and principal. • At last report should be evaluated by the NSSofficer of the institute. • Finally the consolidated marks sheet should besent to the university and also to be made available at LIC visit.
Presentation - 1 Selection of topic, PHASE - 1	10 Marks	
Commencement of activity and its progress - PHASE - 2	10 Marks	
Case study based Assessment Individual performance	10 Marks	
Sector wise study and its consolidation	10 Marks	
Video based seminar for 10 minutes by each student At the end of semester with Report.	10 Marks	
Total marks for the course in each semester	**50 Marks**	

Marks scored for 50 by the students should be Scale down to 25 marks In each semester

for CIE entry in the VTU portal.

25 marks CIE entry will be entered in University IA marks portal at the end of each semester 3rd to 6th

sem, Report and assessment copy should be made available in the department semester wise.

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.

Suggested Learning Resources:

Books :

1. NSS Course Manual, Published by NSS Cell, VTU Belagavi.
2. Government of Karnataka, NSS cell, activities reports and its manual.
3. Government of India, NSS cell, Activities reports and its manual.

PHYSICAL EDUCATION (SPORTS & ATHLETICS)-I

Course Code	**:**	PEK23308		**CIE**	**:**	**100 Marks**
L:T:P	**:**	0:0:2		**Credits**	:	0
Total Hours	**:**	24 P				

Course Outcomes: At the end of the course, the student will be able to

1. Understand the fundamental concepts and skills of Physical Education, Health,Nutrition and Fitness
2. Familiarization of health-related Exercises, Sports for overall growth anddevelopment
3. Create a foundation for the professionals in Physical Education and Sports
4. Participate in the competition at regional/state / national / international levels.
5. Create consciousness among the students on Health, Fitness and Wellness indeveloping and maintaining a healthy lifestyle.
6. Understand and practice of Traditional Games

Module I : Orientation **4 Hours**

A. Lifestyle
B. Health & Wellness
C. Pre-Fitness test.

Module II: General Fitness & Components of Fitness **4 Hours**

A. Warming up (Free Hand exercises)
B. Strength – Push-up / Pull-ups
C. Speed – 30 Mtr Dash

Module III : Specific games (Any one to be selected by the student) **16 Hours**

1. Kabaddi – Hand touch, Toe Touch, Thigh Hold, Ankle hold and Bonus.
2. Kho-Kho – Giving Kho, Single Chain, Pole dive, Pole turning, 3-6 Up.

Scheme and Assessment for auditing the course and Grades:

Sl. No.	Activity	Marks
1.	Participation of student in all the modules	20
2.	Quizzes – 2, each of 15 marks	30
3.	Final presentation / exhibition / Participation in competitions/ practical on specific tasks assigned to the students	50
	Total	**100**

YOGA FOR BETTER LIFE		Semester	III – VI sem
Course Code	**YOK23308 /408 /509 /608**	CIE Marks	100/sem
Teaching Hours/Week(L:T:P: S)	0:0:2:0	SEE Marks	
Total Hours of Pedagogy per semester	24 - 28 hours	Total Marks	100/sem
Examination nature (SEE)	**Objective type Theory / Practical / Viva-Voce**		

Course objectives:

1) To enable the student to have good health.
2) To practice mental hygiene.
3) To possess emotional stability.
4) To integrate moral values.
5) To attain higher level of consciousness.

The Health Benefits of Yoga

The benefits of various yoga techniques have been supposed to improve

- body flexibility,
- performance,
- stress reduction,
- attainment of inner peace, and
- self-realization.

The system has been advocated as a complementary treatment to aid the healing of several ailments such as

- coronary heart disease,
- depression,
- anxiety disorders,
- asthma, and
- extensive rehabilitation for disorders including musculoskeletal problems and traumatic brain injury.

The system has also been suggested as behavioral therapy for smoking cessation and substanceabuse (including alcohol abuse).

If you practice yoga, you may receive these physical, mental, and spiritual benefits:

- Physical
    1. Improved body flexibility and balance
    2. Improved cardiovascular endurance (stronger heart)
    3. Improved digestion
    4. Improved abdominal strength
    5. Enhanced overall muscular strength
    6. Relaxation of muscular strains
    7. Weight control
    8. Increased energy levels
    9. Enhanced immune system
- Mental
    1. Relief of stress resulting from the control of emotions
    2. Prevention and relief from stress-related disorders
    3. Intellectual enhancement, leading to improved decision-making skills

- Spiritual
    1. Life with meaning, purpose, and direction
    2. Inner peace and tranquility
    3. Contentment

Yoga Syllabus

Semester III

Yoga, its origin, history and development. Yoga, its meaning, definitions. Different schools of yoga, Aim and Objectives of yoga, importance of prayerYogic practices for common man to promote positive health
Rules to be followed during yogic practices by practitionerYoga its misconceptions,
Difference between yogic and non yogic practices
Suryanamaskar prayer and its meaning, Need, importance and benefits of Suryanamaskar12count, 2 rounds
Asana, Need, importance of Asana. Different types of asana. Asana its meaning by name, technique, precautionary measures and benefits of each asana
Different types of Asanas

a. Sitting 1. Padmasana
   2. Vajrasana
b. Standing 1. Vrikshana
   2. Trikonasana
c. Prone line 1. Bhujangasana
   2. Shalabhasana
d. Supine line 1. Utthitadvipadasana
   2. Ardhahalasana

Semester IV

Patanjali's Ashtanga Yoga, its need and importance. Yama :Ahimsa, satya, asteya, brahmacarya, aparigraha
Niyama :shoucha, santosh, tapa, svaadhyaya, Eshvarapranidhan

Suryanamaskar12 count- 4 rounds of practice

Asana, Need, importance of Asana. Different types of asana. Asana its meaning by name,technique, precautionary measures and benefits of each asana
Different types of Asanas

a. Sitting 1. Sukhasana
   2. Paschimottanasana
b. Standing 1. Ardhakati Chakrasana
   2. Parshva Chakrasana
c. Prone line 1. Dhanurasana
d. Supine line 1. Halasana
   2. Karna Peedasana

Meaning, importance and benefits of Kapalabhati.40 strokes/min 3 rounds
Meaning, Need, importance of Pranayama. Different types. Meaning by name, technique, precautionary measures and benefits of each Pranayama
Pranayama – 1. Suryanuloma –Viloma 2. Chandranuloma-Viloma 3. Suryabhedana
4. Chandra Bhedana 5. Nadishodhana

Semester V

Patanjali'sAshtanga Yoga its need and importance.

Ashtanga Yoga

1. Asana
2. Pranayama
3. Pratyahara

Asana its meaning by name, technique, precautionary measures and benefits of each asana

Different types of Asanas

a. Sitting 1. Ardha Ushtrasana
   2. Vakrasana
   3. Yogamudra in Padmasana

b. Standing 1. UrdhvaHastothanasana
   2. Hastapadasana
   3. ParivrittaTrikonasana
   4. Utkatasana

c. Prone line 1. Padangushtha Dhanurasana
   2. Poorna Bhujangasana / Rajakapotasana

d. Supine line 1. Sarvangasana
   2. Chakraasana
   3. Navasana/Noukasana
   4. Pavanamuktasana

Revision of practice 60 strokes/min 3 rounds

Meaning by name, technique, precautionary measures and benefits of each Pranayama

1. Ujjayi 2. Sheetali 3. Sheektari

Semester VI

Ashtanga Yoga 1. Dharana 2. Dhyana (Meditation) 3. Samadhi

Asana by name, technique, precautionary measures and benefits of each asana

Different types of Asanas

a. Sitting 1. Bakasana
   2. Hanumanasana
   3. Ekapada Rajakapotasana
   4. Yogamudra in Vajrasana

b. Standing 1. Vatayanasana
   2. Garudasana

c. Balancing 1. Veerabhadrasana
   2. Sheershasana

d. Supine line 1. Sarvangasana
   2. Setubandha Sarvangasana
   3. Shavasanaa (Relaxation poisture).

Revision of Kapalabhati practice 80 strokes/min - 3 rounds

Different types. Meaning by name, technique, precautionary measures and benefits of each Pranayama 1. Bhastrika 2. Bhramari

Meaning, Need, importance of Shatkriya. Different types. Meaning by name, technique, precautionary measures and benefits of each Kriya 1. Jalaneti & sutraneti 2. Nouli (only formen) 3. Sheetkarma Kapalabhati

Course outcomes (Course Skill Set):

At the end of the course, the student will be able to:

- Understand the meaning, aim and objectives of Yoga.
- Perform Suryanamaskar and able to Teach its benefits.
- Understand and teach different Asanas by name, its importance, methods and benefits.
- Instruct Kapalabhati and its need and importance.
- Teach different types of Pranayama by its name, precautions, procedure and uses
- Coach different types of Kriyas , method to follow and usefulness.

Assessment Details (both CIE and SEE)

- Students will be assessed with internal test by a. Multiple choice questions b. Descriptive type questions (Two internal assessment tests with 25 marks/test)
- Final test shall be conducted for whole syllabus for 50 marks. Continuous Internal Evaluation shall be for 100 marks (including IA test)

Suggested Learning Resources:

Books:

1. **Yogapravesha in Kannada by Ajitkumar**
2. **Light on Yoga by BKS Iyengar**
3. **Teaching Methods for Yogic practices by Dr. M L Gharote & Dr. S K Ganguly**

Yoga Instructor Course hand book published by SVYASA University, Bengaluru Yoga for Children –step by step – by Yamini Muthanna

Web links and Video Lectures (e-Resources): Refer links

https://youtu.be/KB-TYlgd1wE
https://youtu.be/aa-TG0Wg1Ls

SEMESTER III

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.
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 matrixas 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, SecondEdition, University press, 2008, Reprinted 2016
2. Seymour Lipschutz, Schaum's Outlines, Data Structures with C, McGraw Hill, Special IndianEdition, 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**

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

SEMESTER – IV

Course: 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**
No. of Credits	**3**	**Examination Hours**	**03**

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

Content	**No. of Hours/ RBT levels**
Module 1 Random Variable, Binomial, Poisson, Uniform, Exponential and Normal distributions. Joint distributions (both discrete and continuous), Expectation and Covariance.	**08 Hours** **L2, L3**
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 Hours** **L2, L3**
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 Hours** **L2, L3**
Module 4 Inner products; inner product spaces; orthogonal sets and projections; Gram-Schmidt process; QR-factorization.	**08 Hours** **L2, L3**
Module 5 Least square solutions and fittings, diagonalization of symmetric matrices, quadratic forms, constrained optimization; Singular value decomposition.	**08 Hours** **L2, L3**

Textbooks:

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:

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

COURSE OUTCOMES:

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

CO41.1	• 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.
CO41.2	• Solve matrix equations of the form AX = b using row reduction algorithm • Analyse the properties and characteristics of linear transformations. • Compute the inverse of a matrix using the Gauss-Jordan elimination method.
CO41.3	• 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.
CO41.4	• 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.
CO41.5	• 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

Scheme of Examination:

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

Continuous Internal Evaluation (CIE):
Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. **Some possible AATs:** seminar/assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

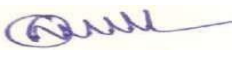
Typical Evaluation pattern for regular courses is shown in Table 2.

Table 2: 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**	
	Assignments	**10**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

CO/PO	PO1	PO2	PO3	PO12
CO41.1	3	2	1	3
CO41.2	3	2	1	3
CO41.3	3	2	1	3
CO41.4	3	2	1	3
CO41.5	3	2	1	3
Average	3	2	1	3

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



SEMESTER IV

SUBJECT: 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**

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, GalgotiaPublications, ISBN:9780716783169.

E-Books / Web References:

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

MOOCs:

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

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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

SEMESTER IV

SUBJECT: DATABASE MANAGEMENT SYSTEMS

Subject Code	**CML23403**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:2**	**SEE Marks**	**50**
Total Hours	**50**	**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 / RBT Levels
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. **Text Book1: Chapter 1.1-1.3, 1.6 , 2.1,2.2, 3.2-3.6**	**10** **L3**
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. **Text Book1: Chapter 5.1, 8.1-8.3, 8.5**	**10** **L3**
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, Specifying Constraints as Assertions and Action Triggers, Views in SQL, Schema change statements in SQL. **Text Book1: Chapter 6.1-6.4, 7.1-7.4**	**10** **L3**
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 and Why you need it?,Document-Based NOSQL Systems and MongoDB **Text Book1: Chapter 14.1-14.5,24.1,24.3**	**10** **L3**
MODULE 5	**10** **L2**

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, Shadow paging, ARIES recovery algorithm. **Text Book1: Chapter 20.1, 20.2.1, 20.3-20.5, 21.1, 21.2, 22.4, 22.5**	

Lab Programs

Note:

- 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.
- Create Schema and insert at least 5 records for each table. Add appropriate database constraints.

List of Experiments

1. Consider the following schema for a Library

   Database:BOOK (Book_id, Title,

   Publisher_Name, Pub_Year)

   BOOK_AUTHORS (Book_id, Author_Name)

   PUBLISHER (Name, Address, Phone)

   BOOK_COPIES (Book_id, Branch_id, No-

   of_Copies)

   BOOK_LENDING (Book_id, Branch_id, Card_No, Date_Out,

   Due_Date)LIBRARY_PROGRAMME (Branch_id, Branch_Name,

   Address)

   CARD (Card_No)

   Write SQL queries to

   a. Retrieve details of all books in the library – id, title, name of publisher, authors, number ofcopies in each Programme, etc.
   b. Get the particulars of borrowers who have borrowed more than 2 books, in the year 2020.
   c. Delete a book in BOOK table. Update the contents of other tables to reflect this datamanipulation operation.
   d. Display the total number of books published by each Publisher.
   e. Create a view of all books and its number of copies that are currently available in the Library.

2. Consider the schema for Company Database:

   EMPLOYEE (SSN, FName, LName, Address, Gender, Salary,

   DNo)DEPARTMENT (DNo, DName, MgrSSN,

   MgrStartDate) DLOCATION (DNo,DLoc)

   PROJECT (PNo, PName, PLocation,

   DNo)WORKS_ON (SSN, PNo,

   Hours)

   Write SQL queries to

a. Convert employee name into uppercase whenever an employee record is inserted or updated.Trigger to fire before the insert or update.
b. Make a list of all project numbers for projects that involve an employee whose last name is'Scott', either as a worker or as a manager of the department that controls the project.
c. Show the resulting salaries if every employee working on the 'IoT' project is given a 10 percentraise.
d. Find the sum of the salaries of all employees of the 'Accounts' department, as well as themaximum salary, the minimum salary, and the average salary in this department.
e. Retrieve the name of each employee who works on all the projects controlled by departmentnumber 5.

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 willkeep 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 statePerform 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 the total interest credited to each customer for a particular year.
   e. Find the customer who has not done any transaction.

4. A database is to be designed for a college to monitor students' progress throughout their course of study.The students are reading for a degree (such as B.E.) within the framework of the modular system. Thecollege provides a number of Subjects (Modules), each being characterized by its code, title, credit value, module leader, teaching staff and the department they come from, prerequisite course. Department may be CSE, ISE etc. A Subject is co- ordinated by a module leader who shares teaching duties with one or more teachers. A Teacher may teach (and be a module leader for) more than one Subject. Students are free to choose any subject they wish. The database also contains some informationabout students including their Serial numbers, names, addresses, their past performance (i.e. subjects taken and Subject Examination Marks).

   For this case study,

   a. Analyze the data required, create the tables and insert the values.
   b. Retrieve the Teacher names who are not Module leaders.
   c. Display the department which offers the subject "Database Management System".
   d. Display the number of Subjects taught by each Teacher.
   e. Categorize students based on the following criterion: If Subject Examination Marks = 70 to 100 then CAT = 'Outstanding' If FinalIA = 40 to 69 then CAT = 'Average' If FinalIA< 39 then CAT = 'Weak'.

5. MINI PROJECT Use Java, C#, PHP, Python, or any other similar front-end tool. All applications must be demonstrated on desktop/laptop as a stand-

alone or web-based application (Mobile apps on Android/IOS are not permitted.)

- For any problem selected, draw the ER Diagram, apply ER-mapping rules, normalize the relations, and follow the application development process.
- Make sure that the application should have five or more tables, at least one trigger and one stored procedure, using suitable front-end tool.
- Indicative areas include; health care, education, industry, transport, supply chain,etc.

Course Outcomes

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

CO403.1	Construct ER models to represent simple database applications.
CO403.2	Develop Relational Algebraic expressions for complex Relational Algebra operations.
CO403.3	Develop SQL/PL/SQL programs for queries using Relational Model Concepts.
CO403.4	Demonstrate relational database model for an application by normalizing the database schema.
CO403.5	Illustrate the use of concurrency control and transactions in database.

Text books:

1. Elmasri, Ramez, and Sham Navathe. Fundamentals of database systems. Vol. 7. Pearson, 2014.
2. Tiwari, Shashank. Professional nosql. John Wiley & Sons, 2011.

Reference Books:

1. Raghurama Krishnan, Johannes Gehrke , Database Management Systems, 3rd edition, Tata McGrawHill, New Delhi, India.
2. Silberschatz, Korth and Sudharshan: Database System Concepts, 6th Edition, Mc-GrawHill, 2010.
3. C.J. Date, A. Kannan, S. Swamynatham: An Introduction to Database Systems, 8th Edition, PearsonEducation, 2006.
4. Coronel, Morris, and Rob, Database Principles Fundamentals of Design, Implementation and Management, Cengage Learning 2012.

E-Books / Web References

1. http://www.mim.ac.mw/books/Elmasri-Navathe-Fundamentals-of-Database-Systems-5th-Editi.pdf
2. Procedures in SQL | SQL Stored Procedures | Edureka
3. Hashing in DBMS | 2 Main Types of Hashing Techniques in DBMS (educba.com)
4. Blog Theme - Details (oracle.com)
5. Bitmap Indexing in DBMS - GeeksforGeeks
6. GridFS — MongoDB Manual

MOOCs

1. https://archive.nptel.ac.in/courses/106/105/106105175

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO403.1	3	-	-	-	-	-	-	-	-	-	-	2	-	2
CO403.2	3	3	2	-	-	-	-	-	1	1	-	2	-	2
CO403.3	3	3	1	-	2	-	-	-	1	1	-	2	-	2
CO403.4	3	3	1	-	2	-	-	-	1	1	-	2	-	2
CO403.5	1	1	-	-	-	-	-	-	1	1	-	2	-	2
Average	**3**	**3**	**1**	**-**	**2**	**-**	**-**	**-**	**1**	**1**	**-**	**2**	**-**	**2**

Low-1: Medium-2: High-3

Scheme of Evaluation: (Integrated courses)

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 four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. The average of the three tests are taken for computation of CIE on a scale of 30, the CIE would also include laboratory evaluation for 20 marks. The laboratory marks of 20 would comprise of 10 marks for regular laboratory assessment to include lab record and observation. 10 marks would be exclusive for laboratory internal assessment test to be conducted at the end of the semester.

Table: Distribution of weightage for CIE & SEE of Integrated courses

	Component	Marks	Total Marks
CIE	CIE Test-1	**30**	**50**
	CIE Test-2	**30**	
	CIE Test-3	**30**	
	Lab	**20**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

SEMESTER IV

SUBJECT: SOFTWARE ENGINEERING

Subject Code	**CML23404**	**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 / RBT Levels**
MODULE 1 **Introduction:** Professional Software Development - Software Engineering, Case Studies. **Software Processes:** Software process models - Waterfall Model, Incremental Model, and Spiral Model, Software Process Activities. **Requirement Engineering:** Requirements Specification, Requirement elicitation and analysis, Requirements Validation, Requirements change, Functional Specification, and Non-Functional Requirements, The software requirements document. **Case Study:** Create a SRS document for the following software projects. **Case Study:** Create a SRS document for the following software projects. 1. Online Ticket Reservation System 2. Stock Maintenance 3. Students' marks analyze systems 4. Stock Maintenance **Text book:1 Chapters: 1.1-1.3,2.1-2.2,4.1-4.6**	**08** **L2**
MODULE 2 **System Models:** Context models. Interaction models. Structural models. Behavioral models. Model-driven engineering. **Software Design and Planning:** Object-oriented design concepts using UML tool: Star UML application, Design patterns, Implementation issues, Open-Source Development. **Case Study:** Create a **Software Design** for the following software projects using **Star UML** tool . 1. Online Ticket Reservation System 2. Stock Maintenance **Text book:1 Chapters:5.1-5.5,7.1-7.4**	**08** **L2**

MODULE 3 **Agile Software Development:** Agile methods, Plan-driven and agile development, Extreme programming, Agile project management, Scaling agile methods. SCRUM Methodology, SCRUM. **Text book:1 & 3 Chapters:3.1-3.4**	**08** **L2**
MODULE 4 **Software testing strategies:** A Strategic Approach to Software Testing, Strategic Issues, Test Strategies for Conventional software, Test Strategies for Object-Oriented Software, Test Strategies for web apps, Validation Testing, and System Testing. **Testing Conventional Applications:** Software Testing Fundamentals, Internal and External views of Testing, White-Box Testing, Basic path Testing, Control structure Testing, and Black-box Testing. **Case study:** 1. Design the test case for finding the roots of the quadratic equation. 2. Design the test case for the e-commerce application. **Text book:2 Chapters: 17.1-17.7,18.1-18.6**	**08** **L2**
MODULE 5 Project planning: Software pricing, Plan-driven development, Project scheduling, Agile planning, and Estimation techniques. Quality management: Software quality, Software standards, Reviews and inspections, Software measurement, and metrics. **Text book:1 Chapters:23.1-23.5,24.1-24.3 & 24.5**	**08** **L2**

Course Outcomes:

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

CO404.1	Understand the fundamentals of Software Engineering, Software process models, and Requirements Engineering.
CO404.2	Summarize the different types of System Models, Software Design and Planning by using UML tool.
CO404.3	Outline Agile Software Development and Agile Methods – SCRUM.
CO404.4	Describe Software testing methods and Conventional Applications.
CO404.5	Discuss the project planning process, Cost estimation models, Software Quality standards, and metrics.

Textbooks:

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

Reference Books:

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

E-Books / Web References

1. https://www.softwaretestingmaterial.com/category/agile/
2. https://www.atlassian.com/agile/kanban

MOOCs

1. https://www.coursera.org/learn/introduction-to-software-engineeringE-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
CO404.1	3	-	-	-	-	1	1	1	-	3	-	2	2	2
CO404.2	3	-	3	-	-	1	1	1	-	3	-	2	2	2
CO404.3	3	-	3	-	-	1	1	1	-	3	-	2	2	2
CO404.4	3	3	3	3	-	3	-	-	3	3	3	3	2	2
CO404.5	3	1	-	-	-	1	1	1	-	3	2	2	2	2
Average	**3**	**2**	**3**	**3**	**-**	**2**	**1**	**1**	**3**	**3**	**3**	**3**	**2**	**2**

Low-1: Medium-2: High-3

Scheme of Evaluation:

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 four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three tests are to be conducted for 40 marks each. Average of all three tests marks is added to the test component. In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the Alternative Assessment Tool (AAT). The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices. Possible AATs are – seminar / assignments / term paper / open ended experiments / mini-projects/group activity or any other.

Table: Distribution of weightage for CIE & SEE

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	AAT	**5**	
	AAT	**5**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

SEMESTER IV

SUBJECT: UNIX SYSTEM PROGRAMMING

Subject Code	**CML23405A**	**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	understand effective use of Unix concepts, commands and terminology
CLO2	Identify, access, and evaluate UNIX file system
CLO3	Explain the fundamental design of the unix operating system
CLO4	Familiarize with the systems calls provided in the unix environment
CLO5	Design and build an application/service over the unix operating system

CONTENTS	**# of Hours / RBT Levels**
MODULE 1 Introduction: Unix Components/Architecture. Features of Unix. The UNIX Environment and UNIX Structure, Posix and Single Unix specification. General features of Unix commands/ command structure. Command arguments and options. Basic Unix commands such as echo, printf, ls, who, date, passwd, cal, Combining commands. Meaning of Internal and external commands. The type command: knowing the type of a command and locating it. The root login. Becoming the super user: su command. Unix files: Naming files. Basic file types/categories. Organization of files. Hidden files. Standard directories. Parent-child relationship. The home directory and the HOME variable. Reaching required files- the PATH variable, manipulating the PATH, Relative and absolute pathnames. Directory commands – pwd, cd, mkdir, rmdir commands. The dot (.) and double dots (..) notations to represent present and parent directories and their usage in relative path names. File related commands – cat, mv, rm, cp, wc and od commands. Text Book1: Chapter-1, 2, 3, 4, 5	**8** **L2**
MODULE 2 File attributes and permissions: The ls command with options. Changing file permissions: the relative and absolute permissions changing methods. Recursively changing file permissions. Directory permissions. The shells interpretive cycle: Wild cards. Removing the special meanings of wild cards. Three standard files and redirection.	**8** **L3**

Connecting commands: Pipe. Basic and Extended regular expressions. The grep, egrep. Typical examples involving different regular expressions. Shell programming: Ordinary and environment variables. The. profile. Read and read-only commands. Command line arguments. exit and exit status of a command. Logical operators for conditional execution. The test command and its shortcut. The if, while, for and case control statements. The set and shift commands and handling positional parameters. The here (<<**)** document and trap command. Simple shell program examples. Text Book1: Chapter-6,8,13,14	
MODULE 3 Unix Standardization and Implementations: Introduction, Unix Standardization, UNIX System Implementation. File I/O: Introduction, File Description, open, create, read, write, close, fcntl functions. Files and Dictionaries: mkdir and rmdir functions, reading dictionaries, chdir, fchdir and getcwd functions. Device Special files. 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, Environment Variables, setjmp and longjmp Functions, getrlimit, setrlimit Functions. Text Book 2: 2,3,4,7.	**8** **L3**
MODULE 4 Process Control: Introduction, Process Identifiers, fork, vfork, exit, wait, waitpid, wait3, wait4 Functions, Race Conditions, exec Functions. Overview of IPC Methods, Pipes, popen, pclose Functions, Coprocesses, FIFOs, System V IPC, Message Queues, Semaphores. Shared Memory, Client-Server Properties, Passing File Descriptors, An Open Server-Version 1. Text Book2: Chapter 8, 15,17	**8** **L3**
MODULE 5 Signals and Daemon Processes: Introduction, Signal Concepts, Signal Functions, SIGCLD Semantics, Kill and Raise functions, Alarm and Pause Functions, Signal Sets, sigprocmask Function, sigpending function, sigaction function, sigsetjmp and siglongjmp functions, sigsuspend function, abort function, system function, sleep, nanosleep and clock_nanosleep functions, sigqueue functions, job-control signals, signal names and numbers. Daemon Processes: Introduction, Daemon Characteristics, Coding Rules, Error Logging, Client-Server Model. Text Book 2: Chapter 10, 13	**8** **L3**

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

CO405A.1	Demonstrate the basics of Unix concepts and commands.
CO405A.2	Demonstrate the UNIX file system
CO405A.3	Apply comands to reflect changes in file system.
CO405A.4	Demonstrate IPC and process management.
CO405A.5	Develop an application/service over a Unix system.

Textbooks:

1. Sumitabha Das., Unix Concepts and Applications., 4thEdition., Tata McGraw Hill
2. W. Richard Stevens: Advanced Programming in the UNIX Environment, 2nd Edition, Pearson Education, 2005

Reference Book:

1. Unix System Programming Using C++ - Terrence Chan, PHI, 1999.
2. M.G. Venkatesh Murthy: UNIX & Shell Programming, Pearson Education.
3. . Richard Blum, Christine Brenham: Linux Command Line and Shell Scripting Bible, 2ndEdition, Wiley, 2014.

MOOCs:

https://www.coursera.org/learn/codio-unix-system-basics

https://www.udemy.com/course/essential-unix-skills-for-developers/?couponCode=LEARNNOWPLANS

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO405A.1	3	2	3		2									2
CO405A.2	3	2	1		2								1	
CO405A.3	3	2	1		2								1	
CO405A.4	3	2	2		2								1	2
CO405A.5	3	2	2		2									
Average	**3**	**2**	**2**		**2**								**1**	**2**

Low-1: Medium-2: High-3

Scheme of Evaluation:

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 four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three tests are to be conducted for 40 marks each. Average of all three tests marks is added to the test component. In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the Alternative Assessment Tool (AAT). The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices. Possible AATs are – seminar / assignments / term paper / open ended experiments / mini-projects/group activity or any other.

Table: Distribution of weightage for CIE & SEE

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	AAT	**5**	
	AAT	**5**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

SEMESTER IV

SUBJECT: METRIC SPACES

Subject Code	**CML23405B**	**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	Provide insight into the theory of sets
CLO2	Learn basic concepts of metric spaces
CLO3	Understand the concepts of connected sets and compact spaces

CONTENTS	# of Hours / RBT Levels
MODULE 1 Finite and infinite sets, countable and uncountable sets, cardinality of sets, Schroder-Bernstein theorem, cantor's theorem, Order relation in cardinal numbers, Arithmetic of cardinal numbers, Partially ordered set, Zorn's lemma and axioms of choice, various set-theoretic paradoxes.	**8** **L3**
MODULE 2 Definition and examples of metric spaces, Open spheres and Closed spheres, Neighborhoods, Open sets, Interior, Exterior and boundary points, Closed sets, Limit points and isolated points,Interior and closure of a set, Boundary of a set, Bounded sets, Distance between two sets, Diameter of a set.	**8** **L3**
MODULE 3 Cauchy and Convergent sequences, Completeness of metric spaces, Cantor's intersection theorem, Dense sets and separable spaces, Nowhere dense sets and Baire's category theorem,continuous and uniformly continuous functions, Homeomorphism. Banach contraction principle.	**8** **L3**
MODULE 4 Compact spaces, Sequential compactness, Bolzano-Weierstrass property, Compactness and finite intersection property, Heine-Borel theorem, Totally bounded set, equivalence of compactness and sequential compactness	**8** **L3**
MODULE 5 Separated sets, Disconnected and connected sets, components, connected subsets of R, Continuousfunctions on connected sets. Local connectedness and arc-wise connectedness	**8** **L3**

Course Outcomes: Upon successful completion of this

course, students will be able to

CO405B.1	Explain basic facts about the cardinality of a set and various set-theoretic paradoxes.
CO405B.2	Apply the concepts of open and closed spheres and bounded sets to solve problems.
CO405B.3	Demonstrate standard concepts of metric spaces and their properties.
CO405B.4	Identify the continuity of a function defined on metric spaces and homomorphism.

Text Books

1. P.K. Jain & Khalil Ahamad, "*Metric Spaces"*. Narosa, 2019.
2. Micheal O; Searcoid, "Metric spaces". Springer-Verlag, 2009.

Reference Books:

1. Satish Shirali & Harikishan L. Vasudeva, "*Metric Spaces"*, Springer-Verlag, 2006.
2. E.T. Copson, "*Metric spaces"*, Cambridge University Press, 1988.
3. P.R. Halmos, "*Naive Set Theory*". Springer, 1974.
4. S. Kumaresan, "*Topology of Metric spaces",* 2nd edition, Narosa, 2011.
5. G.F. Simmons, "Introduction to Topology and Modern Analysis". McGraw-Hill, 2004.

E-Books / Web References

- http://academicearth.org/

MOOCs

- http://nptel.ac.in/courses.php?disciplineID=111
- http://www.class-central.com/subject/math(MOOCs)
- VTU e-Shikshana Program
- VTU EDUSAT Program.

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO405B.1	3	3	2	-		-	-	-	1	1	-	2	1	-
CO405B.2	3	3	2	-		-	-	-	1	1	-	2	1	-
CO405B.3	3	3	2	-		-	-	-	1	1	-	2	1	-
CO405B.4	3	3	3	-		-	-	-	1	1	-	2	1	-
CO405B.1	1	3	3	-		-	-	-	1	1	-	2	1	-
Average	**3**	**3**	**3**	-		-	-	-	**1**	**1**	-	**2**	**1**	-

Low-1: Medium-2: High-3

Scheme of Evaluation: (Integrated courses)

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 four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. The average of the three tests are taken for computation of CIE on a scale of 30, the CIE would also include laboratory evaluation for 20 marks. The laboratory marks of 20 would comprise of 10 marks for regular laboratory assessment to include lab record and observation. 10 marks would be exclusive for laboratory internal assessment test to be conducted at the end of the semester.

Table: Distribution of weightage for CIE & SEE of Integrated courses

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	ASSIGNMENT	**10**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

SUBJECT: THEORY OF COMPUTATION

Subject Code	**CML23405C**	**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	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 / RBT Levels
MODULE 1 Introduction to Finite Automata, Structural Representations, Automata and Complexity. The Central Concepts of Automata Theory. Deterministic Finite Automata, Nondeterministic Finite Automata, An Application: Text Search, Finite Automata with Epsilon-Transitions. TEXT BOOK: Sections 1.1, 1.5, 2.2,2.3,2.4,2.5	8 L3
MODULE 2 Regular Expressions, Finite Automata and Regular Expressions, Proving Languages not to be Regular. Closure Properties of Regular Languages, Equivalence and Minimization of Automata, Applications of Regular Expressions TEXT BOOK: Sections 3.1, 3.2 (Except 3.2.1), 3.3, 4.1, 4.2, 4.4	8 L3
MODULE 3 Context-Free Grammars, Parse Trees, Ambiguity in Grammars and Languages, Ambiguity in Grammars and Languages, Definition of the Pushdown Automaton, The Languages of a PDA, Equivalence of PDA's and CFG's, Deterministic Pushdown Automata. TEXT BOOK: Sections 5.1, 5.2, 5.4, 6.1,6.2,6.3.1,6.4	8 L3
MODULE 4 Normal Forms for Context-Free Grammars, The Pumping Lemma for Context-Free Languages, Closure Properties of Context-Free Languages. TEXT BOOK: Sections 7.1, 7.2, 7.3	8 L3

MODULE 5	8
Introduction to Turing Machines: Problems That Computers Cannot Solve, The Turing Machine, Programming Techniques for Turing Machines, Extensions to the Basic Turing Machine, Undecidability: A Language That Is Not Recursively Enumerable. TEXT BOOK: Sections 8.1,8.2, 8.3,8.4, 9.1, 9.2	L3

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

CO405C.1	Apply the fundamentals of automata theory to write DFA, NFA, Epsilon-NFA and conversion between them.
CO405C.2	Prove the properties of regular languages using regular expressions.
CO405C.3	Design context-free grammars (CFGs) and pushdown automata (PDAs) for formal languages.
CO405C.4	Design Turing machines to solve the computational problems.
CO405C.5	Explain the concepts of decidability and undecidability.

Text books:

1. John E Hopcroft, Rajeev Motwani, Jeffrey D. Ullman," Introduction to Automata Theory, Languages and Computation", Second Edition, Pearson.

Reference Books:

1.Elain Rich, "Automata,Computability and complexity", 1st Edition, Pearson Education,2018.
2. K.L.P Mishra, N Chandrashekaran , 3rd Edition , 'Theory of Computer Science",PHI,2012.
3. Peter Linz, "An introduction to Formal Languages and Automata ", 3rd Edition, Narosa Publishers,1998.
4. Michael Sipser : Introduction to the Theory of Computation, 3rd edition, Cengage learning,2013.
5. John C Martin, Introduction to Languages and The Theory of Computation, 3rd Edition, Tata McGraw –Hill Publishing Company Limited, 2013.

MOOCs:

1. https://www.udemy.com/course/complete-jdbc-programming-part-1/

2. https://www.coursera.org/learn/java-database-connectivity-introduction

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO405C.1	2	3	3						3					
CO405C.2	2	3	3		2				3		2			
CO405C.3	2	3	3		2								1	
CO405C.4	2	3	3								2		1	3
CO405C.5	2	3	3						3				1	3
Average	**2**	**3**	**3**		**2**				**3**		**2**		**1**	**3**

Low-1: Medium-2: High-3

Scheme of Evaluation:

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 four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three tests are to be conducted for 40 marks each. Average of all three tests marks is added to the test component. In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the Alternative Assessment Tool (AAT). The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices. Possible AATs are – seminar / assignments / term paper / open ended experiments / mini-projects/group activity or any other.

Table: Distribution of weightage for CIE & SEE

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	AAT	**5**	
	AAT	**5**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

SEMESTER: IV

SUBJECT : UNIVERSAL HUMAN VALUES

Course Code	**UHK23406**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**1:0:0**	**SEE Marks**	**50**
No. of Credits	**1**	**Examination Hours**	**01**

Course Objectives:

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

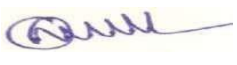
Content
Module 1 (03 hours) Introduction to Value Education: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human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

Reference Books:

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

COURSE OUTCOMES:

Upon completion of this course, student would:



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

Scheme of Examination:

Semester End Examination (SEE):
SEE paper shall be set for 50 questions, each of the 01 mark. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is 01 hour.

Continuous Internal Evaluation (CIE):
Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests.
Typical Evaluation pattern for regular courses is shown in Table 2.

Table 2: 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**	
	Assignments	**10**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

CO/PO	PO6
CO 1	3
CO 2	3
CO 3	3
CO 4	3
Average	3

Low-1: Medium-2: High-3

SEMESTER IV

SUBJECT: ADVANCED PYTHON

Subject Code	**CML23407A**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**1:0:2**	**SEE Marks**	**50**
Total Hours	**30**	**Examination Hours**	**3**
No. of Credits: 2			

Prerequisites (if any): Programming with Python.

Course Learning Objectives:

Sl. No	Course Learning Objectives (CLO)
CLO1	To build a strong foundation to understand advanced python packages for data science.
CLO2	To understand daily tasks that data scientists tackle.
CLO3	To gain skills needed to implement machine learning, AI, and predictive analytics algorithms.
CLO4	To understand the access to a wide variety of data analysis and data science libraries.
CLO5	To meet industry demand for experts with Python skills.

Module 1	Hours / RBT Levels
NumPy Basics: Arrays and Vectorized Computation **Basics of Numpy Arrays:** NumPy Array Attributes **The NumPy and array:** A Multidimensional Array Object, Creating nd arrays, Data Typesfor nd arrays, Arithmetic with NumPy Arrays, Basic Indexing and Slicing, Boolean Indexing,Fancy Indexing, Transposing Arrays and Swapping Axes, Reshaping of Arrays,Aggregations, Universal Functions: Fast Element-Wise Array Functions, Array-OrientedProgramming with Arrays, Expressing Conditional Logic as Array Operations,Mathematical and Statistical Methods, Methods for Boolean Arrays, Sorting, Unique andOther Set Logic, File Input and Output with Arrays, Linear Algebra, Pseudorandom Number Generation, Example: Random Walks.	**06 L3**
Module 2	
Pandas: Installing and using Pandas, Introducing Pandas Objects, Operating on data in 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. **Combining Datasets:** Concat, Append, Merge and Join. Working with Time Series.	**06 L3**
Module 3	
Plotting and Visualization: A Brief matplotlib API Primer: Figures and Subplots, Chartsusing plot(),pie chart, violin plot, scatter plot, histogram, bar chart, area plot, Quiver plot,Mesh grid, contour plot,Colors, Markers, and Line Styles, Ticks, Labels, and Legends, Annotations and Drawing on a Subplot, Saving Plots to File, matplotlib Configuration.	

Plotting with pandas and seaborn: Three-Dimensional Plotting in Matplotlib, Python Visualization Tools for categorical Variables and Continuous Variables.	
Module 4 **Data Cleaning and Preparation:** Handling Missing Data, Filtering Out Missing Data, Filling in Missing Data, Data Transformation, Removing Duplicates, Transforming Data Using a Function or Mapping, Replacing Values, Renaming Axis Indexes, Discretization and Binning, Detecting and Filtering Outliers, Computing Indicator/Dummy Variables. **Data Wrangling:** Join, Combine, and Reshape: Combining and Merging Datasets,Database-Style Data Frame Joins, Merging on Index, Concatenating Along an Axis,Combining Data with Overlap, Reshaping and Pivoting, Reshaping with Hierarchical Indexing, Pivoting "Long" to "Wide"Format, Pivoting "Wide"to "Long"Format	**6** **L3**
Module 5 **Data Preprocessing** Datasets and Partitions, Data Pre-processing and Scaling: Different Preprocessing techniques, Data Integration, Outlier removal, artifact removal, Applying Data Transformations, Scaling, Training and Test Data the Same Way, Data Normalization, Data Transformation techniques.	**6** **L3**

Lab programs

1. Create a 3D NumPy array and perform basic arithmetic operations on it.
2. Demonstrate basic indexing, slicing, and fancy indexing on a 2D array.
3. For a given array , perform the following
   a. Use boolean indexing to filter out even numbers and odd numbers from an array
   b. Compute various aggregations like sum, mean, and standard deviation on a 1D array.
4. Create a DataFrame, add a new column, and update values.
5. For a data frame , perform the following
   a. Filter rows based on multiple conditions and display selected columns.
   b. Merge two DataFrames based on a common key and display the result.
6. Create a bar chart and a pie chart using sample data.
7. Create a scatter plot and add annotations for specific points
8. Create a DataFrame with missing values, fill them, and drop rows with missing values
9. Remove duplicate entries and rename columns in a DataFrame.
10. Normalize a dataset using Min-Max scaling and standardization**.**

Course Outcomes:

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

CO407A.1	Apply the fundamental of NumPy and Ndarrays on the real data.
CO407A.2	Apply the fundamental of Pandas on the dataset for analysis.
CO407A.3	Illustrate graphically data using matplotlib and seaborn libraries and results of statistical calculations.
CO407A.4	Identify proficiency in the Data preparation and wrangling.
CO407A.5	Apply the concepts of data preprocessing on the real world data.

Text Books:

1. Python Data Science handbook, by Jake Vander Plas, O'Reilly.
2. Python for Data Analysis, by Wes McKinney, 2nd Edition, O'Reilly.
3. Bharti Motwani, Data Analytics using Python, Wiley.

Reference Books:

1. Gowrishankar S, Veena A, —Introduction to Python Programming, 1st Edition, CRC Press/Taylor & Francis, 2018. ISBN-13: 978-0815394372.
2. AurelienGeron, —Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems‖, 2nd Edition, O'Reilly Media, 2019. ISBN – 13: 978- 9352139057.

E-Books / Web References:

1. Automate The Boring Stuff With Python: https://automatetheboringstuff.com/
2. Python3Tutorialhttps://www.tutorialspoint.com/python3/python_tutorial.pdf
3. Python for Absolute Beginners http://indexof.es/Python/Python%203%20for%20Absolute%20Beginners.pdf

MOOCs:

1. https://www.coursera.org/learn/python-for-applied-data-science-ai
2. https://www.edx.org/course/python-basics-for-data-science
3. https://cognitiveclass.ai/courses/python-for-data-science

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO407A.1	3	3	3		2	2			2			2	1	2
CO407A.2	3	3	3		2	3					2	2	1	2
CO407A.3	3	2	3		2					3		2	1	2
CO407A.4	2	3	3		3	2			3	3		2	1	2
CO407A.5	3	3	3		2				2		3	3	1	2
Average	3	3	3		2	2			3	3	2	2	**1**	2

Low-1: Medium-2: High-3

Scheme of Evaluation:

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 four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three tests are to be conducted for 40 marks each. Average of all three tests marks is added to the test component. In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the Alternative Assessment Tool (AAT). The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices. Possible AATs are – seminar / assignments / term paper / open ended experiments / mini-projects/group activity or any other.

Table: Distribution of weightage for CIE & SEE of Integrated courses

	Component	Marks	Total Marks
CIE	CIE Test-1	**30**	**50**
	CIE Test-2	**30**	
	CIE Test-3	**30**	
	Lab	**20**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

SEMESTER IV

SUBJECT: OBJECT ORIENTED PROGRAMMING WITH JAVA

Subject Code	**CML23407B**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**1:0:2**	**SEE Marks**	**50**
Total Hours	**30**	**Examination Hours**	**3**
No. of Credits: 2			

Course Learning Objectives:

The course will enable students to:

CLO1	Set up Java JDK environment to create, debug, and run simple Java programs.
CLO2	Learn object-oriented concepts using programming examples.
CLO3	Create multi-threaded programs and event-handling mechanisms.
CLO4	Learn string handling methods using programming examples.
CLO5	Create Interactive programs.

CONTENTS	**# of Hours / RBT Levels**
MODULE 1 **An Overview of Java:** Object-Oriented Programming, A First Simple Program, Lexical Issues, The Java Class Libraries. **Introducing Classes:** Class Fundamentals, Declaring Objects, Assigning Object, Introducing Methods, Constructors, The this Keyword, Garbage Collection, A Stack Class **Methods and Classes:** Overloading Methods, Using Objects as Parameters, A Closer Look at Argument Passing, Returning Objects **Textbook: 1 Chapters: 2,6,7**	**6** **L3**
MODULE 2 **Inheritance:** Inheritance Basics, using super, creating a Multilevel Hierarchy, When Constructors Are Executed, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance, Local Variable Type Inference and Inheritance, The Object Class **Packages and Interfaces**: Packages, Packages and Member Access, Importing Packages, Interfaces, Default Interface Methods, Use static Methods in an Interface, Private Interface Methods, Final Thoughts on Packages and Interfaces **Textbook: 1 Chapters: 8 and 9**	**6** **L3**
MODULE 3 **String:** The String Constructors, String Length, Special String Operations. String Literals, String Concatenation, String Concatenation with Other Data Types. String Conversion toString(). Character Extraction methods, String Comparison methods, Searching Strings, and Modifying a String. Data Conversion using valueOf(), Changing the Case of Characters Within a String. Jumping Strings.	**6** **L3**

StringBuffer, StringBuffer Constructors, length() and capacity(). ensureCapacity(), setlength(), and setCharAl(), getChars(), append( ), insert(), reverse(), delete() and deleteCharAt(), replace( ). **Textbook: 1 Chapters: 17**	
MODULE 4 **Exception handling-**Benefits of exception handling, the classification of exceptions exception hierarchy, checked exceptions and unchecked exceptions, usage of try, catch, throw, throws and finally, creating own exception subclasses. **Multithreading –** Differences between multiple processes and multiple threads, thread life cycle, creating threads, interrupting threads, thread priorities, synchronizing threads, inter-thread communication, producer consumer problem. **Textbook: 1 Chapters: 10 and 11**	**6** **L3**
MODULE 5 **Using AWT Controls, Layout Managers, and Menus:** AWT Classes, Window Fundamentals, Working with Frame Windows, Introducing Graphics, Working with Color Setting the Paint Mode, Working with Fonts, Managing Text Output Using Font Metrics. **Textbook: 1 Chapters: 25**	**6** **L3**

Lab Programs

Prerequisite :

- Students should be familiarized about java installation and setting the java environment.
- Usage of IDEs like Eclipse should be introduced.

1.	Aim: Introduce the java fundamentals, data types, operators in java a) Write a java program that prompts the user for an integer and then printouts all prime numbers up to that integer b) Write a java program to multiply two given matrices
2.	Aim: Demonstrating creation of java classes, objects, constructors, declaration and initialization of variables. Program: Create a Java class called **Student** with the following details as variables within it. USN Name Branch Phone Write a Java program to create n Student objects and print the USN, Name, Branch, and Phone of these objects with suitable headings.
3.	Aim: Discuss the various Decision-making statements, loop constructs in java Program: a) Write a program to check prime number b) Write a program for Arithmetic calculator using switch case menu
4.	Aim: Demonstrate the core object-oriented concept of Inheritance, polymorphism

	Design a super class called **Staff** with details as StaffId, Name, Phone, Salary. Extend this class by writing three subclasses namely Teaching (domain, publications), Technical (skills), and Contract (period). Write a Java program to read and display at least 3 staff
5.	Aim: Introduction to abstract classes, abstract methods, and Interface in java Program: Write a program to generate the resume. Create 2 Java classes Teacher (data: personal information, qualification, experience, achievements) and Student (data: personal information, result, discipline) which implements the java interface Resume with the method biodata ().
6.	Aim: Introduce concepts of method overloading, constructor overloading, overriding. Program: Write a java program demonstrating Method overloading and Constructor overloading.
7.	Aim: Introduce java Strings with following methods • charAt(): • equals(): • concat(): • length(): • toLowerCase(): • toUpperCase(): • indexOf(): • substring(): Program: Write a program to make use of above listed methods in java
8.	Aim: Exception handling in java, introduction to throwable class, throw, throws, finally Program: Write a program to demonstrate the below listed exceptions. ArithmeticException NullPointerException ArrayIndexOutOfBoundException ArrayStoreException
9.	Aim: Demonstrate creation of threads using Thread class and Runnable interface, multi-threaded programming. Program: Write a Java program that implements a multi-thread application that has three threads. First thread generates a random integer for every 1 second; second thread computes the square of the number and prints; third thread will print the value of cube of the number.
10.	Aim: Introduce java Applet, awt, swings. Programs: a) Develop an applet that displays a simple message in center of the screen. b) Write a Java program for display the exception in a message dialogbox

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

CO407B.1	Illustrate the fundamental concepts of Object-Oriented Programming using Java
CO407B.2	Develop Java applications using Inheritance and Exception handling

CO407B.3	Utilize Arrays and String handling functions to write the Java application
CO407B.4	Apply Interfaces and multi-threading concepts to create parallel programming
CO407B.5	Make use of Event-handling mechanisms to create interactive Java applications

Textbooks:

1. Herbert Schildt, Java The Complete Reference, 11th Edition, Tata McGraw Hill, 2019.

Reference Books:

1. Mahesh Bhave and Sunil Patekar, "Programming with Java", First Edition, Pearson Education,200B, ISBN:9788 I 3 I 720806
2. Rajkumar Buyya,S Thamarasi selvi, xingchen chu, "Object-oriented Programming with java", Tata McGraw Hill education private limited.
3. Cay S Horstmann and Cary Gornell, "CORE JAVA volume I-Fundamentals", Pearson
4. James W. Cooper, "Java TM Design Patterns – A Tutorial", Addison-Wesley Publishers.

E-Books / Web References

1. https://greenteapress.com/thinkjava6/thinkjava.pdf
2. https://books.goalkicker.com/JavaBook/

MOOCs

1. https://nptel.ac.in/courses/106105191
2. https://www.mooc-list.com/tags/java-programming
3. https://java-programming.mooc.fi/

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO407B.1	3	3	3	-	3	-	-	-	1	1	-	2	1	-
CO407B.2	3	3	3	-	3	-	-	-	1	1	-	2	1	-
CO407B.3	3	3	3	-	3	-	-	-	1	1	-	2	1	-
CO407B.4	3	3	3	-	3	-	-	-	1	1	-	2	1	-
CO407B.5	1	3	3	-	3	-	-	-	1	1	-	2	1	-
Average	**3**	**3**	**3**	-	**3**	-	-	-	**1**	**1**	-	**2**	**1**	-

Low-1: Medium-2: High-3

Scheme of Evaluation: (Integrated courses)

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 four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. The average of the three tests are taken for computation of CIE on a scale of 30, the CIE would also include laboratory evaluation for 20 marks. The laboratory marks of 20 would comprise of 10 marks for regular laboratory assessment to include lab record and observation. 10 marks would be exclusive for laboratory internal assessment test to be conducted at the end of the semester.

Table: Distribution of weightage for CIE & SEE of Integrated courses

	Component	Marks	Total Marks
CIE	CIE Test-1	**30**	**50**
	CIE Test-2	**30**	
	CIE Test-3	**30**	
	Lab	**20**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

SEMESTER:IV

SUBJECT: OBJECT ORIENTED PROGRAMMING with C++

Subject Code	**CML23407C**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**1:0:2**	SEE Marks	**50**
Total Hours	**30**	**Examination Hours**	**3**
No. of Credits: 2			

Course Learning Objectives:

The course will enable students to:

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

CONTENTS	**# of Hours / RBT Levels**
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 Ch 11, Ch 12	**6** **L3**
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. Ch 13, Ch 14	**6** **L3**
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 Ch 15, Ch 16	**6** **L3**

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 Ch 17, Ch 18	**6** **L3**
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. Ch 19, Ch 20, Ch21	**6** **L3**

Lab Programs

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 empolyee to print name of the employee, account_no. & balance.Print invalid balance if amount<500, Display the same, also display the balance after withdraw anddeposit.
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 aC++ program to demonstrate usage of try, catch and throw to handle exception.

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

CO407C.1	Illustrate the basic concepts of object-oriented programming.
CO407C.2	Design appropriate classes for the given real world scenario.
CO407C.3	Apply the knowledge of compile-time / run-time polymorphism to solve the given problem
CO407C.4	Use the knowledge of inheritance for developing optimized solutions
CO407C.5	Apply the concepts of templates and exception handling for the given problem

Textbooks:

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. Bhave , " Object Oriented Programming With C++", Pearson Education , 2004.
3. A K Sharma , "Object Oriented Programming with C++", Pearson Education, 2014

MOOCs:

1. **https://www.edx.org/course/introduction-to-c-3**
2. **https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013843642506788864433 75_shared/overview**

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO407C.1	3	2	3		2								1	2
CO407C.2	3	2	1		2								1	2
CO407C.3	3	2	1		2								1	
CO407C.4	3	2	2		2								1	2
CO407C.5	3	2	2		2								1	
Average	**3**	**2**	**2**		**2**								**1**	**2**

Low-1: Medium-2: High-3

Scheme of Evaluation:

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 four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three tests are to be conducted for 40 marks each. Average of all three tests marks is added to the test component. In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the Alternative Assessment Tool (AAT). The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices. Possible AATs are – seminar / assignments / term paper / open ended experiments / mini-projects/group activity or any other.

Table: Distribution of weightage for CIE & SEE

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	AAT	**5**	
	AAT	**5**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

Semester: IV

PHYSICAL EDUCATION (SPORTS & ATHLETICS) – II

Course Code	**:**	PEK23408		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	0:0:2				
Total Hours	**:**	24 P				

Course Outcomes: At the end of the course, the student will be able to

1. Understand the ethics and moral values in sports and athletics
2. Perform in the selected sports or athletics of student's choice.
3. Understand the roles and responsibilities of organisation and administration of sports and games.

Module I : Ethics and Moral Values **4 Hours**

A. Ethics in Sports
B. Moral Values in Sports and Games

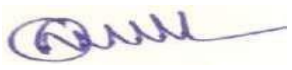
Module II : Specific Games (Any one to be selected by the student) **16 Hours**

A. Volleyball – Attack, Block, Service, Upper Hand Pass and Lower hand Pass.
B. Athletics (Track Events) – Any event as per availability of Ground.

Module III: Role of Organisation and administration **4 Hours**

Scheme and Assessment for auditing the course and Grades:

Sl. No.	Activity	Marks
1.	Participation of student in all the modules	20
2.	Quizzes – 2, each of 15 marks	30
3.	Final presentation / exhibition / Participation in competitions/ practical on specific tasks assigned to the students	50
	Total	**100**



SEMESTER IV

SUBJECT: ALGORITHMS LABORATORY

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

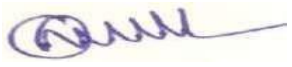
Course Code:	**CSEL23409**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**0:0:2**	**SEE Marks**	**50**
No. of Credits	**1**	**Examination Hours**	**3**

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 Warshall's 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.

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:

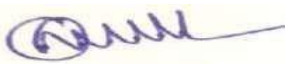
1. Computer Algorithms, Horowitz E., Sahani S., Rajasekharan S., 2nd Edition, 2006, GalgotiaPublications, ISBN:9780716783169.

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

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**



Global Academy of Technology

(An Autonomous Institution, affiliated to VTU, Belagavi, recognized by Karnataka and Approved by AICTE, New Delhi.)

B.E. in Computer Science and Engineering(AI&ML)Engineering Scheme of Teaching and Examinations 2023

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

(Effective from the academic year 2023-24)

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 inhours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	HSMS	CML23501	Management, Economics and Finance for IT Engineers	TD: CI PSB: CI	3	0	0		03	50	50	100	3
2	IPCC	CML23502	Computer Networks	TD: CI PSB: CI	3	0	2		03	50	50	100	4
3	PCC	CML23503	Fundamentals of MachineLearning	TD: CI PSB: CI	4	0	0		03	50	50	100	4
4	PCCL	CMLL23504	Fundamentals of MachineLearning Laboratory	TD: CI PSB: CI	0	0	2		03	50	50	100	1
5	PEC	CML23505X	Professional Elective – I	TD: CI PSB: CI	3	0	0		03	50	50	100	3
6	PROJ	CMLP23506	Mini Project	TD: CI PSB: CI	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/Env/Chem PSB:CV	2	0	0		03	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**
Professional Elective Course – I					
CML23505A	Enterprise Java Programming	CML23505C	Fundamentals of Internet of Things		
CML23505B	Cryptography & Network security	CML23505D	Data mining & Data warehousing		

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 al 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.) 2023-23

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:

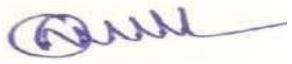
(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of them being the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of the project report, project 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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B.E. in Computer Science and Engineering(AI&ML)Engineering Scheme of Teaching and Examinations 2023

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

(Effective from the academic year 2023-24)

VI SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical / Drawing	Self -Study	Duration inhours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	CML23601	Cloud Computing	TD: CI PSB: CI	3	0	2		03	50	50	100	4
2	PCC	CML23602	Advanced Machine learning	TD: CI PSB: CI	4	0	0		03	50	50	100	4
3	PEC	CML23603X	Professional Elective – II	TD: CI PSB: CI	3	0	0		03	50	50	100	3
4	OEC	CML23604X	Open Elective -I	TD: CI PSB: CI	3	0	0		03	50	50	100	3
5	PROJ	CMLP23605	Major Project Phase – I	TD: CI PSB: CI	0	0	4		03	100	--	100	2
6	PCCL	CMLL23606	Advanced Machine learning LAB	TD: CI PSB: CI	0	0	2		03	50	50	100	1
7	AEC/ SDC	CML23607X	Ability Enhancement Course/ SkillDevelopment Course – IV	TD: CI PSB: CI	0	0	2		01	50	50	100	1
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	PSB:HSS TD:CI	1	0	0		01	50	50	100	0
									Total	**550**	**350**	**900**	**18**

Professional Elective Course

CML23603A	Server side Scripting	CML23603C	Networking And Data Analysis In Iot
CML23603B	Fundamentals of Cyber security	CML23603D	Fundamentals of Data Science
Open Elective Course			
CML23604A	Chat GPT-AI Learning models	CML23604C	Introduction to Machine Learning
CML23604B	Scala Programming	CML23604D	Mobile Application Development
Ability Enhancement Course / Skill Enhancement Course – IV			
CML23607A	MongoDB		
CML23607B	Data Visualization		

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 al 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 regulationgoverning the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2023-23

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.

SEMESTER – V

SUBJECT: MANAGEMENT, ECONOMICS AND FINANCE FOR IT ENGINEERS

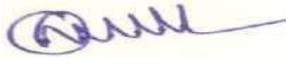
Subject Code	**CML23501**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	SEE Marks	**50**
Total Hours	**40**	**Examination Hours**	**3**
No. of Credits: 3			

Course Learning Objectives:

The course will enable students to:

CLO1	To enable the student to understand and appreciate, with a practical insight, the importance of certain basic issues governing the business operations that are needed for sound economic decision making
CLO2	The main purpose is to provide inputs on an overall analysis of an individual firm namely: demand and supply, production function, cost analysis, markets etc.
CLO3	To understand and analyse the financial formats of the organization for smooth running of the Business
CLO4	To ensure the smooth operation of the business, it is essential to understand and analyze the organization's financial formats

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Nature of management and its process**: – Contribution of Taylor and Fayol to management – Functions and principles of management –Industrial ownership – Types, formation, merits and demerits – Management by objective, Management by exception. **Case Study :** Design and Analyze Market Analysis, Customer Needs. **Text Book:1 Chapter :1.1 to 1.9**	8 L2
MODULE 2 **Production & Cost Analysis:** Production Function- Isocost and Isoquants, MRTS, Least Cost Combination of Inputs, Cobb-Douglas Production Function, Laws of Returns, Internal and External Economies of Scale. **Cost Analysis:** Cost Concepts. Break-Even Analysis (BEA) - Determination of Break-Even Point (Simple Problems) **Case Study :** Design and Analyze Cost Analysis, Customer Break-even-Points. **Text Book:1 Chapter :2.1 to 2.8**	8 L3



MODULE 3 **Markets:** Types of Competition and Markets, Features of Perfect Competition, Monopoly and Monopolistic Competition; **Pricing:** Objectives, Methods of Pricing; **Business**: Features of different forms of Business Organisation (Sole Trader, Partnership, Joint Stock Company, Cooperative Society, and Public Enterprises). **Case Study :** Design and Analyze Profit Cost Analysis Cooperative Society, Stock Company **Text Book:1 Chapter :3.1 to 3.9**		8
MODULE 4 **Basic economic concept: -**Importance of economic in engineering-Economic and technical decisions-Demand and supply-Factors influencing demand-Elasticity of demand- demand forecasting-Competition. **Text Book:1 Chapter :5.1 to 5.9**	L2	8
MODULE 5 **Investment Decision:** Capital Budgeting - Features, Objectives, and Methods (Payback Method, Accounting Rate of Return and Net Present Value) - advantages & disadvantages. (Simple Problems) Financial Analysis: Analysis and Interpretation of Liquidity Ratios, Activity Ratios, Capital Structure Ratios and Profitability Ratios. (Simple Problems) **Text Book:1 Chapter :6.1 to 6.9**	L3	8

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

CO501.1	To understand the basic economic principles, forecast demand and supply
CO501.2	To estimate cost and understand market structure, pricing practices
CO501.3	To interpret the financial results of the Organisation
CO501.4	Understand accounting systems and analyze financial statements using ratio analysis
CO501.5	Evaluate the economic theories, cost concepts and pricing policies

Text books:

1. Managerial Economics & Financial Analysis, Special Edition-MRCET. McGraw Hill Publications, 2017

Reference Books:

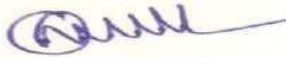
1. D.N. Dwivedi, Managerial Economics, Vikas Publications.
2. Justin Paul, Leena, Sebastian, Managerial Economics, Cengage

MOOCs

1. https://www.coursera.org/learn/financial-engineering-intro
2. https://www.coursera.org/specializations/finance-for-technical-managers

E-Books:

1. https://www.amazon.in/Managerial-Economics-Financial-Analysis-Aryasri/dp/9353160219



Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO501.1	2				3				3	3		3		
CO501.2	2				3				3	3		3	1	3
CO501.3	2			3	3				3	3		3	1	3
CO501.4	2				3				3	3		3	2	3
CO501.5	2			3	3				3	3		3	1	3
Average	**2**			**3**	**3**				**3**	**3**		**3**	**1**	**3**

Low-1: Medium-2: High-3

Scheme of Evaluation:

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 four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three tests are to be conducted for 40 marks each. Average of all three tests marks is added to the test component. In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the Alternative Assessment Tool (AAT). The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices. Possible AATs are – seminar / assignments / term paper / open ended experiments / mini-projects/group activity or any other.

Table: Distribution of weightage for CIE & SEE

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	AAT	**5**	
	AAT	**5**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

SEMESTER – V

SUBJECT: COMPUTER NETWORKS

Subject Code	**CML23502**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:2**	SEE Marks	**50**
Total Hours	**50**	**Examination Hours**	**3**
No. of Credits: 4			

Course Learning Objectives:

The course will enable students to:

CLO1	Fundamentals of data communication networks
CLO2	Software and hardware interfaces
CLO3	Application of various physical components and protocols
CLO4	Communication challenges and remedies in the networks

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Introduction:** Data Communications, Networks, Network Types, Networks Models: Protocol Layering, TCP/IP Protocol suite, The OSI model, Introduction to Physical Layer: Transmission media, Guided Media, Unguided Media: Wireless. Switching: Packet Switching and its types. **Textbook: Ch. 1.1 - 1.3, 2.1 - 2.3, 7.1 – 7.3, 8.3.**	10 L3
MODULE 2 **Data Link Layer:** Error Detection and Correction: Introduction, Block Coding, Cyclic Codes. Data link control: DLC Services: Framing, Flow Control, Error Control, Connectionless and Connection Oriented, Data link layer protocols, High Level Data Link Control. Media Access Control: Random Access, Controlled Access. Check Sum and Point to Point Protocol **Textbook: Ch. 10.1-10.4, 11.1 -11.4, 12.1 - 12.2**	10 L3
MODULE 3 **Network Layer**: Network layer Services, Packet Switching, IPv4 Address, IPv4 Datagram, IPv6 Datagram, Introduction to Routing Algorithms, Unicast Routing Protocols: DVR, LSR, PVR, Unicast Routing protocols: RIP, OSPF, BGP, Multicasting Routing-MOSPF **Textbook: Ch. 18.1, 18.2, 18.4, 22.2,20.1-20.3, 21.3.2**	10 L3
MODULE 4 **Introduction to Transport Layer**: Introduction, Transport-Layer Protocols: Introduction, User Datagram Protocol, Transmission Control Protocol: services, features, segments, TCP connections, flow control, Error control, Congestion control.	10 L3

Textbook: Ch. 23.1- 23.2, 24.1-24.3.4, 24.3.6-24.3.9	
MODULE 5 **Introduction to Application Layer**: Introduction, Client-Server Programming, Standard ClientServer Protocols: World Wide Web and HTTP, FTP, Electronic Mail, Domain Name System (DNS), TELNET, Secure Shell (SSH) **Textbook: Ch. 25.1-25.2, 26.1-26.6**	10 L3

Lab Programs

Implementation using NS2 Simulator:

1. Implement Three nodes point – to – point network with duplex links between them for different topologies. 1Set the queue size, vary the bandwidth, and find the number of packets dropped for various iterations.
2. Implement transmission of ping messages/trace route over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion.
3. Implement an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion window for different source / destination.
4. Develop a program for error detecting code using CRC-CCITT (16- bits).
5. Develop a program to implement a sliding window protocol in the data link layer.
6. Develop a program to find the shortest path between vertices using the Bellman-Ford and path vector routing algorithm
7. Using TCP/IP sockets, write a client – server program to make the client send the file name and to make the server send back the contents of the requested file if present.
8. Develop a program on a datagram socket for client/server to display the messages on client side, typed at the server side
9. Develop a program for a simple RSA algorithm to encrypt and decrypt the data.
10. Develop a program for congestion control using a leaky bucket algorithm.

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

CO502.1	Explain the fundamentals of computer networks.
CO502.2	Apply the concepts of computer networks to demonstrate the working of various layers and protocols in communication network.
CO502.3	Analyze the principles of protocol layering in modern communication systems.
CO502.4	Demonstrate various Routing protocols and their services
CO502.5	Understand principles of application layer protocols

Text books:

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

Reference Books:

1. Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2019.
2. Nader F. Mir: Computer and Communication Networks, 2nd Edition, Pearson Education, 2015.
3. William Stallings, Data and Computer Communication 10th Edition, Pearson Education, Inc., 2014.

MOOCs

1. https://www.digimat.in/nptel/courses/video/106105183/L01.html
2. http://www.digimat.in/nptel/courses/video/106105081/L25.html
3. https://nptel.ac.in/courses/106105081

E-Books/web links:

1. https://www.digimat.in/nptel/courses/video/106105183/L01.html
2. http://www.digimat.in/nptel/courses/video/106105081/L25.html
3. https://nptel.ac.in/courses/10610

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO502.1	2	3	3		3	1			3					
CO502.2	2	3	3		3	1			3					
CO502.3	2	3	3		3	1			3					
CO502.4	2	3	3		3	1			3					3
CO502.5	3	3	3		3	1			3					3
Average	**2**	**3**	**3**		**3**	1			**3**					**3**

Low-1: Medium-2: High-3

Scheme of Evaluation: (Integrated courses)
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 four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. The average of the three tests are taken for computation of CIE on a scale of 30, the CIE would also include laboratory evaluation for 20 marks. The laboratory marks of 20 would comprise of 10 marks for regular laboratory assessment to include lab record and observation. 10 marks would be exclusive for laboratory internal assessment test to be conducted at the endof the semester.

Table: Distribution of weightage for CIE & SEE of Integrated courses

	Component	Marks	Total Marks
CIE	CIE Test-1	**30**	**50**
	CIE Test-2	**30**	
	CIE Test-3	**30**	
	Lab	**20**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

SEMESTER – V

SUBJECT: FUNDAMENTALS OF MACHINE LEARNING

Subject Code	**CML23503**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**4:0:0**	**SEE Marks**	**50**
Total Hours	**50**	**Examination Hours**	**3**
No. of Credits: 4			

Prerequisite: Concepts of Python

Course Learning Objectives:

The course will enable students to:

CLO1	Learn the fundamentals of Machine Learning, its types and designing of a learning system
CLO2	Understand the concept learning and the role of find s and candidate elimination algorithms
CLO3	Analyze the decision tree learning models and fundamentals of rule based learning
CLO4	Applying Bayesian techniques in solving problems
CLO5	Demonstrate the process in hypothesis evaluation and to apply instance based learning methods

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Introduction to Machine Learning:** Need for ML, ML Explained, ML in relation to other fields, Types of Machine Learning, Machine Learning Process,Machine Learning Applications Well posed learning problems, Designing a Learning system, Perspective and Issues in Machine Learning. Ethical Initiatives in the field of Artificial Intelligence, AI Standards and Regulations. **Text book:1** Chapter 1 1.1 – 1.3 **TextBook 2:** Chapter 1 (1.1-1.4,1.6,1.7) **TextBook 3:** Chapter 3 (3.1,3.2), 4	**10** **L3**
MODULE 2 **Concept Learning:** Concept learning task, Concept learning as search, Find-S algorithm, Version space, Candidate Elimination algorithm, Inductive Bias. Modelling in machine learning, Learning Frameworks **Text book:1 Chapter** 2 2.1-2.5, 2.7 **Textbook:2 Chapter 3**(3.6-3.7)	**10** **L3**
MODULE 3 **Decision Tree Learning:** Decision tree representation, Appropriate problems for decision tree learning, Basic decision tree learning algorithm, hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning.	**10** **L3**

Rule Based Learning: Introduction, Sequential Covering Algorithm, First Order Rule Learning, Induction as Inverted deduction, Inverting Resolution **Text book:1 Chapter 3** **Text book :2 Chapter 7 (7.1-7.5)**	
MODULE 4 **Bayesian Learning:** Introduction, Bayes theorem, Bayes theorem and concept learning, ML and LS error hypothesis, ML for predicting probabilities, MDL principle, Naive Bayes classifier, Bayesian belief networks, EM algorithm **Text book:1 Chapter 6**	**10** **L3**
MODULE 5 **Evaluating Hypothesis:** Motivation, Estimating hypothesis accuracy, Basics of sampling theorem, General approach for deriving confidence intervals, Difference in error of two hypothesis, Comparing learning algorithms. **Instance Based Learning:** Introduction, k-nearest neighbor learning, locally weighted regression, radial basis function, cased-based reasoning, **Text book:1 Chapter 5,8**	**10** **L3**

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

CO503.1	Understand the need of Machine learning, its types, AI ethics and design of an expert system
CO503.2	Illustrate the use of find s and candidate elimination algorithm
CO503.3	Demonstrate the role of decision tree algorithm in real data
CO503.4	Apply Bayesian techniques and EM algorithm in classifying real data examples
CO503.5	Demonstrate the evaluation in hypothesis and illustrate the role of KNN

Textbooks:

1. Tom M. Mitchell, Machine Learning, McGraw Hill Education, India Edition 2013.
2. S. Sridhar, M Vijayalakshmi "Machine Learning". Oxford ,2021
3. y. Eleanor Bird, Jasmin Fox-Skelly, Nicola Jenner, Ruth Larbey, Emma Weitkamp and Alan Winfield ,"The ethics of artificial intelligence: Issues and initiatives", EPRS | European Parliamentary Research Service Scientific Foresight Unit (STOA) PE 634.452 – March 2020

Reference Books:

1. Dipanjan Sarkar, Raghav Bali, Tushar Sharma, "Practical Machine Learning with Python-A Problem Solver's Guide to Building Real-World Intelligent Systems", APress, 2018.
2. Kevin P. Murphy , Francis Bach , "Machine Learning: A Probabilistic Perspective (Adaptive Computation and Machine Learning) 1st Edition, Massachusets Institute of Technology, 2012.
3. Introduction to Machine Learning with Python ,by Sarah Guido, Andreas C. Müller, O' Reilly, 2017.

E-Books / Web References

1. https://www.cs.huji.ac.il/~shais/UnderstandingMachineLearning/understanding-machine-learningtheory-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-jpmorganchase/

MOOCs

1. introduction to machine learning https://nptel.ac.in/courses/106106139
2. https://www.simplilearn.com/pgp-ai-machine-learning-certification-training-course
3. https://www.udemy.com/course/machinelearning/
4. https://www.coursera.org/learn/machine-learning

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO503.1	1	1	1					3				2		2
CO503.2	3	3	2		3							2		2
CO503.3	3	3	2		3							2		2
CO503.4	3	3	2		3							2		2
CO503.5	3	3	2		3							2		2
Average	3	3	2		3			3				2		2

Low-1: Medium-2: High-3

Scheme of Evaluation: (Integrated courses)
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 four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. The average of the three tests are taken for computation of CIE on a scale of 30, the CIE would also include laboratory evaluation for 20 marks. The laboratory marks of 20 would comprise of 10 marks for regular laboratory assessment to include lab record and observation. 10 marks would be exclusive for laboratory internal assessment test to be conducted at the endof the semester.

Table: Distribution of weightage for CIE & SEE of Integrated courses

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	Assignment	**10**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

SUBJECT: FUNDAMENTALS OF MACHINE LEARNING LABORATORY

Course Code	CMLL23504	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	Learn the fundamentals of Machine Learning, its types and designing of a learning system
CLO2	Understand the concept learning and the role of find s and candidate elimination algorithms
CLO3	Analyze the decision tree learning models and fundamentals of rule based learning
CLO4	Applying Bayesian techniques in solving problems
CLO5	Demonstrate the process in hypothesis evaluation and to apply instance based learning methods

Sl. No.	EXPERIMENTS
1	Write a python program to i) Import and export data using Anaconda/Jupiter library functions. ii) Demonstrate any 2 data pre-processing techniques for a given dataset
2	Implement and demonstrate the FIND-Salgorithm for finding the most specific hypothesis based on a given set of training data samples
3	For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
4	Demonstrate the working of the decision tree-based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample
5	Implement the random forest classifier for a given training dataset.
6	Implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file
7	Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set.
8	Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points.
9	Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions.
10	Apply EM algorithm to cluster a set of data stored in a .CSV file. Analyze the results

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

CO504.1	Apply techniques for importing, exporting data and data preprocessing

CO504.2	Illustrate the use of find s and candidate elimination algorithm
CO504.3	Demonstrate the role of decision tree and Random forest algorithm in real data
CO504.4	Apply Bayesian techniques in classifying real data examples
CO504.5	Demonstrate the the role of KNN and EM algorithms.

Textbooks:

1. Tom M. Mitchell, Machine Learning, McGraw Hill Education, India Edition 2013.
2. S. Sridhar, M Vijayalakshmi "Machine Learning". Oxford ,2021
3. y. Eleanor Bird, Jasmin Fox-Skelly, Nicola Jenner, Ruth Larbey, Emma Weitkamp and Alan Winfield ,"The ethics of artificial intelligence: Issues and initiatives", EPRS | European Parliamentary Research Service Scientific Foresight Unit (STOA) PE 634.452 – March 2020

Reference Books:

1. Dipanjan Sarkar, Raghav Bali, Tushar Sharma, "Practical Machine Learning with Python-A Problem Solver's Guide to Building Real-World Intelligent Systems", APress, 2018.
2. Kevin P. Murphy , Francis Bach , "Machine Learning: A Probabilistic Perspective (Adaptive Computation and Machine Learning) 1st Edition, Massachusets Institute of Technology, 2012.
3. Introduction to Machine Learning with Python ,by Sarah Guido, Andreas C. Müller, O' Reilly, 2017.

E-Books / Web References

1. https://www.cs.huji.ac.il/~shais/UnderstandingMachineLearning/understanding-machine- learningtheory-algorithms.pdf
2. https://medium.com/@prithvilee22/ai-ml-case-study-55d34e308c92

MOOCs

1. introduction to machine learning https://nptel.ac.in/courses/106106139
2. https://www.simplilearn.com/pgp-ai-machine-learning-certification-training-course
3. https://www.udemy.com/course/machinelearning/
4. https://www.coursera.org/learn/machine-learning

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO504.1	3	2	2		3							2		2
CO504.2	3	3	2		3							2		2
CO504.3	3	3	2		3							2		2
CO504.4	3	3	2		3							2		2
CO504.5	3	3	2		3							2		2
Average	3	3	2		3							2		2

Low-1: Medium-2: High-3

SEMESTER – V

SUBJECT: ENTERPRISE JAVA PROGRAMMING

Subject Code	**CML23505A**	**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	Set out Java Application Development and related terminologies.
CLO2	Understand principles of object-oriented design and development
CLO3	Learn enterprise frameworks and technologies for building scalable applications
CLO4	Develop skills in designing and implementing enterprise-level solutions.
CLO5	Apply best practices for testing, debugging, and maintaining enterprise Java applications

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Understanding Java EE:** What is an Enterprise Application? What is java enterprise edition? Java EE Technologies, Java EE evolution, Glassfish server Java EE Architecture, Server and Containers: Types of System Architecture, Java EE Server, Java EE Containers. **Introduction to Java Servlets:** The Need for Dynamic Content, Java Servlet Technology, Why Servlets? What can Servlets do? **Text book:1 Chapter :1.1 to1.6 and 2.1 to 2.4**	8 L3
MODULE 2 **Servlet API and Lifecycle:** Java Servlet API, The Servlet Skeleton, The Servlet Life Cycle, A Simple Welcome Servlet Working with Servlets: Getting Started, Using Annotations Instead of Deployment Descriptor. Working with Databases: What Is JDBC? JDBC Architecture, Accessing Database, The Servlet GUI and Database Example. **Text book:1 Chapter: 3.1 to3.8 and 4.1 to 4.4**	8 L3
MODULE 3 **Introduction to Java Server Pages:** Why use Java Server Pages? Disadvantages Of JSP, JSP v/s Servlets, Life Cycle of a JSP Page, how does a JSP function? How does JS execute? About Java Server Pages. **Getting Started with Java Server Pages:** Comments, JSP Document, JSP Elements,	8 L3

Text book:1 Chapter: 12.1 to 12.10		
MODULE 4 **Introduction to Enterprise JavaBeans:** Enterprise Bean Architecture, Benefits of Enterprise Bean, Types of Enterprise Bean, Accessing Enterprise Beans, Enterprise Bean Application, Packaging Enterprise Beans Working with Session Beans: When to use Session Beans? Types of Session Beans, Remote and Local Interfaces, Accessing Interfaces, Lifecycle of Enterprise Beans. **Text book:1 Chapter: 16.1 to 16.6 and 17.1 to 17.5**	L3	8
MODULE 5 **Introduction to Hibernate:** What is Hibernate? Why Hibernate? Hibernate, Database and The Application, Components of Hibernate, Architecture of Hibernate, How Hibernate Works? Creating Database and Tables in MySQL, creating a Web Application, Adding the Required Library Files, creating a JavaBean Class, Creating Hibernate Configuration File, adding a Mapping Class, Creating JSPS, Running the Hibernate Application **Text book:1 Chapter: 21.1 to 21.4 and 20.1 to 20.5**	L3	8

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

CO505A.1	Demonstrate the ability to design and develop java programs, analyze, and interpret object-oriented data and document results
CO505A.2	Design a suitable user interface and database for the given real-world application.
CO505A.3	Analyze the necessity for Object Oriented Programming paradigm over structured programming and become familiar with the fundamental concepts in OOP.
CO505A.4	Apply the concepts of multiprogramming, exception/event handling, abstraction to develop robust programs.
CO505A.5	Develop user friendly applications using File I/O and GUI concepts.

Text books:

1. Java EE 7 For Beginners, Sharanam Shah, Vaishali Shah, SPD, First 2017

Reference Books:

1. Java EE 8 Cookbook: Build reliable applications with the most robust and mature technology for enterprise development, Elder Moraes Packt, First 2018

2. Advanced Java Programming, Uttam Kumar Roy, Oxford Press 2015

MOOCs:

3. https://www.udemy.com/course/complete-jdbc-programming-part-1/

4. https://www.coursera.org/learn/java-database-connectivity-introduction

E-Books / Web References:

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

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO505A.1	2	3	3						3					
CO505A.2	2	3	3		2				3		2			
CO505A.3	2	3	3		2								1	
CO505A.4	2	3	3								2		1	3
CO505A.5	2	3	3						3				1	3
Average	**2**	**3**	**3**		**2**				**3**		**2**		**1**	**3**

Low-1: Medium-2: High-3

Scheme of Evaluation:

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 four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three tests are to be conducted for 40 marks each. Average of all three tests marks is added to the test component. In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the Alternative Assessment Tool (AAT). The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices. Possible AATs are – seminar / assignments / term paper / open ended experiments / mini-projects/group activity or any other.

Table: Distribution of weightage for CIE & SEE

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	AAT	**5**	
	AAT	**5**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

SEMESTER – V

SUBJECT: CRYPTOGRAPHY & NETWORK SECURITY

Subject Code	**CML23505B**	**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	Learn the classical encryption techniques and working of DES
CLO2	Explore public key cryptography and cryptosystem
CLO3	Identify key distribution techniques, symmetric keys and public keys
CLO4	Analyze various transport level security considerations
CLO5	Describe electronic mail security and IP security overview

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Classical Encryption Techniques:** Symmetric Cipher Model, Cryptography, Cryptanalysis and Brute-Force Attack, Substitution Techniques, Caesar Cipher, Monoalphabetic Cipher, Playfair Cipher, Hill Cipher **Block Ciphers and the data encryption standard:** Traditional block Cipher structure-stream Ciphers and block Ciphers, The data encryption standard- DES encryption, DES decryption, A DES example- results, the avalanche effect, The strength of DES-the use of 56-Bit Keys, the nature of the DES algorithm, timing attacks, Block cipher design principles-number of rounds, design of function F, key schedule algorithm **Text book:1 Chapter 2 (2.1,2.2), 3**	**8** **L3**
MODULE 2 **Public-Key Cryptography and RSA:** Principles of public-key cryptosystems. Public-key cryptosystems. Applications for public-key cryptosystems, requirements for public-key cryptosystems. public-key cryptanalysis. The RSA algorithm, description of the algorithm, computational aspects, the security of RSA. **Other Public-Key Cryptosystems:** Diffie-Hellman key exchange, The algorithm, key exchange protocols, man in the middle attack **Text book:1 Chapter 9,10.1,10.2**	**8** **L3**

MODULE 3 **Key Management and Distribution :**Symmetric key distribution using Symmetric encryption, A key distribution scenario, Hierarchical key control, session key lifetime, a transparent key control scheme, Decentralized key control, controlling key usage, Symmetric key distribution using asymmetric encryption, simple secret key distribution, secret key distribution with confidentiality and authentication, A hybrid scheme,distribution of public keys, public announcement of public keys, publicly available directory, public key authority, public keys certificates. **Text book:1 Chapter 14**	**8** **L3**
MODULE 4 **Network access control:** Network Access Control, Extensible Authentication Protocol, Cloud Security Risks and Counter measures**,** Data protection in cloud. **Transport Level Security:** web security considerations, secure socket layers, Transport layer security, HTTPS, SSH **Text book:1 Chapter 16(16.1,16.2,16.5,16.6) , 17**	**8** **L3**
MODULE 5 **Electronic Mail Security:** Pretty good privacy, notation, operational; description, S/MIME, RFC5322, Multipurpose internet mail extensions, S/MIME functionality, S/MIME messages, S/MIME certificate processing, **IP Security Overview**: Applications of IPsec Benefits of IPsec Routing Applications IPsec Documents IPsec Services Transport and Tunnel Modes IP Security Policy Security Associations Security Association Database Security Policy Database IP Traffic Processing **Text book:1 Chapter 19,20**	**8** **L2**

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

CO505B.1	Understand the classical encryption techniques and data encryption standards
CO505B.2	Illustrate public key cryptography and cryptosystems
CO505B.3	Summarize various key management and distribution techniques
CO505B.4	Describe the network access control and transport level security considerations
CO505B.5	Apprehend multipurpose internet mail extensions and IP security methods

Textbooks:

1. William Stallings: Cryptography and Network Security, Pearson 6th edition.

Reference Books:

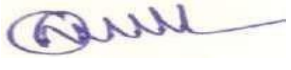
1. V K Pachghare: Cryptography and Information Security, PHI 2nd Edition
2. Cryptography, Network Security and Cyber Laws – Bernard Menezes, Cengage Learning, 2010 edition
3. Cryptography and Network Security- Behrouz A Forouzan, Debdeep Mukhopadhyay, Mc-GrawHill, 3rd Edition, 2015

E-Books / Web References

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

MOOCs

1. https://www.coursera.org/learn/cryptography



2. https://onlinecourses.nptel.ac.in/

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO505B.1	3	3	2			1						2		1
CO505B.2	3	3	2			1						2		1
CO505B.3	3	3	2			1						2		1
CO505B.4	3	3	2			1						2		1
CO505B.5	3	3	2			1						2		1
Average	3	3	2			1						2		1

Low-1: Medium-2: High-3

Scheme of Evaluation:

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 four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three tests are to be conducted for 40 marks each. Average of all three tests marks is added to the test component. In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the Alternative Assessment Tool (AAT). The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices. Possible AATs are – seminar / assignments / term paper / open ended experiments / mini-projects/group activity or any other.

Table: Distribution of weightage for CIE & SEE

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	AAT	**5**	
	AAT	**5**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

SEMESTER – V

SUBJECT: FUNDAMENTALS OF INTERNET OF THINGS

Subject Code	**CML23505C**	**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	Assess the genesis and impact of IoT applications, architectures in real world
CLO2	Illustrate diverse methods of deploying smart objects and connect them to network.
CLO3	Compare different Application protocols for IoT
CLO4	Infer the role of Data Analytics and Security in IoT

CONTENTS	# of Hours / RBT Levels
MODULE 1 What is The Internet of Things? Overview and Motivations, Examples of Applications, IPV6 Role, Areas of Development and Standardization, Scope of the Present Investigation. Internet of Things Definitions and frameworks-IoT Definitions, IoT Frameworks, Basic Nodal Capabilities. **Textbook:1 Chapter:1.1 to 1.8**	**8** **L2**
MODULE 2 **Internet of Things Application Examples-**Overview, Smart Metering/Advanced Metering Infrastructure Health/Body Area Networks, City Automation, Automotive Applications, Home Automation, Smart Cards, Tracking. **IoT for Clouds:** Introduction**,** Sensor-Cloud, Smart Cities and Smart Homes, Connected Vehicles, Smart Grid, Industrial IoT, Case Study: Agriculture, Healthcare, Activity Monitoring. **Text Book:1 Chapter:2.1 to 2.9, 11.1 to 11.8**	**8** **L2**
MODULE 3 What is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack **Textbook 2: Ch.1, 2**	**8** **L3**

MODULE 4 Smart Objects: The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies. **Textbook 2: Ch.3, 4**	**8** **L3**
MODULE 5 IP as the IoT Network Layer, The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances, Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods. **Textbook 2: Ch.5, 6**	**8** **L2**

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

CO505C.1	Create and execute IoT solutions for various real-time scenarios such as smart cities, healthcare, and industrial automation.
CO505C.2	Develop strategies for efficient allocation and management of network resources in IoT settings.
CO505C.3	Create and analyze business use cases that leverage IoT for enhanced efficiency, customer experience, and innovation.
CO505C.4	Apply insights from case studies to address practical IoT challenges.
CO505C.5	Learn techniques for efficient and reliable data collection from IoT devices

Textbooks:

1. Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications Published by: Daniel Minoli Wiley 2013
2. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry,"IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1 stEdition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978-9386873743)

Reference Book:

4. The Internet of Things Michael Miller Pearson 2015 First Edition

MOOCs:

1. https://www.udemy.com/course/internet-of-things-iot-fundamentals/
2. https://www.coursera.org/specializations/iot
3. https://www.coursera.org/courses?query=internet%20of%20things%20(iot)

E-Books:

1. https://download.e-bookshelf.de/download/0000/8067/18/L-G-0000806718-0002366365.pdf

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO505C.1	3	2	3											2

CO505C.2	3	2	1										1	
CO505C.3	3	2	1		2			1					1	
CO505C.4	3	2	2										1	2
CO505C.5														
Average	**3**	**2**	**2**		**2**			**1**			**2**		**1**	**2**

Low-1: Medium-2: High-3

Scheme of Evaluation:

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 four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three tests are to be conducted for 40 marks each. Average of all three tests marks is added to the test component. In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the Alternative Assessment Tool (AAT). The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices. Possible AATs are – seminar / assignments / term paper / open ended experiments / mini-projects/group activity or any other.

Table: Distribution of weightage for CIE & SEE

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	AAT	**5**	
	AAT	**5**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

SEMESTER – V

SUBJECT: DATA MINING & DATA WAREHOUSING

Subject Code	**CML23505D**	**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	Define multi-dimensional data models.
CLO2	Explain rules related to association, classification and clustering analysis
CLO3	Compare and contrast between different classification algorithms
CLO4	Compare and contrast between different clustering algorithms

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Data Warehousing & modeling:** Basic Concepts: Data Warehousing: A multitier Architecture, Data warehouse models: Enterprise warehouse, Data mart and virtual warehouse, Extraction, Transformation and loading. Data Cube: A multidimensional data model, Stars, Snowflakes. **Case Study:** Design and process for ETL operation using Pentaho Data Integration tool **Textbook 2: Ch.4.1,4.2**	**8** **L2**
MODULE 2 **Data warehouse implementation& Data mining:** Efficient Data Cube computation: An overview, Indexing OLAP Data: Bitmap index and join index, Efficient processing of OLAP Queries, OLAP server Architecture ROLAP versus MOLAP Versus HOLAP. : Introduction: What is data mining, Challenges, Data Mining Tasks, Data: Types of Data, Data Quality, Data Preprocessing, Measures of Similarity and Dissimilarity. **Textbook 2: Ch.4.4 ,Textbook 1: Ch.1.1,1.2,1.4, 2.1 to 2.4**	**8** **L2**
MODULE 3 **Association Analysis:** Association Analysis: Problem Definition, Frequent Item set Generation, Rule generation. Alternative Methods for Generating Frequent Item sets, FPGrowth Algorithm, Evaluation of Association Patterns. **Textbook 1: Ch 6.1 to 6.7 (Excluding 6.4)**	**8** **L3**
MODULE 4 Classification: Decision Trees Induction, Method for Comparing Classifiers, Rule Based	**8** **L3**

Classifiers, Nearest Neighbor Classifiers, Bayesian Classifiers. **Textbook 1: Ch 4.3,4.6,5.1,5.2,5.3**	
MODULE 5 **Clustering Analysis:** Overview, K-Means, Agglomerative Hierarchical Clustering, DBSCAN, Cluster Evaluation, Density-Based Clustering, Graph-Based Clustering, Scalable Clustering Algorithms. **Textbook 1: Ch 8.1 to 8.5, 9.3 to 9.5**	**8** **L3**
MODULE 5 **Clustering Analysis:** Overview, K-Means, Agglomerative Hierarchical Clustering, DBSCAN, Cluster Evaluation, Density-Based Clustering, Graph-Based Clustering, Scalable Clustering Algorithms. **Textbook 1: Ch 8.1 to 8.5, 9.3 to 9.5**	**8** **L3**

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

CO505D.1	Explains the basic concept of data warehousing, architecture and data warehousing models
CO505D.2	Understand data mining problems and implement the data warehouse.
CO505D.3	Illustrate the various data preprocessing methods
CO505D.4	Demonstrate the association rules for a given data pattern
CO505D.5	Analyze classification and prediction of data

Textbooks:

1. Pang-Ning Tan, Michael Steinbach, Vipin Kumar: Introduction to Data Mining, Pearson, First impression,2014.
2. Jiawei Han, Micheline Kamber, Jian Pei: Data Mining -Concepts and Techniques, 3rd Edition, Morgan Kaufmann Publisher, 2012

Reference Books:

1. Sam Anahory, Dennis Murray: Data Warehousing in the Real World, Pearson, Tenth Impression,2012.
2. Michael.J. Berry, Gordon.S. Linoff: Mastering Data Mining , Wiley Edition, second edtion,2012

E-Books / Web References

1. https://www.w3schools.com/js/
2. https://dl.ebooksworld.ir/motoman/Cambridge.University.Press.Data.Mining.and.Data.Warehousing.www.EBooksWorld.ir.pdf

MOOCs

1. https://onlinecourses.swayam2.ac.in/cec23_cs01/preview
2. https://www.udemy.com/course/data-warehousing/?couponCode=ST18MT62524

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO505D.1	3	3	3		2								2	1
CO505D.2	3	3	3		2								2	1

CO505D.3	3	3	3										2	1
CO505D.4	3	3	3										2	1
CO505D.5	3	3	3										2	1
Average	**3**	**3**	3		2								**2**	**1**

Low-1: Medium-2: High-3

Scheme of Evaluation:

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 four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three tests are to be conducted for 40 marks each. Average of all three tests marks is added to the test component. In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the Alternative Assessment Tool (AAT). The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices. Possible AATs are – seminar / assignments / term paper / open ended experiments / mini-projects/group activity or any other.

Table: Distribution of weightage for CIE & SEE

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	AAT	**5**	
	AAT	**5**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

SEMESTER – V

MINI PROJECT

Course Code:	**CMLP23506**	**CIE Marks:**	**100**
Hours/Week (L:T:P):	**0:0:4**	**SEE Marks:**	**--**
Credits:	**02**	**Duration of SEE (hours):**	**--**

Mini-project work: 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:

a. 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.

b. 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.

Typical Evaluation pattern for regular courses is shown in Table 1.

Table 1: Distribution of weightage for CIE & SEE

	Component	Marks	Total Marks
CIE	Review-1	**50**	**100**
	Review-2	**50**	
SEE	Semester End Examination	--	--
Grand Total			**100**

SEMESTER – V

Course: Research Methodology and IPR

Course Code	**RMIK23507**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:2:0**	**SEE Marks**	**50**
No. of Credits	**3**	**Examination Hours**	**03**

Course Objectives:

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 static and dynamic aero elastic equations of motion.
CLO4	To understand the different types of IPR

Content
Module 1 (08 hours)
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
Module 2 (08 hours)
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
Module 3 (08 hours)
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.
Module 4 (08 hours)
TESTING OF HYPOTHESES: Hypothesis, Basic Concepts Concerning Testing of Hypotheses, Testing of Hypothesis, Test Statistics and Critical Region, Critical Value and Decision Rule, Procedure for Hypothesis Testing, Hypothesis Testing for Mean, Proportion, Variance, for Difference of Two Mean, for Difference of Two Proportions, for Difference of Two Variances, P-Value approach, Power of Test, Limitations of the Tests of Hypothesis. **INTERPRETATION AND REPORT WRITING:** Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.
Module 5 (08 hours)
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;

Textbook:

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.

COURSE OUTCOMES:

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

CO 1	Understand the research problem by literature review to solve problems
CO 2	Develop skills in qualitative and quantitative data analysis and presentation.
CO 3	Develop advanced critical thinking skills.
CO 4	Understand to write the report writing and awareness about IPR

Semester End Examination (SEE):

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

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. **Some possible AATs:** seminar/assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

Typical Evaluation pattern for regular courses is shown in Table 2.

Table 2: 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**	
	Assignments	**10**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

CO/PO	PO6	PO8	PO12
CO 1	3	3	3
CO 2	3	3	3
CO 3	3	3	3
CO 4	3	3	3
Average	3	3	3

Low-1: Medium-2: High-3

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;	**6 Hours L2**

Industrial and Municipal Sludge Solid Waste Management , types and sources, 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.

Suggested Learning Resources:

Textbooks

1. S M Prakash , "Environmental Studies" 3rd Edition, Elite Publishing House, Mangalore, 2018.
2. Hester R.E., and Harrison R.M, Electronic Waste Management. Science, 2009.

Reference Books:

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

Web Reference:

https://www.hzu.edu.in/bed/E%20V%20S.pdf
https://onlinecourses.nptel.ac.in/noc23_hs155/preview
https://onlinecourses.swayam2.ac.in/cec19_bt03/preview
https://sdgs.un.org/goals 2. https://kspcb.karnataka.gov.in/waste-management/biomedical-waste
E Waste (Management) Rules, 2022:
https://kspcb.karnataka.gov.in/sites/default/files/inlinefiles/E%20Waste%20%28Management%29%20Rules%2C%202022.pdf

Scheme of Examination:

Semester End Examination (SEE):

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

Continuous Internal Evaluation (CIE):

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

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

Typical Evaluation pattern is shown in Table 1.

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

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

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							3
CIVK23508.2	2	2	2			1	3	1							3
CIVK23508.3		2	2	2		1	3	1							2
CIVK23508.4		2	2	2		1	3	1							2
CIVK23508.5	1	2	2	2		1	2	1							2
Average	**1.67**	**2**	**2**	**2**		**1**	**2.4**	**1**							**2.4**

Semester: V						
PHYSICAL EDUCATION (SPORTS & ATHLETICS) – I						
Course Code	**:**	PEK23509		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	0:0:2				
Total Hours	**:**	24 P				

Course Outcomes: At the end of the course, the student will be able to

1. Understand the fundamental concepts and skills of Physical Education, Health,Food, Nutrition and general fitness
2. Familiarization of health-related Exercises, Sports for overall growth anddevelopment
3. Create a foundation for the professionals in Physical Education and Sports
4. Participate in the competition at regional/state / national / international levels.
5. Understand and practice of specific games and athletic throwing events.

Module I : Orientation **4 Hours**

A. Fitness
B. Food & Nutrition

Module II: General Fitness & Components of Fitness **4 Hours**

A. Agility – Shuttle Run
B. Flexibility – Sit and Reach
C. Cardiovascular Endurance – Harvard step Test

Module III : Specific games (Any one to be selected by the student) **16 Hours**

1. Badminton (Fore hand low/high service, back hand service, smash, drop)
2. Basketball (Dribbling, passing, shooting etc.)
3. Athletics (Field events – Throws)

Scheme and Assessment for auditing the course and Grades:

Sl. No.	Activity	Marks
1.	Participation of student in all the modules	20
2.	Quizzes – 2, each of 15 marks	30
3.	Final presentation / exhibition / Participation in competitions/ practical on specific tasks assigned to the students	50
	Total	**100**

SEMESTER – VI

SUBJECT: CLOUD COMPUTING

Subject Code	**CML23601**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:2**	**SEE Marks**	**50**
Total Hours	**50**	**Examination Hours**	**3hrs**
No. of Credits: 4			

Course Learning Objectives:

The course will enable students to:

CLO1	Introduce the rationale behind the cloud computing revolution and the business drivers
CLO2	Introduce various models of cloud computing
CLO3	Introduction on how to design cloud native applications, the necessary tools and the design tradeoffs.
CLO4	Realize the importance of Cloud Virtualization, Abstraction`s and Enabling Technologies and cloud security

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Introduction:** Cloud Computing at a Glance, Historical Developments, Building Cloud Computing Environments, Amazon Web Services (AWS), Google AppEngine, Microsoft Azure, Hadoop, Force.com and Salesforce.com, Manjrasoft Aneka **Textbook 1: Chapter 1: 1.1,1.2 and 1.3**	**10** **L3**
MODULE 2 Virtualization: Introduction, Characteristics of Virtualized, Environments Taxonomy of Virtualization Techniques, Execution Virtualization, Other Types of Virtualizations, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Technology Examples. **Textbook 1: Chapter 3: 3.1 to 3.6**	**10** **L3**
MODULE 3 Cloud Computing Architecture: Introduction, Cloud Reference Model, Types of Clouds, Economics of the Cloud, Open Challenges **Textbook 1: Chapter 4: 4.1 to 4.5**	**10** **L3**
MODULE 4 Cloud Security: Risks, Top concern for cloud users, privacy impact assessment, trust, OS security, VM Security, Security Risks posed by shared images and management OS. **Textbook 2: Chapter 9: 9.1 to 9.6, 9.8, 9.9**	**10** **L3**
MODULE 5	**10**

Cloud Platforms in Industry Amazon web services: - Compute services, Storage services, Communication services, Additional services. Google AppEngine: - Architecture and core concepts, Application life cycle, Cost model, Observations. **Textbook 1: Chapter 9: 9.1 to 9.2** Cloud Applications: Scientific applications: - HealthCare: ECG analysis in the cloud, Biology: gene expression data analysis for cancer diagnosis, Geoscience: satellite image processing. Business and consumer applications: CRM and ERP, Social networking, media applications. **Textbook 1: Chapter 10: 10.1 to 10.2**	**L3**

Lab Programs

List of Experiments/ Mini projects/ case studies

Experiment 01 – Introduction to Microsoft Azure

1. Creating a Microsoft Azure account
2. Configuring Azure PowerShell
3. Configuring Azure CLI

Experiment 02 – Introduction to ARM and Azure Storage

1. Manage Resource Groups in Azure
2. Move Resource From One Resource Group to Another
3. Apply Tags
4. Create a Storage Account
5. Access Storage Account
6. Create Blob Storage
7. Upload in Blob Storage
8. Create a File Share
9. Creating and Using CDN Endpoint

Experiment 03 – Introduction to Azure Storage

1. Attach and Detach an External Storage Account
2. Storage explorer – Blob, file
3. Queues and Table Storage
4. Backup-Archive
5. Backup – Snapshots
6. Backup – AZCopy
7. Azure Shared Access Signature (SAS)
8. Use the Azure Data Factory Copy Data Tool to Transfer Data to Azure

Experiment 04 – Azure Virtual Machines

1. Creating and Configuring an Azure VM
2. Deploying a custom image of Azure VM
3. Virtual Machine Scale Sets.

Experiment 05 – Azure App and Container services

1. Create an App Service Web App for Containers
2. Create a container image
3. configure Azure Kubernetes Service
4. publish and automate image deployment to the Azure Container Registry

Experiment 06 – Azure Networking – I

1. Vnet creation
2. Create and configure VNet-VNet Peering
3. Verify Virtual Network Connectivity
4. Assign Static IP to VM
5. Create Route Tables
6. Add Routes
7. Create NIC

8. Attach NIC to VM
9. Create a DNS
10. Add RecordSet
11. Create NSG
12. Add Security Rule to NSG
13. Attach NSG to a Subnet
14. Verify NSG is Applied

Experiment 07 – Azure Networking – II

1. Create Internal load balancer
2. Create Public load balancer
3. Application Gateway
4. Implement the Azure Front Door Service
5. implement Azure Traffic Manager
6. Deploy and configure Azure Bastion Service

Experiment 08 – Authentication and Authorization in Azure using RBAC

1. Create a Custom Role for Azure Resources
2. Assign a Role to Configure Access to Azure Resources

Experiment 09 – Microsoft Azure Active Directory

1. Add or Delete Users Using Azure Active Directory
2. Add or Delete Tenants Using Azure Active Directory
3. Create a Basic Group and Add Members
4. Applying Resource Locks

Experiment 10 – Azure Monitoring

1. Configure and Interpret Azure Metrics
2. Configure Log Analytics
3. Query and Analyze Logs
4. Set up Alerts and Actions
5. Create a Recovery Services Vault
6. Backing up and Restoring a Virtual Machine

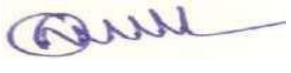
Experiment 11 – Non-Relational Data Stores and Azure Data Lake Storage

1. Document Data Stores
2. Columnar Data Stores
3. Key/value Data Stores
4. Graph Data Stores
5. Time Series Data Stores
6. Object Data Stores
7. External Index
8. Why NoSQL or Non-Relational DB?
9. When to Choose NoSQL or Non-Relational DB?
10. Best Uses, Scenarios
11. Azure Data Lake Storage
12. Definition
13. Azure Data Lake-Key Components
14. How Does It Store Data?
15. Azure Data Lake Storage Gen2
16. Why Data Lake?
17. Data Lake Architecture

Experiment 12 – Data Lake and Azure Cosmos DB

1. Load Data from AmazonS3 to ADLS Gen2 with Data Factory/ browse from computer.
2. Working with Azure Cosmos DB

Experiment 13 – Relational Data Stores



1. Create a Single Database Using Azure Portal
2. Create a Managed Instance
3. Create an Elastic Pool

1. Create a SQL Virtual Machine
2. Configure Active Geo-Replication for Azure SQL Database in the Azure Portal and Initiate Failover

Experiment 14 – Why Azure SQL?

1. Design an Azure Database for MySQL Database Using the Azure Portal
2. Connect Using MySQL Workbench
3. Import Data from Blob Storage to Azure Synapse Analytics by Using PolyBase.

Azure Lab

1. Deploy workloads on Azure Resource Manager (ARM) virtual machines (VMs)

2. Identify workloads that can and cannot be deployed; run workloads, including Microsoft and Linux; create VMs; connect to a Windows/Linux VM

3. Implement Azure storage blobs and Azure files

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

CO601.1	Understand and analyze various cloud computing platforms and service provider.
CO601.2	Illustrate various virtualization concepts.
CO601.3	Identify the architecture, infrastructure and delivery models of cloud computing.
CO601.4	Understand the Security aspects of CLOUD.
CO601.5	Define platforms for development of cloud applications

Textbooks:

1. Rajkumar Buyya, Christian Vecchiola, and Thamrai Selvi Mastering Cloud Computing McGraw Hill Education.
2. Dan C. Marinescu, Cloud Compting Theory and Practice, Morgan Kaufmann, Elsevier 2013

Reference Books:

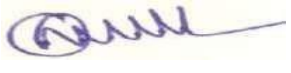
1. Toby Velte, Anthony Velte, Cloud Computing: A Practical Approach, McGraw-Hill Osborne Media.
2. George Reese, Cloud Application Architectures: Building Applications and Infrastructure in the Cloud, O'Reilly Publication.
3. John Rhoton, Cloud Computing Explained: Implementation Handbook for Enterprises, Recursive Press.

E-Books / Web References

1. https://www.youtube.com/watch?v=1N3oqYhzHv4
2. https://www.youtube.com/watch?v=RWgW-CgdIk0

MOOCs

1. **https://www.udemy.com/course/introduction-to-cloud-computing-on-amazon-aws-for-beginners/?couponCode=ST18MT62524**
2. **https://onlinecourses.nptel.ac.in/noc21_cs14/preview**



Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO601.1	3	3	3		2				1				2	
CO601.2	3	3	3		2				1				2	
CO601.3	3	3	3		2				1				2	
CO601.4	3	3	3		2	2			1				2	
CO601.5	3	3	3		2	2			1				2	
Average	**3**	**3**	**3**		**2**	2			**1**				**2**	

Low-1: Medium-2: High-3

Scheme of Evaluation: (Integrated courses)

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 four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. The average of the three tests are taken for computation of CIE on a scale of 30, the CIE would also include laboratory evaluation for 20 marks. The laboratory marks of 20 would comprise of 10 marks for regular laboratory assessment to include lab record and observation. 10 marks would be exclusive for laboratory internal assessment test to be conducted at the end of the semester.

Table: Distribution of weightage for CIE & SEE of Integrated courses

	Component	Marks	Total Marks
CIE	CIE Test-1	**30**	**50**
	CIE Test-2	**30**	
	CIE Test-3	**30**	
	Lab	**20**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

SEMESTER - VI

SUBJECT: ADVANCED MACHINE LEARNING

Subject Code	**CML23602**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**4:0:0**	**SEE Marks**	**50**
Total Hours	**50**	**Examination Hours**	**3**
No. of Credits: 4			

Prerequisite : Fundamentals of Machine Learning

Course Learning Objectives:

The course will enable students to:

CLO1	Build an ANN using perceptron rule and Back Propagation algorithm
CLO2	Understand Support Vector Machine , kernels and to apply SVR
CLO3	Familiarize with various clustering algorithms and its roles
CLO4	Illustrate the role of reinforcement learning and computational learning theory
CLO5	Interpret the fundamentals of genetic algorithm and how the genetic operators are used

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Artificial Neural Networks:** Introduction, Neural Network representation, Appropriate problems for neural network learning, Perceptrons, Multilayer networks, Back propogation algorithm, Convergence and local Minima, Represenational power of feed forward networks. Applications of Artificial Neural Networks, Advantages and Disadvantages of ANN, Challenges of Artificial Neural Networks **TextBook 2: Chapter 4(4.1-4.5),(4.6.1,4.6.2)** **TextBook 1: Chapter10(10.9-10.11)**	**10** **L3**
MODULE 2 **Support Vector Machines :** Introduction, Optimal Hyperplane, Functional and Geometric Margin, Hard Margin SVM, Soft Margin SVMM, Introduction to kernels and Non Linear SVM, Kernel based non linear classifier, Support Vector Regression **Ensemble Learning:** Introduction, Parallel ensemble models, Incremental ensemble models **Textbook 1: Chapter 11, Chapter 12(12.1,12.3)**	**10** **L3**
MODULE 3 **Clustering Algorithms : I**ntroduction, Proximity measures, Hierarchical Clustering, Partitional clustering Algorithm, Density based methods, Grid based approach, Probability Model based methods, Cluster evaluation methods **Textbook-1 : Chapter 13**	**10** **L3**
MODULE 4 **Reinforcement Learning :** Overview, scope, Reinforcement learning as ML, Components of reinforcement learning, Markov Decision Process, Reinforcement problem types, Model	**10** **L3**

Base Learning, Model Free methods, Q Learning **Computational Learning Theory** : Introduction, Probably learning an approximate hypothesis, Sample complexity for finite hypothesis space, The mistake bound model of learning. **Textbook1: Chapter 14** **Textbook 2 : Chapter 7(7.1-7.3,7.5)**	
MODULE 5 **Genetic Algorithms :** Overview, optimization problems and search spaces, General structure of a genetic algorithm, Genetic Algorithm Components, Case studies **Analytical Learning :** Introduction, Learning with perfect domain theories : PROLOG-EBG, Remarks on explanation based learning **Textbook1: Chapter 15** **Textbook 2: Chapter 11(11.1-11.3)**	**10** **L3**

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

CO602.1	Apply perceptron training rule and Back propogation algorithm to build an ANN
CO602.2	Illustarate the role of SVM and support vector regression in classification
CO602.3	Implement various clustering techniques and cluster evaluation methods
CO602.4	Interpret the computational learning theory and to apply reinforcement learning techniques
CO602.5	Demonstrate the role of genetic algorithm in various search spaces

Textbooks:

1. S. Sridhar, M Vijayalakshmi "Machine Learning". Oxford ,2021
2. Tom M. Mitchell, Machine Learning, McGraw Hill Education, India Edition 2013.

Reference Books:

1. Fundamentals of Machine Learning for Predictive Data Analytics: Algorithms‖, by John D. Kelleher, Brian Mac Namee, and Aoife D'Arcy, Worked Examples, and Case Studies, The MIT Press, 2015.]
2. Introduction to Machine Learning‖, by Ethem Alpaydin, PHI Learning, 2nd Edition, 2019.

E-Books / Web References

1. https://www.cs.huji.ac.il/~shais/UnderstandingMachineLearning/understanding-machine-learningtheory-algorithms.pdf
2. https://medium.com/@prithvilee22/ai-ml-case-study-55d34e308c92__3
3. https://d3.harvard.edu/platform-digit/submission/robo-banking-artificial-intelligence-at-jpmorganchase/

MOOCs

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

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO602.1	2	3	3		2							2		2
CO602.2	2	3	3		2							2		2
CO602.3	2	3	3		2							2		2
CO602.4	2	3	3		2							2		2
CO602.5	2	3	3		2							2		2
Average	**2**	**3**	**3**		2							2		2

Low-1: Medium-2: High-3

Scheme of Evaluation: (Integrated courses)

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 four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. The average of the three tests are taken for computation of CIE on a scale of 30, the CIE would also include laboratory evaluation for 20 marks. The laboratory marks of 20 would comprise of 10 marks for regular laboratory assessment to include lab record and observation. 10 marks would be exclusive for laboratory internal assessment test to be conducted at the end of the semester.

Table: Distribution of weightage for CIE & SEE of Integrated courses

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	Assignment	**10**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

SEMESTER – VI

SUBJECT: SERVER-SIDE SCRIPTING

Subject Code	**CML23603A**	**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 learn web page designing using HTML, CSS for the WWW along with the need for assistive technology and mechanisms to implement the same
CLO2	To learn web page designing using JavaScript, jQuery, XML, PHP, MySQL technologies
CLO3	To get familiarity with the JavaScript language and understand Document Object Model handling of Java Script
CLO4	Design dynamic web pages using client-side scripting.

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Internet:** Introduction to internet and its application, E-mail, telnet, FTP, ecommerce, e-business, internet service providers, Domain name Server, Internet address, World Wide Web (WWW) World Wide Web and its evolution, Exploring the Uniform resource locator (URL) and its components, **Browsers:** Google Chrome, Mozilla Firefox, Opera, Apple Safari, Internet Explorer, Search engine, Web server: Apache, IIS, proxy server, xampp, HTTP protocol method **Text book:1 Chapter: 1.1 to 1.10**	8 L2
MODULE 2 **Introduction to Node JS:** Introduction, What is Node JS? Advantages of Node JS, Traditional Web Server Model, Node.js Process Model. Functions, Module Types, Core Node JS debugger **Text book:1 Chapter: 6.1 to 6.8**	8 L2
MODULE 3 **Document Object Model (DOM):** Objects and Collections, JavaScript Event Handling: A Deeper Look HTML5: Introduction to canvas – Introduction, canvas coordinate System,	8 L3

Rectangles, using paths to draw Lines, Drawing Arcs and Circles, Shadows, Quadratic Curves, Bezier Curves, Linear Gradients, Radial Gradients, Images, Image Manipulation, Patterns, Transformations, Text. **Text book:1 Chapter : 9.1 to 9.8**	
MODULE 4 **jQuery:** Introduction to jQuery, Selecting and filtering, Events, manipulating content and attributes, Iteration of arrays and objects, CSS and AJAX, Methods for Traversing, jQuery Events, CSS using jQuery, jQuery Fundamentals of jQuery, Loading and using jQuery, jQuery Syntax, jQuery Selectors, Element Properties and attributes. **Text book:1 Chapter: 15.1 to 15.7**	8 L3
MODULE 5 **PHP and MYSQL:** Why PHP and MySQL? Server-side web scripting, installing PHP, Adding PHP to HTML, Syntax and Variables, passing information between pages, Strings, Arrays and Array Functions, Numbers, Basic PHP errors/problems Advanced PHP and MySQL PHP/MySQL Functions, displaying Queries in tables, building forms from queries. **Text book:1 Chapter: 16.1 to 16.6**	8 L3

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

CO603A.1	Understand various application of browsers and about internet
CO603A.2	Implement core constructs and event handling mechanisms of JavaScript
CO603A.3	Create XML documents and work with web servers
CO603A.4	Implementation of java script libraries like jQuery
CO603A.5	Design dynamic web pages using server-side scripting

Text books:

1. John Pullock, Tata McGraw Hill – JavaScript: A beginner's guide

Reference Books:

1. Jason Cranford Teague "Visual Quick Start Guide CSS, DHTML & AJAX", 4/ e, "Pearson Education".

2. Tom Nerino Doli Smith "JavaScript & AJAX for the Web" Pearson Education, 2007

3. "jQuery Cookbook", jQuery Community Experts, O'REILLY.

MOOCs

1. https://www.coursera.org/courses?query=server-side

2. https://www.udemy.com/course/the-complete-javascript-course/?couponCode=IND21PM

E-Books:

1. https://onlinecourses.swayam2.ac.in/aic20_sp11/preview

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO603A.1	2	3	3						3					
CO603A.2	2	3	3		2				3		2			
CO603A.3	2	3			2								1	
CO603A.4	2	3	3					1			2		1	2
CO603A.5	2	3							3				1	2
Average	**2**	**3**	**3**		**2**			**1**	**3**		**2**		**1**	**2**

Low-1: Medium-2: High-3

Scheme of Evaluation:

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 four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three tests are to be conducted for 40 marks each. Average of all three tests marks is added to the test component. In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the Alternative Assessment Tool (AAT). The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices. Possible AATs are – seminar / assignments / term paper / open ended experiments / mini-projects/group activity or any other.

Table: Distribution of weightage for CIE & SEE

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	AAT	**5**	
	AAT	**5**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

SEMESTER – VI

SUBJECT: FUNDAMENTALS OF CYBERSECURITY

Subject Code	**CML23603B**	**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	Learn about cybercrime, cybersecurity and different types of cyber attacks
CLO2	Understand security challenges presented by mobile devices and Organizational measures for handling security issues
CLO3	Summarize various cybersecurity components
CLO4	get an overview of tools and methods used in cybercrime
CLO5	Analyze legal perspective, Amendments in Indian IT Act and cyber law

CONTENTS	# of Hours / RBT Levels
MODULE 1 Introduction to Cybercrime: Cyber Crime: Definitions and origin , cybercrime and information security, who are cybercriminals? Classification of cyber crimes, Cyber crimes – Legal Perspective Introduction to cybersecurity: What is cyber security?, CIA triad, Reasons for cyber crimes, why we need cybersecurity? Cyber Offenses: Attacks Plan, Social Engineering, Cyber Stalking, Cybercafé and Cybercrimes ,Botnets **Text Book 1: Chapter: 1,2 Text Book 2: Chapter 2 (2.1-2.4)**	**8** **L2**
MODULE 2 **Cyber Crime in Devices**: Introduction, Proliferation of mobile and wireless devices,Credit card fraud in the mobile era, Challenges posed by mobile devices, Registry settings, Attacks on mobile/cell phones, Security implications for organizations in handling mobile devices, Organizational measures for handling mobile devices-related security issues **Text Book1 : Chapter 3**	**8** **L2**

MODULE 3 **CyberSecurity components**: OSI layer, Zero Day attacks, types of network attacks,application security, endpoint security, Identity and access Management, Mobile security **TextBook 2: chapter 3(3.1-3.7)**	**8** **L3**
MODULE 4 **Tools and Methods**: Introduction, proxy servers and Anonymizers, Phishing, Password cracking, Keyloggers and spywares, virus and worms, Trojan Horses and back doors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer overflow, Identity Theft **Text Book: 1 Chapter: 4, chapter 5(5.3)**	**8** **L3**
MODULE 5 **Cyber Crimes and Cyber Security, The Legal Perspective:** The Indian IT Act 2000, challenges, Digital Signatures and the Indian IT act, Amendments in the Indian IT Act, Cybercrime and Punishments, Cyber law Text Book:1 Chapter: 6(6.4,6.5,6.7-6.10)	**8** **L2**

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

CO603B.1	Learn the fundamentals of Cyber security, cybercrimes, its classification and various cyber offenses
CO603B.2	Illustrate different attacks on mobile phones, credit card frauds and various security implications
CO603B.3	Interpret cyber security components and its roles
CO603B.4	Get an overview of tools and methods used in cybercrime
CO603B.5	Summarize Indian IT act, its challenges and cyber law

Textbooks:

1. SunithBelapure and Nina Godbole, "Cyber Security: Understanding Cyber crime, computer forensics and legal perspectives", Wiley India, 2013
2. Anand Shinde, "Introduction to Cyber Security: Guide to the world of cyber security", Notion Press, 2021.

Reference Books:

1. Marjie T Britz, "Computer Forensics and Cyber Crime - An Introduction", Pearson Education, 2nd Edition, 2012.
2. Harish Cahnder, "Cyber Laws and IT Protection", PHI, 2012.
3. Thomas JMoubray, "Cyber Security: Managing Systems, Conducting Testing and Investigating Inrusions", John Wiley, 2014.

MOOCs

1. NPTEL Cyber Security and Privacy https://onlinecourses.nptel.ac.in/noc23_cs127/preview
2. Beginners Guide To Cyber-Security - https://www.udemy.com/course/2021-beginners-guide-to-cyber-security/

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO603B.1	2	2	1		2							2	1	2
CO603B.2	2	2	1		2							2	1	2
CO603B.3	2	2	1		2							2	1	2
CO603B.4	2	2	1		2							2	1	2
CO603B.5	2	2	1		2							2	1	2
Average	2	2	1		2							2	1	2

Low-1: Medium-2: High-3

Scheme of Evaluation:

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 four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three tests are to be conducted for 40 marks each. Average of all three tests marks is added to the test component. In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the Alternative Assessment Tool (AAT). The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices. Possible AATs are – seminar / assignments / term paper / open ended experiments / mini-projects/group activity or any other.

Table: Distribution of weightage for CIE & SEE

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	AAT	**5**	
	AAT	**5**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

SEMESTER – VI

SUBJECT: NETWORKING AND DATA ANALYSIS IN IOT

Subject Code	**CML23603C**	**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 basics of artificial intelligence and its subfields
CLO2	Explore real-world applications of AI across different industries.
CLO3	Gain insights into the ethical, social, and economic implications of AI.
CLO4	Develop an appreciation for the potential of AI to drive innovation and transformation.

CONTENTS	# of Hours / RBT Levels
Networking in IoT: networking and protocols, IP addressing and routing, IoT Networking Protocols, MQTT (Message Queuing Telemetry Transport), CoAP (Constrained Application Protocol),HTTP/HTTPS for IoT.	8 L2
MODULE 2 **Low Power Wide Area Networks (LPWAN):** LoRaWAN (Long Range Wide Area Network), Sigfox, NB-IoT (Narrowband IoT), Network security and encryption techniques **Case Study:** Design and Create Security for Networks using LoRaWAN Tool	8 L3
MODULE 3 **Data Analysis in IoT:** Data Collection and Storage,Data types and formats, Cloud storage solutions for IoT data, Time-series data management. **Data Analysis Techniques:** Statistical analysis and machine learning basics, Data cleaning and preprocessing, Visualization tools and techniques **Case Study:** Design and Analyse data storage for Clouds using IoT analytics platforms (e.g., AWS IoT Analytics, Google Cloud IoT)	8 L3

MODULE 4 **IoT System Design and Implementation:** Designing IoT Systems, Requirements gathering and system design, Integration of IoT devices and networks, Case studies of IoT applications, Prototyping and deployment, Troubleshooting and optimization.	8 L3
MODULE 5 **Emerging Trends and Future:** Edge computing and fog computing, AI and IoT integration, Privacy and ethical considerations, Data Privacy and Security, Interoperability, Scalability, Edge Computing Frameworks. **Case Study:** Design and create for Edge Computing Frameworks using Microsoft Azure IoT Edge, AWS IoT Greengrass, and Google Edge TPU	8 L3

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

CO603C.1	Interpret the impact and challenges posed by IoT networks leading to new architectural models.
CO603C.2	Compare and contrast the deployment of smart objects and the technologies to connect them to network
CO603C.3	Appraise the role of IoT protocols for efficient network communication.
CO603C.4	Elaborate the need for Data Analytics and Security in IoT
CO603C.5	Illustrate different sensor technologies for sensing real world entities and identify the applications of IoT in Industry

Text books:

1. **"Networking for IoT: Design and Analysis"** by Rajkumar Buyya and S. K. Sood

MOOCs

1. https://www.coursera.org/specializations/internet-of-things

2. https://onlinecourses.nptel.ac.in/noc22_cs53/preview

3. https://www.isaca.org/credentialing/iot-fundamentals-certificate

E-Books:

1. https://powerunit-ju.com/wp-content/uploads/2021/04/Aurelien-Geron-Hands-On-Machine-Learning-with-Scikit-Learn-Keras-and-Tensorflow_-Concepts-Tools-and-Techniques-to-Build-Intelligent-Systems-OReilly-Media-2019.pdf

2. https://files.stample.co/stample-1430144818200-designingfortheinternetofthings.pdf

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO603C.1	3	2	3											2
CO603C.2	3	2	1										1	
CO603C.3	3	2	1		2			1					1	
CO603C.4	3	2	2										1	2
CO603C.5	3	2	2		2			1					1	2
Average	**3**	**2**	**2**		**2**			**1**			**2**		**1**	**2**

Low-1: Medium-2: High-3

Scheme of Evaluation:

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 four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three tests are to be conducted for 40 marks each. Average of all three tests marks is added to the test component. In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the Alternative Assessment Tool (AAT). The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices. Possible AATs are – seminar / assignments / term paper / open ended experiments / mini-projects/group activity or any other.

Table: Distribution of weightage for CIE & SEE

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	AAT	**5**	
	AAT	**5**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

SEMESTER – VI

SUBJECT: FUNDAMENTALS OF DATA SCIENCE

Subject Code	**CML23603D**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**3HRS**
No. of Credits: 3			

Course Learning Objectives:

The course will enable students to:

CLO1	To provide a foundation in data Science terminologies
CLO2	To familiarize data science process and steps
CLO3	To Demonstrate the data visualization tools
CLO4	To analyze the data science applicability in real time applications.

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Introduction To Data Science:** Definition, Big Data and Data Science Hype, Datafication, Data Science Profile, Meta-Definition, Data Scientist, Statistical Inference, Populations and Samples, Populations and Samples of Big Data, Big Data Can Mean Big Assumptions, Modeling, Philosophy of Exploratory Data Analysis, The Data Science Process, A Data Scientist's Role in this Process **Textbook 2** **Chapter 1,2**	**8** **L3**
MODULE 2 **Mathematical Preliminaries:** Probability, Descriptive Statistics, Correlation Analysis. **Data Munging:** Properties of Data, Languages for Data Science, Collecting Data, Cleaning Data, Crowdsourcing. **Textbook 1: Ch 2.1 to 2.3 and 3.1 to 3.5**	**8** **L3**
MODULE 3 **Scores and Rankings:** Developing Scoring Systems, Z-scores and Normalization, Advanced Ranking Techniques Statistical Analysis: Sampling from Distributions, Statistical Distributions, Statistical Significance, Permutation Tests and P-values **Textbook 1: Chapter :4.1 to 4.4 and 5.1 to 5.5**	**8** **L3**

MODULE 4 **Visualizing Data:** Exploratory Data Analysis, developing a Visualization Aesthetic, Chart Types, Great Visualizations Mathematical Models: Philosophies of Modeling, A Taxonomy of Models, Baseline Models, Evaluating Models, Evaluation Environment. **Textbook 1: Chapter :6.1 to 6.4 and 7.1 to 7.5**	**8** **L3**
MODULE 5 **Supervised Learning:** Linear Regression, Better Regression Models, Regression as Parameter Fitting, Simplifying Models through Regularization Classification and Logistic Regression, Issues in Logistic Classification, Decision Trees Classifiers. **Textbook 1: Chapter: 9.1 to 9.7**	**8** **L3**

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

CO603D.1	Describe the significance of data science and understand the Data Science process
CO603D.2	Explain how data is collected, managed and stored for data science
CO603D.3	Build, and prepare data for use with a variety of statistical methods and models
CO603D.4	Analyze Data using various Visualization techniques.
CO603D.5	Choose contemporary models, such as machine learning, AI, techniques to solve practical problems

Textbooks:

1. Steven S. Skiena, "The Data Science Design Manual", Springer 2017.
2. Rachel Schutt & O'neil, "Doing Data Science", Straight Talk from The Frontline O'REILLY, ISBN:978-1-449-35865-5, 1st edition, October 2013.

Reference Books:

1. Doing Data Science, Straight Talk from the Frontline, Cathy O'Neil, Rachel Schutt, O' Reilly, 1st edition, 2013.
2. Mining of Massive Datasets, Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, Cambridge University Press, 2nd edition, 2014
3. An Introduction to Statistical Learning: with Applications in R, Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, Springer, 1st edition, 2013
4. Think Like a Data Scientist, Brian Godsey, Manning Publications, 2017.

E-Books / Web References

1. https://www.youtube.com/watch?v=N6BghzuFLIg
2. https://www.youtube.com/watch?v=ua-CiDNNj30

MOOCs

1. https://www.simplilearn.com/tutorials/data-science-tutorial/what-is-data-science
2. https://www.coursera.org/lecture/what-is-datascience/fundamentals-of-data-science-tPgFU

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO603D.1	3	3											2	
CO603D.2	3	3											2	
CO603D.3	3	3											2	
CO603D.4	3	3											2	
CO603D.5	3	3											2	
Average	**3**	**3**											**2**	

Low-1: Medium-2: High-3

Scheme of Evaluation:

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 four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three tests are to be conducted for 40 marks each. Average of all three tests marks is added to the test component. In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the Alternative Assessment Tool (AAT). The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices. Possible AATs are – seminar / assignments / term paper / open ended experiments / mini-projects/group activity or any other.

Table: Distribution of weightage for CIE & SEE

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	AAT	**5**	
	AAT	**5**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

SEMESTER – VI

SUBJECT: ChatGPT-AI Learning Models

Subject Code	**CML23604A**	**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 the AI knowledge to solve problem on ChatGPT Models.
CLO2	Develop knowledge base sentences using propositional logic and first order logic
CLO3	Apply first order logic to solve knowledge engineering process
CLO4	Understanding the Training Process for ChatGPT Models
CLO5	Understanding the architecture of transformer-based models

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Introduction to ChatGPT:** Basics of ChatGPT, Capabilities and Applications of ChatGPT, Benefits of ChatGPT, How ChatGPT Works? Underlying Architecture and Technology, Analyze the Training Process and Data Used to Train ChatGPT, Concept of Language Modelling and its Relevance to Chat GPT. **Text book:2 Chapter :1.1 to 1.7**	8 L2
MODULE 2 **Natural Language Processing (NLP) Fundamentals For Chat GPT:** Fundamentals of Natural Language Processing Techniques, processing and Data Preparation for ChatGPT, Importance of Pre-processing, Data Cleaning, Techniques for Data Cleaning and Pre-processing, Preparing Data for Training and Fine-Tuning Chat GPT models **Text book:1 Chapter:1.1 to 1.9**	8 L2
MODULE 3 **Training and Fine-Tuning Chat GPT Models:** Training Process for ChatGPT Models, Approaches for Training and Fine-Tuning Chat GPT Models, Strategies for Optimizing Chat GPT Models Based on Specific Use Cases, Ethical Considerations in ChatGPT, Ethical Concerns and Challenges Associated with ChatGPT, Biases and Fairness Issues in Chat GPT Responses, Strategies for Mitigating Ethical Concerns in Chat GPT Applications **Text book:2 Chapter :5.1 to 5.9**	8 L3
MODULE 4	

Evaluating and Improving ChatGPT Performance: Metrics and Techniques for Evaluating Chat GPT Performance, Strategies for Improving Chat GPT Responses and Reducing Errors, Challenges and Troubleshooting Techniques in ChatGPT, Applications and Future Developments of ChatGPT, Real-World Applications of ChatGPT Across Various Industries, Current Trends and Advancements in ChatGPT Technology, Future Developments and Potential of ChatGPT **Text book:1 Chapter: 3.1 to 3.8**	8 L3
MODULE 5 **Introduction to Prompt Engineering:** Definition and importance of prompt engineering, History and evolution of language models, Applications and use cases of prompt engineering, **Principles of Prompt Design:** Types of prompts: open-ended, closed-ended, context-based, Techniques for formulating clear and precise prompts, Examples of effective vs. ineffective prompts. Use cases of prompt engineering.	8 L2

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

CO604A.1	Explore the architecture and workings of ChatGPT models.
CO604A.2	Explore the underlying technology, including deep learning and NLP techniques
CO604A.3	Gain practical experience in developing and fine-tuning conversational AI systems
CO604A.4	Discuss ethical considerations and societal impacts of conversational AI
CO604A.5	Understand the principles and techniques behind conversational AI

Text books:

1. " The_Ultimate_ChatGPT_Guide_for_Beginners ", by Max Rascher.
2. ChatGPT by Pam Baker Published by: John Wiley & Sons, Inc

Reference Books:

1. "Natural Language Processing with Python" by Steven Bird, Ewan Klein, and Edward Lopper

MOOCs:

1. https://www.udemy.com/course/chatgpt-crash-course-automate-tasks-with-ai/

2. https://www.mygreatlearning.com/academy/learn-for-free/courses/chatgpt-for-beginners

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO604A.1	3	2												2
CO604A.2	3	2												

CO604A.3	3	2			2			1						
CO604A.4	3	2												2
CO604A.5	3	2			2									2
Average	**3**	**2**			**2**			**1**			**2**			**2**

Low-1: Medium-2: High-3

Scheme of Evaluation:

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 four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three tests are to be conducted for 40 marks each. Average of all three tests marks is added to the test component. In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the Alternative Assessment Tool (AAT). The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices. Possible AATs are – seminar / assignments / term paper / open ended experiments / mini-projects/group activity or any other.

Table: Distribution of weightage for CIE & SEE

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	AAT	**5**	
	AAT	**5**	
SEE	Semester End Examination	**50**	**50**

SEMESTER – VI

SUBJECT: SCALA PROGRAMMING

Subject Code	**CML23604B**	**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 fundamental concepts of basic object-oriented programming in scala.
CLO2	Apply the knowledge of functional programming concepts to develop applications.
CLO3	Analyze and the behavior of programs involving fundamental programming concepts in Scala.
CLO4	Apply object-oriented concepts to design and use of Scala in a variety of technologies and on different platforms.

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Scala:** Introduction, Scala Environment, Scala Shell, Scala IDE, Implementing the Object **Scala Building Blocks:** Introduction, Apps and Applications, Basics of the Language **Scala Classes:** Introduction, Classes, Case Classes **Scala Methods:** Introduction, Method Definitions, Named Parameters **Text book 1: Chapter 7.1 to 7.5 ,chapter 8, 9,10**	8 L3
MODULE 2 **Classes, Inheritance and Abstraction:** Introduction, Inheritance Between Types, Inheritance Between Classes, Restricting a Subclass, Abstract Classes, The Super Keyword, Scala Type Hierarchy, Polymorphism **Objects and Instances:** Introduction, Singleton Objects, Companion Objects **Value Classes:** Introduction, Value Classes, Simple Value Type Example **Text book 1: Chapter 13,14,15.1 to 15.3**	8 L3
MODULE 3 **Scala Constructs:** Introduction, Numbers and Numeric Operators, Characters and Strings, Assignments, Variables, Messages and Message Selectors, Control and Iteration **Traits:** Introduction, Abstract Trait Members, Dynamic Binding of Traits, Sealed Traits, Marker Traits **Arrays:** Introduction, Arrays, Creating Square Arrays, Looping Through Arrays **Tuples:** Introduction, Tuple Characteristics, classes, Creating a Tuple. **Text book 1: Chapter 16,17, 18.1,18.5 to 18.8, 20.1 to 20.4, 21.1to 21.5**	8 L3

MODULE 4 **Functional Programming in Scala:** Introduction, Scala as a Functional Language, Defining Scala Functions **Scala Collections Framework**: Introduction, Scala Collections **Immutable Lists and Maps:** Introduction, the Immutable List Collection **Text book 1: Chapter 22.1 to 22.3, 25,26.1 to 26.2**	8 L3
MODULE 5 **Scala and JDBC Database Access:** Introduction, Working with JDBC, The Database Driver, Registering Drivers, Setting Up MySQL, Setting Up the Database **GUIs in Scala Swing:** Introduction, Windows as Objects, Windows in Scala, Scala Swing, Scala Swing Packages, Swing Scala Worked Examples **Scala& Java Interoperability:** Introduction, a Simple Example, Inheritance, Issues, Functions **Text book 1: Chapter 33.1,33.4 to 33.8, 41,44.1,44.5**	8 L3

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

CO604B.1	Understand the fundamental concepts of scala programming basics
CO604B.2	Understand the fundamental concepts of basic object-oriented programming in scala.
CO604B.3	Apply the knowledge of functional programming concepts to develop applications.
CO604B.4	Analyze and the behavior of programs involving fundamental programming concepts in Scala.
CO604B.5	Apply object-oriented concepts to design and use of Scala in a variety of and on different platforms.

Text books:

1. A Beginner's Guide to Scala, Object Orientation and Functional Programming, Second Edition John Hunt, Midmarsh Technology Ltd, Bath, Wiltshire Springer publications

Reference Books:

1. Functional Programming in Scala by Paul Chiusano, Runa Bjarnason, MEAP Edition Manning Early Access Program, version 10

E-Books / Web References

1. https://dokumen.pub/qdownload/a-beginners-guide-to-scala-object-orientation-and-functional-programming-2nbsped-9783319757711-3319757717.html
2. https://www.manning.com/books/functional-programming-in-scala

MOOCs

1. https://www.tutorialspoint.com/scala/index.htm
2. https://docs.scala-lang.org/online-courses.html

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO604B.1	3	2	2						3				2	1
CO604B.2	3	2	2						3				2	1

CO604B.3	3	2	2						3				2	1
CO604B.4	3	2	2						3				2	1
CO604B.5	3	2	2						3				2	1
Average	**3**	**2**	**2**						**3**				**2**	**1**

Low-1: Medium-2: High-3

Scheme of Evaluation:

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 four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three tests are to be conducted for 40 marks each. Average of all three tests marks is added to the test component. In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the Alternative Assessment Tool (AAT). The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices. Possible AATs are – seminar / assignments / term paper / open ended experiments / mini-projects/group activity or any other.

Table: Distribution of weightage for CIE & SEE

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	AAT	**5**	
	AAT	**5**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

SEMESTER – VI

SUBJECT: INTRODUCTION TO MACHINE LEARNING

Subject Code	**CML23604C**	**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	Learn the fundamentals of Machine Learning, its types and designing of a learning system
CLO2	Understand the concept learning and the role of find s and candidate elimination algorithms
CLO3	Analyze the decision tree learning models in real time data sets
CLO4	Applying Bayesian techniques in solving problems
CLO5	Apply instance based learning methods

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Introduction to Machine Learning:** Need for ML, ML Explained, ML in relation to other fields, Types of Machine Learning, Machine Learning Applications Well posed learning problems, Designing a Learning system, Perspective and Issues in Machine Learning. **Text book:1** Chapter 1 1.1 – 1.3 **TextBook 2:** Chapter 1 (1.1-1.4,1.7)	**8** **L3**
MODULE 2 **Concept Learning:** Concept learning task, Concept learning as search, Find-S algorithm, Version space, Candidate Elimination algorithm, Inductive Bias. **Text book:1 Chapter** 2 2.1-2.5, 2.7	**8** **L3**
MODULE 3 **Decision Tree Learning:** Decision tree representation, Appropriate problems for decision tree learning, Basic decision tree learning algorithm, hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning. **Text book:1 Chapter 3**	**8** **L3**
MODULE 4 **Bayesian Learning:**	**8** **L3**

Introduction, Bayes theorem, Bayes theorem and concept learning, ML and LS error hypothesis, ML for predicting probabilities, MDL principle, Naive Bayes classifier, Bayesian belief networks, EM algorithm **Text book:1 Chapter 6**	
MODULE 5 **Instance Based Learning:** Introduction, k-nearest neighbor learning, locally weighted regression, radial basis function, cased-based reasoning, **Text book:1 Chapter 8**	**8** **L3**

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

CO604C.1	Understand the need of Machine learning, its types and design of an expert system
CO604C.2	Illustrate the use of find s and candidate elimination algorithm
CO604C.3	Demonstrate the role of decision tree algorithm in real data
CO604C.4	Apply Bayesian techniques and EM algorithm in classifying real data examples
CO604C.5	Demonstrate the role of KNN in instance-based learning

Textbooks:

1. Tom M. Mitchell, Machine Learning, McGraw Hill Education, India Edition 2013.
2. S. Sridhar, M Vijayalakshmi "Machine Learning". Oxford ,2021

Reference Books:

1. Dipanjan Sarkar, Raghav Bali, Tushar Sharma, "Practical Machine Learning with Python-A Problem Solver's Guide to Building Real-World Intelligent Systems", APress, 2018.
2. Kevin P. Murphy , Francis Bach , "Machine Learning: A Probabilistic Perspective (Adaptive Computation and Machine Learning) 1st Edition, Massachusets Institute of Technology, 2012.
3. Introduction to Machine Learning with Python ,by Sarah Guido, Andreas C. Müller, O' Reilly, 2017.

E-Books / Web References

1. https://www.cs.huji.ac.il/~shais/UnderstandingMachineLearning/understanding-machine-learningtheory-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-jpmorganchase/

MOOCs

1. Introduction to machine learning https://nptel.ac.in/courses/106106139
2. https://www.simplilearn.com/pgp-ai-machine-learning-certification-training-course
3. https://www.udemy.com/course/machinelearning/
4. https://www.coursera.org/learn/machine-learning

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO604C.1	3	3	2		3							2		2
CO604C.2	3	3	2		3							2		2
CO604C.3	3	3	2		3							2		2
CO604C.4	3	3	2		3							2		2
CO604C.5	3	3	2		3							2		2
Average	3	3	2		3							2		2

Low-1: Medium-2: High-3

Scheme of Evaluation:

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 four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three tests are to be conducted for 40 marks each. Average of all three tests marks is added to the test component. In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the Alternative Assessment Tool (AAT). The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices. Possible AATs are – seminar / assignments / term paper / open ended experiments / mini-projects/group activity or any other.

Table: Distribution of weightage for CIE & SEE

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	AAT	**5**	
	AAT	**5**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

SEMESTER – VI

SUBJECT: MOBILE APPLICATION DEVELOPMENT

Subject Code	**CML23604D**	**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	Discuss mobile application models/architectures and patterns for development of a mobile software application
CLO2	Demonstrate the installation of software and tools required for development of android Applications
CLO3	Illustrate the use of fundamentals of android with graphics and animation APIs
CLO4	Describe an application with multimedia concepts of audio, video with entertainment services

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Fundamentals of Android Application Development:** Introduction to Android., The Android Jellybean SDK, Understanding the Android Software Stack, Installing the Android SDK, Creating Android Virtual Devices. **Text book:1 Chapter:1.1 to 1.7**	8 L3
MODULE 2 Creating the First Android Project, Using the Text View Control, Using the Android Emulator, User Interaction, Delightful user experience, Testing your UI **Textbook 1**: **Chapter :2.1 to 2.6**	8 L3
MODULE 3 **Layouts, Menus and Graphics in Android:** Menus: Options menu and app bar, Context menu and contextual action mode, Popup menu, defining a Menu in XML, Creating an Options Menu, changing menu items at runtime, **Text book:1 Chapter:3.1 to 3.6**	8 L3
MODULE 4 **Creating the Activity, working with views:** Exploring common views, using a list view, creating custom views, understanding layout. Using Selection Widgets and Debugging	

Displaying and Fetching Information Using Dialogs and Fragments. Multimedia: Playing Audio, Playing Video and Capturing Media. **Text book:1 Chapter:4.1 to 4.7**	8 L3
MODULE 5 **Using Common Android APIs:** Using Android Data and Storage APIs, managing data using SQLite, Sharing Data between Applications with Content Providers, Using Android Networking APIs, Using Android Web APIs, Using Android Telephony APIs, Deploying Android Application to the World. **Text book:1 Chapter:5.1 to 5.9**	8 L3

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

CO604D.1	Make use of Android features to develop real world application.
CO604D.2	Design a suitable user interface and database for the given real-world application.
CO604D.3	Develop Android Services for multimedia, camera and location-based activities
CO604D.4	Discuss mobile application models/ architectures and patterns for development of a mobile software application
CO604D.5	Demonstrate the installation of software and tools required for development of android Applications

Text books:

1. T1. Lauren Darcey and Shane Conder, "Android Wireless Application Development", Pearson Education, 2nd ed. (2011)

Reference Books:

1. R1. Reto Meier, "Professional Android
2. Application Development", Wiley India Pvt Ltd 2. R2. Mark L Murphy, "Beginning Android", Wiley India Pvt Ltd
3. R3. Android Application Development All in one for Dummies by Barry Burd, Edition:

MOOCs

1. https://elearn.nptel.ac.in/shop/iit-workshops/introduction-to-android-app-development/?v=c86ee0d9d7ed

2. https://www.mygreatlearning.com/mobile-app-development/free-courses?p=1&level=Beginner

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO604D.1	2	3	3						3					
CO604D.2	2	3	3		2				3		2			
CO604D.3	2	3	3		2				3					
CO604D.4	2	3	3		2				3		2			3
CO604D.5	2	3	3		2				3					3
Average	**2**	**3**	**3**		2				**3**		**2**			**3**

Low-1: Medium-2: High-3

Scheme of Evaluation:

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 four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three tests are to be conducted for 40 marks each. Average of all three tests marks is added to the test component. In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the Alternative Assessment Tool (AAT). The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices. Possible AATs are – seminar / assignments / term paper / open ended experiments / mini-projects/group activity or any other.

Table: Distribution of weightage for CIE & SEE

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	AAT	**5**	
	AAT	**5**	
SEE	Semester End Examination	**50**	**50**

SEMESTER VI

Major Project Phase-I

Semester:	**06**	**CIE Marks:**	**100**
Course Code:	**CMLP23605**	**SEE Marks:**	**-**
Hours/Week (L: T: P):	**0:0:4**	**Duration of SEE (hours):**	**-**
Credits: 02			

Content
Project work phase - 1: Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary project can be assigned to an individual student or to a group having not more than 4 students. In extraordinary cases, like the funded projects requiring students from different disciplines, with the project student strength 4 **CIE procedure for Project Work Phase - 1:** **a. 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 phase -1, shall be based on the evaluation of the project work phase -1 Report (covering Literature Survey, Problem identification, Objectives and Methodology) using Rubrics, 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. **b. 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 phase -1, shall be based on the evaluation of project work phase -1 Report (covering Literature Survey, Problem identification, Objectives and Methodology), 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 as per Rubrics covering all Program Outcomes.

Table 1: Distribution of weightage for CIE

	Component	Marks	Total Marks
CIE	Review-1	**100**	**100**
	Review-2		
SEE	Semester End Examination	--	--
Grand Total			**100**

SUBJECT: ADVANCED MACHINELEARNING LABORATORY

Course Code	CMLL23606	CIE Marks	50
Hours/Week (L: T: P)	0:0:2	SEE Marks	50
No. of Credits	1	Examination Hours	3 Hours

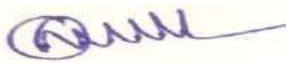
Course Learning Objectives:
The course will enable students to:

CLO1	Learn the fundamentals of Machine Learning, its types and designing of a learning system
CLO2	Understand the concept learning and the role of find s and candidate elimination algorithms
CLO3	Analyze the decision tree learning models and fundamentals of rule based learning
CLO4	Applying Bayesian techniques in solving problems
CLO5	Demonstrate the process in hypothesis evaluation and to apply instance based learning methods

Sl. No.	EXPERIMENTS
1	Build an Artificial Neural Network using the Back-propagation algorithm and test the same using appropriate data sets
2	Demonstrate the perceptron algorithm for AND and OR gates
3	Implement K-means, K-Modes Clustering to Find Natural Patterns in Data
4	Implement Hierarchical clustering
5	Apply DBSCAN to a dataset and visualize the resulting clusters
6	Develop a classification system utilizing Support Vector Machines (SVM)
7	Implement the Q-learning algorithm to solve a grid-world problem.
8	Demonstrate Fitting an SVR Model on the Sine Curve data using Linear Kernel
9	Implement a simple genetic algorithm to maximize a function.
10	Use a small dataset to Implement a simple explanation-based learning algorithm.

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

CO606.1	Apply perceptron training rule and Back propogation algorithm to build an ANN
CO606.2	Illustarate the role of SVM and support vector regression in classification
CO606.3	Implement various clustering techniques and cluster evaluation methods



CO606.4	Interpret the computational learning theory and to apply reinforcement learning techniques
CO606.5	Demonstrate the role of genetic algorithm and explanation based learning methods in various search spaces

Textbooks:

1. S. Sridhar, M Vijayalakshmi "Machine Learning". Oxford ,2021
2. Tom M. Mitchell, Machine Learning, McGraw Hill Education, India Edition 2013.

Reference Books:

1. Fundamentals of Machine Learning for Predictive Data Analytics: Algorithms‖, by John D. Kelleher, Brian Mac Namee, and Aoife D'Arcy, Worked Examples, and Case Studies, The MIT Press, 2015.]
2. Introduction to Machine Learning‖, by Ethem Alpaydin, PHI Learning, 2nd Edition, 2019.

E-Books / Web References

1. https://www.cs.huji.ac.il/~shais/UnderstandingMachineLearning/understanding-machine- learningtheory-algorithms.pdf
2. https://medium.com/@prithvilee22/ai-ml-case-study-55d34e308c92 3
3. https://d3.harvard.edu/platform-digit/submission/robo-banking-artificial-intelligence-at- jpmorganchase/

MOOCs

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

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO606.1	2	3	3		2							2		2
CO606.2	2	3	3		2							2		2
CO606.3	2	3	3		2							2		2
CO606.4	2	3	3		2							2		2
CO606.5	2	3	3		2							2		2
Average	**2**	**3**	**3**		2							2		2

Low-1: Medium-2: High-3

SEMESTER VI

SUBJECT: MongoDB

Course Code	**CML23607A**	**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 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

Sl. No.	**EXPERIMENTS**
1	a. Illustration of Where Clause, AND,OR operations in MongoDB. b. Execute the Commands of MongoDB and operations in MongoDB : Insert, Query, Update, Deleteand Projection. (Note: use any collection) [Refer: Book 1 chapter 4].
2	a. Develop a MongoDB query to select certain fields and ignore some fields of the documents fromany collection. b. Develop a MongoDB query to display the first 5 documents from the results obtained in a.[use of limit and find] [Refe: Book1 Chapter 4, book 2: chapter 5]
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 [Refer: Book 3 Chapter 13]
4	Create and demonstrate how projection operators ($, $elematch and $slice) would be used in theMondoDB. [Refer: Book 3 Chapter 14]
5	Execute Aggregation operations ($avg, $min,$max, $push, $addToSet etc.). students encourage to execute several queries to demonstrate various aggregation operators) [Refer: Book 3 Chapter 15]
6	Execute Aggregation Pipeline and its operations (pipeline must contain $match, $group, $sort, $project, $skip etc. students encourage to execute several queries to demonstrate various aggregation operators)[refer book 2: chapter 6]
7	a. Find all listings with listing_url, name, address, host_picture_url in the listings And Reviewscollection that have a host with a picture url

	b. Using E-commerce collection write a query to display reviews summary. [refer Book2: chapter 6]
8	a) Demonstrate creation of different types of indexes on collection (unique, sparse, compound andmultikey indexes) b) Demonstrate optimization of queries using indexes. Refer: Book 2: Chapter 8 and Book 3: Chapter 12]
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 Refer: Book 2: Chapter 9]
10	Develop an aggregation pipeline to illustrate Text search on Catalog data collection. Refer: Book 2 :Chapter 9]

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

CO607A.1	Make use of MongoDB commands and queries.
CO607A.2	Illustrate the role of aggregate pipelines to extract data.
CO607A.3	Demonstrate optimization of queries by creating indexes.
CO607A.4	Develop aggregate pipelines for text search in collections.

Textbooks:

1. **"**MongoDB: The Definitive Guide", Kristina chodorow, 2nd ed O'REILLY, 2013
2. **"***MongoDB in Action*" by KYLE BANKER et. al. 2nd ed, Manning publication, 2016
3. "MongoDB Complete Guide" by Manu Sharma 1st ed, bpb publication, 2023.

E-Books / Web References

1. installation of MongoDB Video: https://www.youtube.com/watch?v=dEm2AS5amyA
2. video on Aggregation: https://www.youtube.com/watch?v=vx1C8EyTa7Y
3. MongoDB in action book Code download URL: https://www.manning.com/downloads/529
4. 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
CO607A.1	2	3	3		2							2		2
CO607A.2	2	3	3		2							2		2
CO607A.3	2	3	3		2							2		2
CO607A.4	2	3	3		2							2		2
Average	**2**	**3**	**3**		2							2		2

Low-1: Medium-2: High-3

SEMESTER VI

SUBJECT: DATA VISUALIZATION

Course Code	**CML23607B**	**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 the Importance of data Visualization for business intelligence and decision making.
CLO2	Learn different approaches to understand the importance of visual perception
CLO3	Learn different data visualization techniques and tools
CLO4	Gain knowledge of effective data visuals to solve workplace problems

Sl. No.	**EXPERIMENTS**
1	Getting Started - Tableau Workspace, Tableau terminologies, basic functionalities.
2	Connecting to Data Source – Connecting to Database, Different types of Tableau Joins.
3	Creating a View - formatting charts, adding filters, creating calculated fields and defining parameters.
4	Dashboard Design and Storytelling – Components of Dashboard, Understanding how to place worksheets in Containers, Action filters and its types
5	Introducing Power BI –Components and the flow of work. Power BI Desktop Interface-The Report has five main areas.
6	Querying Data from CSV - Query Editor, Connecting the data from the Excel Source, Clean, Transform the data.
7	Creating Reports & Visualizations - Different types of charts, Formatting charts with Title, Colors.
8	Dashboards - Filters in Power BI, Formatting dashboards.
9	Analysis of revenue in sales dataset: i) Create a choropleth map (fill the map) to spot the special trends to show the state which has the highest revenue. ii) Create a line chart to show the revenue based on the month of the year. iii) Create a bin of size 10 for the age measure to create a new dimension to show the revenue. iv) Create a donut chart view to show the percentage of revenue per region by creating zero access in the calculated field. v) Create a butterfly chart by reversing the bar chart to compare female & male revenue based on product category. vi) Create a calculated field to show the average revenue per state & display profitable & non-profitable state. vii) Build a dashboard

10	Analysis of GDP dataset: i) Visualize the countries data given in the dataset with respect to latitude and longitude along with country name using symbol maps. ii) Create a bar graph to compare GDP of Belgium between 2006 – 2026. iii) Using pie chart, visualize the GDP of India, Nepal, Romania, South Asia, Singapore by the year 2010. iv) Visualize the countries Bhutan & Costa Rica competing in terms of GDP. v) Create a scatter plot or circle views of GDP of Mexico, Algeria, Fiji, Estonia from 2004 to 2006. vi) Build an interactive dashboard.
11	Analysis of HR Dataset: i)Create KPI to show employee count, attrition count, attrition rate, attrition count, active employees, and average age. ii) Create a Lollipop Chart to show the attrition rate based on gender category. iii) Create a pie chart to show the attrition percentage based on Department Category- Drag department into colours and change automatic to pie. Entire view, Drag attrition count to angle. Label attrition count, change to percent, add total also, edit label. iv) Create a bar chart to display the number of employees by Age group, v) Create a highlight table to show the Job Satisfaction Rating for each job role based on employee count. vi) Create a horizontal bar chart to show the attrition count for each Education field Education field wise attrition – drag education field to rows, sum attrition count to col, vii) Create multiple donut chart to show the Attrition Rate by Gender for different Age group.
12	Analysis of Amazon Prime Dataset: i) Create a Donut chart to show the percentage of movie and tv shows ii) Create a area chart to shows by release year and type iii) Create a horizontal bar chart to show Top 10 genre iv) Create a map to display total shows by country v) Create a text sheet to show the description of any movie/movies. vi) Build an interactive Dashboard.

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

CO607B.1	Design the experiment to create basic charts and graphs using Tableau and Power BI.
CO607B.2	Develop the solution for the given real world problem
CO607B.3	Analyze the results and produce substantial written documentation.

Textbooks:

1. Microsoft Power BI Dashboards Step by Step by Errin O'Connor, 2019 by Pearson Education, Inc
2. Information Dashboard Design: Displaying Data for At-a-glance Monitoring" by Stephen Few

E-Books / Web References

1. https://help.tableau.com/current/guides/get-started-tutorial/en-us/get-started-tutorial- home.htm
2. https://www.tutorialspoint.com/tableau/index.htm
3. https://www.simplilearn.com/tutorials/power-bi-tutorial/power-bi-vs-tableau

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO607B.1	2	3	3		3							2	2	2
CO607B.2	2	3	3		3							2	2	2
CO607B.3	2	3	3		3							2	2	2
Average	**2**	**3**	**3**		**3**							2	2	2

Low-1: Medium-2: High-3

Semester: VI						
PHYSICAL EDUCATION (SPORTS & ATHLETICS) – II						
Course Code	**:**	PEK23608		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	0:0:1				
Total Hours	**:**	24 P				

Course Outcomes: At the end of the course, the student will be able to

1. Understand the Postural deformities and Stress management in sports andathletics
2. Participate in the competition at regional/state / national / international levels.
3. Understand and practice of specific games and athletic Jumping events.
4. Understand and practice of Aerobics.

Module IV : Orientation **4 Hours**

1. Postural deformities.
2. Stress management

Module V : Specific Games (Any one to be selected by the student) **16 Hours**

1. Throw ball
2. Table Tennis
3. Athletics (Field Events- Jumps) – Any event as per availability of Ground.

Module VI: Aerobics **4 Hours**

Scheme and Assessment for auditing the course and Grades:

Sl. No.	Activity	Marks
1.	Participation of student in all the modules	20
2.	Quizzes – 2, each of 15 marks	30
3.	Final presentation / exhibition / Participation in competitions/ practical on specific tasks assigned to the students	50
	Total	**100**

SEMESTER – VI

Course: 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: Lingistics, Number and measurements-Mathematics, Chemistry, Physics, Art, Astronomy, Astrology, Crafts and Trade in India and Engineering and Technology
Module 3 (05 hours)
Traditional Knowledge in Professional domain: Town planning and architecture Construction, Health, wellness and Psychology-Medicine, Agriculture, Governance and public administration, United Nations Sustainable development goals.

Reference Books:

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

Scheme of Examination:

Semester End Examination (SEE):

SEE paper shall be set for 50 questions, each of the 01 mark. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is 01 hour.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests.
Typical Evaluation pattern for regular courses is shown in Table 2.

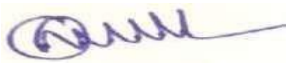


Table 2: Distribution of weightage for CIE & SEE of Regular courses

Component		Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	Assignments	**10**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

CO/PO	**PO6**
CO 1	3
CO 2	3
CO 3	3
CO 4	3
Average	3

Low-1: Medium-2: High-3

Global Academy of Technology

(An Autonomous Institution, affiliated to VTU, Belagavi, recognized by Karnataka and Approved by AICTE, New Delhi.)

B.E. in Computer Science and Engineering(AI&ML)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 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 inhours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	CML23701	Natural Language Processing	TD:CI PSB:CI	3	0	2		03	50	50	100	4
2	IPCC	CML23702	Deep Learning		3	0	2		03	50	50	100	4
3	PCC	CML23703	Computer vision and image processing		3	2	0		03	50	50	100	4
4	PEC	CML23704x	**Professional Elective-III**		3	0	0		03	50	50	100	3
5	OEC	CML23705x	**Open Elective- II**		3	0	0		03	50	50	100	3
6	PROJ	CMLP23706	**Major Project Phase-II**		0	0	12		03	100	100	200	6
									Total	**350**	**350**	**700**	**24**

Professional Elective Course

CML23704A	Framework for Application Deployment	CML23704C	Industrial IOT
CML23704B	Ethical Hacking	CML23704D	Business Intelligence & Analytics

Open Elective Course

CML23705A	R Programming	CML23705C	Fundamentals of IOT
CML23705B	Java Programming	CML23705D	Digital Image Processing

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.

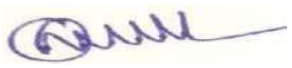
CIE procedure for Project Work:

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

(Effective from the academic year 2023-24)

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				Credits
					Theory Lecture	Tutorial	Practical / Drawing	Self -Study	Duration inhours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PEC	CML23801x	**Professional Elective -IV (Online Courses)**	TD: CI PSB:CI	3	0	0		03	50	50	100	3
2	OEC	CML23802x	**Open Elective - III (Online Courses)**	TD: CI PSB:CI	3	0	0		03	50	50	100	3
3	INT	CMLI23803	**Internship (Industry/Research) (14 - 20 weeks)**		0	0	12		03	100	100	200	10
									Total	**200**	**200**	**400**	**16**

Professional Elective Course (Online courses)

CML23801A	Parametrized Algorithm	CML23801C	Google Cloud Computing Foundation
CML23801B	Blockchain and its Applications	CML23801D	Social Network Analysis

Open Elective Courses (Online Courses)

CML23802A	Cyber Security and Privacy	CML23802C	BIG DATA computing
CML23802B	Computer Vision	CML23802D	Responsible and Safe AI sytems

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

Note: VII and VIII semesters of IV years of the programSwapping 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.

SEMESTER – VII

SUBJECT: NATURAL LANGUAGE PROCESSING

Subject Code	**CML23701**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:2**	**SEE Marks**	**50**
Total Hours	**50**	**Examination Hours**	**3**
No. of Credits: 4			

Prerequisite: Machine Learning

Course Learning Objectives:

The course will enable students to:

CLO1	Understand the concepts of language and grammar processing
CLO2	Analyze the importance of word level and syntactic level analysis
CLO3	Learn the architectures of NLG
CLO4	Illustrate machine translation and information retrieval techniques.
CLO5	Learn the fundamentals of large language models

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Overview and language modeling:** Overview: Origins and challenges of NLP-Language and Grammar-Processing Indian Languages- NLP Applications-Information Retrieval. **Language Modeling:** Various Grammar- based Language Models Statistical Language Model. **Text book:1 Chapter :1.1 to 1.9, 2.2,2.3**	10 L3
MODULE 2 **Word level and syntactic analysis:** Word Level Analysis: 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. **Text book:1 Chapter: 3.1 to 3.6, 41-4.5**	10 L3
MODULE 3 **Semantic Analysis :** Introduction, Meaning representation, Lexical semantics, Ambiguity. **Natural Language Generation:** Introduction, architectures, Generation task and representation, Applications of NLG **Text book:1 Chapter: 5.1-5.4, 7.1-7.4**	10 L3

MODULE 4 **Machine Translation:** Problems in Machine Translation, Characteristics of Indian Languages, Machine Translation Approaches, Direct Machine Translation, Rule based Machine Translation. **Information Retrieval:** Design features of Information Retrieval Systems, Information Retrieval Models, Classical Information Retrieval Models, Non-classical models of IR. **Text book:1 Chapter: 8.2 to 8.6, 9.2-9.5**	10 L3
MODULE 5 **Lexical Resources:** Word Net, Frame Net, Stemmers, Part-of-Speech Tagger **Large Language models:** The birth of LLM, uses of LLM, sustainability of LLMs, Conversational LLMs **Text book:1 Chapter 12.2-12.5** **Text book: 2 Chapter 1**	10 L3

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

CO701.1	Understand the fundamentals of Natural Language Processing and language modeling
CO701.2	Illustrate the role of word level and syntactic level analysis
CO701.3	Describe the lexical semantics and Natural language architectures
CO701.4	Utilize the types of machine translation techniques and information retrieval models
CO701.5	Outline the role of lexical resources and the Large Language Models

Lab Programs

1. Download nltk and packages. Use it to print the tokens in a document and the sentences from it.
2. Include custom stop words and remove them and all stop words from a given document using nltk or spaCY package
3. Implement a stemmer and a lemmatizer program
4. Implement a simple Part-of-Speech Tagger
5. Write a program for spam detection using NLTK
6. Write a program to demonstrate Neural machine translation with attention
7. Write a program to build an NLP classifier which can use input text parameters to determine the label/s of the blog.
8. Write a program to implement transfer learning, paraphrasing from iNLTK.

Text books:

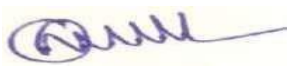
1. Tanveer Siddiqui, U.S. Tiwari, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.
2. "Introduction to Generative AI" , Numa Dhamani, Kindle Edition, 2024.

Reference Books:

1. Daniel Jurafsky and James H Martin, "Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", 2nd Edition, Prentice Hall, 2008.

2. James Allen, "Natural Language Understanding", 2nd edition, Benjamin/Cummings publishing company, 1995.

3. Gerald J. Kowalski and Mark.T. Maybury, "Information Storage and Retrieval systems", Kluwer academic Publishers, 2000



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/
4. https://nptel.ac.in/courses/106/101/106101007/
5. https://www.coursera.org/specializations/natural-language-processing
6. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-864-advanced- naturallanguage-processing-fall-2005/

E-Books / Web References:

1. https://www.coursera.org/learn/language-processing
2. https://towardsdatascience.com/a-practitioners-guide-to-naturallanguage-processing-part-iprocessing-understanding-text-9f4abfd13e72
3. https://www.tutorialspoint.com/natural_language_processing/index.htm
4. https://www.kaggle.com/learn/natural-language-processing

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO701.1	2	3	3						3					
CO701.2	2	3	3		2				3		2			
CO701.3	2	3	3	3	2				3					
CO701.4	2	3	3	3	2				3		2			3
CO701.5	2	3	3	3	2				3					3
Average	**2**	**3**	**3**	**3**	**2**				**3**		**2**			**3**

Low-1: Medium-2: High-3

Scheme of Evaluation:

Semester End Examination (SEE):

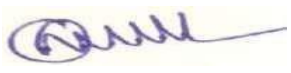
SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full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

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. The average of the three tests are taken for computation of CIE on a scale of 30, the CIE would also include laboratory evaluation for 20 marks. The laboratory marks of 20 would comprise of 10 marks for regular laboratory assessment to include lab record and observation. 10 marks would be exclusive for laboratory internal assessment test to be conducted at the end of the semester.

Table: Distribution of weightage for CIE & SEE of Integrated courses

	Component	Marks	Total Marks
CIE	CIE Test-1	**30**	**50**
	CIE Test-2	**30**	
	CIE Test-3	**30**	
	Lab	**20**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**



SEMESTER – VII

SUBJECT: DEEP LEARNING

Subject Code	**CML23702**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:2**	**SEE Marks**	**50**
Total Hours	**50**	**Examination Hours**	**3**
Credits: 4			

Pre requisite: Machine Learning

Course Learning Objectives:

The course will enable students to:

CL01	Understand the basic concept of Deep networks
CLO2	Use the concepts of Recurrent neural networks in solving real world task.
CLO3	Illustrate Convolution Neural Networks
CLO4	Analyze structured probabilistic models for deep learning
CLO5	Understand the concept of Auto encoders and GAN

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Deep Networks:** Deep Feed forwarded Networks - Gradient-Based Learning, Hidden Units, Architecture, Back-Propagation and Other Differentiation Algorithms. **Regularization:** Parameter Norm Penalties (NP), NP as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised & Multi-Task Learning, Early Stopping, Parameter Tying and Sharing, Sparse Representations, Bagging and Other Ensemble Methods, Dropout, Adversarial Training, Tangent Distance, Tangent Prop and Manifold Tangent Classifier **TextBook 1 Chapter 6,7**	**10/L3**
MODULE 2 **Recurrent Neural Networks (RNN):** Introduction – Expressiveness; Architecture – Language Modeling, Back Propagation, Bidirectional RNN, Multilayer RNN; Challenges of Training RNNs - Layer Normalization; Echo State Networks, LSTM, GRUs, Applications of RNN. **Textbook 2 Chapter 7**	**10/L3**

MODULE 3 **Convolutional Networks (CNN):** Introduction, Structure of CNN, Training a CNN – Back propagations through Convolutions, Backpropagation as Convolution with inverted/Transposed Filter, Convolution/Backpropagation as Matrix Multiplications, Data Augmentation; Case Studies on Architectures – AlexNet, ZFNet, ResNet,Applications of CNN **TextBook 2 Chapter 8(8.1-8.4.1,8.4.2,8.4.5), 8.6**	**10/L3**
MODULE 4 **Structured Probabilistic Models for Deep Learning:** The Challenge of Unstructured Modeling, Using Graphs to Describe Model Structure, Sampling from Graphical Models, Advantages of Structured Modeling, Learning about Dependencies, Inference and Approximate Inference, The Deep Learning Approach to Structured Probabilistic Models **Monte Carlo Methods:** Sampling and Monte Carlo Methods, Importance Sampling, Markov Chain Monte Carlo Methods, Gibbs Sampling, The Challenge of Mixing between Separated Modes **TextBook 1 Chapter 16,17**	**10/L3**
MODULE 5 **Autoencoders (AE):** Undercomplete and Regularized AE, Representational Power, Layer Size and Depth, Stochastic Encoders and Decoders, Denoising Autoencoders, Learning Manifolds, Contractive Autoencoders, Predictive Sparse Decomposition and Applications **Generative Adversial Networks (GANs):** Training a Generative Adversarial Network, Comparison with Variational Autoencoder, Using GANs for Generating Image Data, Conditional Generative Adversarial Networks **TextBook 1 Chapter 14** **TextBook 2 Chapter 10(10.4)**	**10/L3**

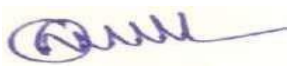
Lab programs

1. Implement the following for the CIFAR-10 (Canadian Institute forAdvanced Research) dataset: using KNN, using 3-layer neural network
2. Train a Deep learning model to classify a given image using the pre- trained model.
3. Train a CNN using Tensorflow and Keras.
4. Write a python program to demonstrate the Image captioning.
5. Implement an Object detection using a Convolution Neural Network variant
6. Write a program for Time-Series Forecasting with the LSTM Model
7. Write a program to predict a caption for a sample image using LSTM.
8. Write a program for character recognition using RNN and compare it with CNN
9. Write a python program to implement the variant of GAN.

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

CO702.1	Utilize the principles of Deep networks and regularization techniques
CO702.2	Illustrate the concepts of Recurrent neural networks in solving real world task.
CO702.3	Demonstrate the principles and usage of of Convolutional Neural Networks
CO702.4	Make use of structured probabilistic models for deep learning
CO702.5	Apply the concept of Auto encoders and GAN

Textbooks:



1. Ian Goodfellow, Yoshua Bengio, Aaron Courville-Deep Learning, MIT Press, 2016.
2. Amit, Deep Learning Pearson Publication:ISBN: 978-93-544-9387-4, 2021

Reference Books:

1 Cosma Rohilla Shalizi, -Advanced Data Analysis from an Elementary Point of View, 2015.
2 Deng & Yu, -Deep Learning: Methods and Applications, Now Publishers, 2013.
3 Michael Nielsen, -Neural Networks and Deep Learning, Determination Press, 2015.
4 Li Deng and Dong Yu-Deep Learning Methods and Applications, in Signal Processing Volume 7 Issues 3-4, ISSN: 1932-8346.

E-Books / Web References

1 Ian Goodfellow and Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press book.
2 Deep Learning with Python 1st Edition by François Chollet
3 Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems 1st Edition by AurélienGéron

MOOC

1. https://onlinecourses.nptel.ac.in/noc20_cs62/preview
2. https://www.coursera.org/specializations/deep-learning

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO702.1	3	3	3		2			2				2		3
CO702.2	3	3	3		2			2				2		3
CO702.3	3	3	3		2			2				2		3
CO702.4	3	3	3		2			2				2		3
CO702.5	3	3	3		2			2				2		3
Average	**3**	**3**	**3**		2			2				**2**		**3**

Low-1: Medium-2: High-3

Scheme of Evaluation:

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 four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. The average of the three tests are taken for computation of CIE on a scale of 30, the CIE would also include laboratory evaluation for 20 marks. The laboratory marks of 20 would comprise of 10 marks for regular laboratory assessment to include lab record and observation. 10 marks would be exclusive for laboratory internal assessment test to be conducted at the end of the semester.

Table: Distribution of weightage for CIE & SEE of Integrated courses

	Component	Marks	Total Marks
CIE	CIE Test-1	**30**	**50**
	CIE Test-2	**30**	
	CIE Test-3	**30**	
	Lab	**20**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

SEMESTER – VII

SUBJECT: COMPUTER VISION AND IMAGE PROCESSING

Subject Code	**CML23703**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:2:0**	SEE Marks	**50**
Total Hours	**40**	**Examination Hours**	**3**
No. of Credits: 3			

Course Learning Objectives:

The course will enable students to:

CLO1	Understanding fundamentals of Computer vision and Image Processing
CLO2	Discuss various segmentation techniques and their applications
CLO3	Demonstrate the use of techniques for registration and classification of images.
CLO4	Describe the object detection and recognition process in a given application

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Introduction to Computer Vision:** What is Digital Image Processing, The Origins of Digital Image Processing, Processing, Fundamental Steps in Digital Image Processing, Components of an Image Processing System. **Digital Image Fundamentals:** Image Sampling and Quantization, Representing Digital Images, Spatial and Gray-level Resolution, Zooming and Shrinking Digital Images, Some Basic Relationships between Pixels, Introduction to the Basic Mathematical Tools Used in Digital Image Processing **Text Book: 2 Chapter: 1.1 to 1.5 and 2.1 to 2.6**	10 L2
MODULE 2 **Intensity Transformations and Spatial Filtering:** Background, Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing (Lowpass) Spatial Filters, Sharpening (High pass) Spatial Filters **Text Book:1 Chapter: 3.1 to 3.9**	10 L3
MODULE 3 **Applications of Computer Vision:** Artificial Neural Network for Pattern Classification, Convolutional Neural Networks, Autoencoders, Gesture Recognition, Motion Estimation and Object Tracking, Programming Assignments. **Text Book:2 Chapter :9**	10 L3

MODULE 4 **Color Image Processing:** Color Fundamentals, Color Models, Pseudo color Image Processing, Wavelets and Multiresolution Processing: Wavelet and Another Image. Transforms: Preliminaries, Haar Transform, Multiresolution **Text Book:1 Chapter: 8.1 to 8.11**	10 L3
MODULE 5 **Morphological Image Processing:** Basic Concepts, Dilation and Erosion, Opening and Closing, Hit or miss transformation, sample applications **Image Descriptors and Features:** Interest or Corner Point Detectors, Histogram of Oriented Gradients, Scale Invariant Feature Transform, Speeded up Robust Features, Saliency **Text Book:1 Chapter: 9.1 to 9.10**	10 L3

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

CO703.1	Utilize linear filters to enhance the quality of images in given real world application.
CO703.2	Apply segmentation techniques to solve real world problems
CO703.3	Develop image transformation techniques for solving real world problems
CO703.4	Illustrate different filtering technique for Image Restoration and Reconstruction
CO703.5	Apply watermarking and image compression techniques in computer vision applications.

Text books:

1. Rafael C. Gonzalez, University of Tennessee, Richard E. Woods, "Digital Image Processing", Pearson, 4th Edition, 2018
2. Forsyth & Ponce,"Computer Vision-A Modern Approach" Pearson Education.

Reference Books:

1. David A. Forsyth, Jean Ponce, "Computer Vision: A Modern Approach", 2nd Edition, University of Illinois at Urbana-Champaign Jean Ponce, EcoleNormaleSuperieure, Paris©2012, Pearson

2. Richard Zaleski, "Computer Vision: Algorithms and Applications" , Springer

MOOCs:

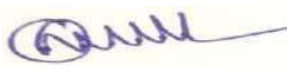
1. https://onlinecourses.nptel.ac.in/noc21_ee22/preview

2. https://nptel.ac.in/courses/106/105/106105216/

3. https://nptel.ac.in/courses/106/106/106106224/

E-Books:

1.https://sde.uoc.ac.in/sites/default/files/sde_videos/Digital%20Image%20Processing%203rd%20ed.%20-%20R.%20Gonzalez,%20R.%20Woods-ilovepdf-compressed.pdf



Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO703.1	2	3	3		3				3					
CO703.2	2	3	3		3				3					
CO703.3	2	3	3	3	3				3					
CO703.4	2	3	3	3	3				3					3
CO703.5	2	3	3	3	3				3					3
Average	**2**	**3**	**3**	**3**	**3**				**3**					**3**

Low-1: Medium-2: High-3

Scheme of Evaluation: (Integrated courses)

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 four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. The average of the three tests are taken for computation of CIE on a scale of 30, the CIE would also include laboratory evaluation for 20 marks. The laboratory marks of 20 would comprise of 10 marks for regular laboratory assessment to include lab record and observation. 10 marks would be exclusive for laboratory internal assessment test to be conducted at the end of the semester.

Table: Distribution of weightage for CIE & SEE of Integrated courses

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	AAT	**10**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

SEMESTER – VII

SUBJECT: FRAMEWORK FOR APPLICATION DEPLOYMENT

Subject Code	**CML23704A**	**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 use of learning full stack web development.
CLO2	Make use of rapid application development in the design of responsive web pages
CLO3	Illustrate Models, Views and Templates with their connectivity in Django for full stack web Development
CLO4	Demonstrate the use of state management and admin interfaces automation in Django
CLO5	Design and implement Django apps containing dynamic pages with SQL databases.

CONTENTS	# of Hours / RBT Levels
MODULE 1 **MVC based Web Designing:** Web framework, MVC Design Pattern, Django Evolution, Views, Mapping URL to Views, Working of Django URL Confs and Loose Coupling, Errors in Django, Wild Card patterns in URLS. **Textbook 1: Chapter 1 and Chapter 3**	8 L3
MODULE 2 **Django Templates and Models:** Template System Basics, Using Django Template System, Basic Template Tags and Filters, MVT Development Pattern, Template Loading, Template Inheritance, MVT Development Pattern. Configuring Databases, Defining and Implementing Models, Basic Data Access, Adding Model String Representations, Inserting/Updating data, Selecting and deleting objects, Schema Evolution **Textbook 1: Chapter 4 and Chapter 5**	8 L3
MODULE 3 **Django Admin Interfaces and Model Forms:** Activating Admin Interfaces, Using Admin Interfaces, Customizing Admin Interfaces, Reasons to use Admin Interfaces. Form Processing, Creating Feedback forms, Form submissions, custom validation, creating Model Forms, URLConf Ticks, Including Other URLConfs. **Textbook 1: Chapters 6, 7 and 8**	8 L3

MODULE 4 **Generic Views and Django State Persistence:** Using Generic Views, Generic Views of Objects, Extending Generic Views of objects, Extending Generic Views. MIME Types, Generating Non-HTML contents like CSV and PDF, Syndication Feed Framework, Sitemap framework, Cookies, Sessions, Users and Authentication. **Textbook 1: Chapters 9, 11 and 12**	8 L3
MODULE 5 **jQuery and AJAX Integration in Django:** Ajax Solution, Java Script, HTML, CSS, XHTMLHttpRequest and Response, JSON, iFrames, Settings of Java Script in Django, jQuery and Basic AJAX, jQuery AJAX Facilities, Using jQuery UI Autocomplete in Django **Textbook 2: Chapters 1, 2 and 7**	8 L3

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

CO704A.1	Understand the working of MVT based full stack web development with Django
CO704A.2	Designing of Models and Forms for rapid development of web pages
CO704A.3	Analyze the role of Template Inheritance and Generic views for developing full stack web Applications
CO704A.4	Apply the Django framework libraries to render non-HTML contents like CSV and PDF
CO704A.5	Perform jQuery-based AJAX integration to Django Apps to build responsive full stack web applications,

Text books:

1. Adrian Holovaty, Jacob Kaplan Moss, The Definitive Guide to Django: Web Development Done Right, Second Edition, Springer-Verlag Berlin and Heidelberg GmbH & Co. KG Publishers, 2009

2. Jonathan Hayward, Django Java Script Integration: AJAX and jQuery, First Edition, Pack Publishing, 2011

Reference Books:

1. Aidas Bendroraitis, Jake Kronika, Django 3 Web Development Cookbook, Fourth Edition, Packt Publishing, 2020

2. William Vincent, Django for Beginners: Build websites with Python and Django, First Edition, Amazon Digital Services, 2018

3. Antonio Mele, Django3 by Example, 3rd Edition, Pack Publishers, 2020

4. Arun Ravindran, Django Design Patterns and Best Practices, 2nd Edition, Pack Publishers, 2020.

5. Julia Elman, Mark Lavin, Light weight Django, David A. Bell, 1st Edition, Oreily Publications, 2014

MOOCs:

1. https://www.coursera.org/courses?query=full%20stack%20web%20development
2. https://www.udemy.com/topic/full-stack-web-development/

E-Books / Web References:

1. MVT architecture with Django: https://freevideolectures.com/course/3700/django-tutorials

2. Using Python in Django: https://www.youtube.com/watch?v=2BqoLiMT3Ao

3. Model Forms with Django: https://www.youtube.com/watch?v=gMM1rtTwKxE

4. Real time Interactions in Django: https://www.youtube.com/watch?v=3gHmfoeZ45k

5. AJAX with Django for beginners: https://www.youtube.com/watch?v=3VaKNyjlxAU

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO704A.1	3	3	3	2	3	2			3					
CO704A.2	3	3	3	2	3	2			3					
CO704A.3	3	3	3	3	3	2			3					
CO704A.4	3	3	3	3	3	2			3				1	3
CO704A.5	3	3	3	3	3	2			3				1	3
Average	**3**	**3**	**3**	**3**	**3**	**2**			**3**				**1**	**3**

Low-1: Medium-2: High-3

Scheme of Evaluation:
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 four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three tests are to be conducted for 40 marks each. Average of all three tests marks is added to the test component. In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the Alternative Assessment Tool (AAT). The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices. Possible AATs are – seminar / assignments / term paper / open ended experiments / mini-projects/group activity or any other

Table: Distribution of weightage for CIE & SEE

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	AAT	**5**	
	AAT	**5**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

SEMESTER – VII

SUBJECT: ETHICAL HACKING

Subject Code	**CML23704B**	**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 basics of computer-based vulnerabilities
CLO2	Explore different foot printing and scanning methods.
CLO3	Analyse the enumeration and vulnerability analysis methods
CLO4	Understand hacking options available in Web and wireless applications
CLO5	Describe the role of backdoors, rootkits and meterpreter in post exploitation

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Ethical Hacking Overview** - Role of Security and Penetration Testers, Penetration- Testing Methodologies, Laws of the Land; **TCP/IP Concept Review**-Overview of TCP/IP; IP Addressing; **Network and Computer Attacks** - Malware; Protecting Against Malware Attacks; Intruder Attacks; Addressing Physical Security **Textbook 1: Chapter 1,2,3**	**8** **L2**
MODULE 2 **Footprinting and Social Engineering**- using web tools for footprinting, conducting competitive intelligence, Introduction to social engineering **Port Scanning**: introduction, types, port scanning tools, conducting ping sweeps, scripting basics **Textbook 1: Chapter 4,5**	**8** **L3**
MODULE 3 **Enumeration:** introduction, enumerating windows OS, enumerating NetWare OS, Enumerating the *nix OS **Desktop and server OS vulnerabilities**: windows OS vulnerabilities, tools for	**8** **L2**

identifying vulnerabilities, Linux OS vulnerabilities **Textbook 1: Chapter 6,8**	
MODULE 4 **Hacking Web servers**: understanding web applications, web application vulnerabilities, tools for web attackers and security testers **Hacking wireless networks**: understanding wireless technology, components, understanding wireless hacking, **Textbook 1: Chapter 10,11 (only specified topics)**	**8** **L2**
MODULE 5 **Post Exploitation and Maintaining Access with Backdoors, Rootkits, and Meterpreter:** Introduction, Netcat, Rootkits Hacker Defender, Detecting and Defending Against Rootkits, Meterpreter Writing penetration testing reports **Textbook 2 : Chapter 7, 8**	**8** **L3**

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

CO704B.1	Acquire the fundamental knowledge on penetration testing and malware attacks
CO704B.2	Apply the tools for footprinting and interpreting the role of port scanners
CO704B.3	To demonstrate the enumeration and vulnerability analysis methods
CO704B.4	gain knowledge on hacking options available in Web and wireless applications.
CO704B.5	Illustrating the use of backdoors, rootkits and meterpreter in post exploitation and Maintenance

Textbooks:

1. Michael T. Simpson, Kent Backman, and James E. Corley, Hands-On Ethical Hacking and Network Defense, Course Technology, Delmar Cengage Learning, 2016.
2. The Basics of Hacking and Penetration Testing - Patrick Engebretson, SYNGRESS, Elsevier, 2013.

Reference Books:

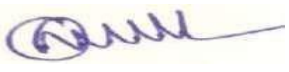
1. Stuart McClure, Joel Scambray and Goerge Kurtz, "Hacking Exposed Network Security Secrets & Solutions", 5th Edition, Tata Mc Graw Hill Publishers, 2010.
2. Rafay Baloch, "A Beginners Guide to Ethical Hacking".
3. Allen Harper, Shon Harris, Jonathan Ness, Chris Eagle, "Gray Hat Hacking The Ethical Hackers Handbook", 3rd Edition, McGraw-Hill Osborne Media paperback(January 27, 2011)

E-Books / Web References

1. https://www.pdfdrive.com/hands-on-ethical-hacking-and-network-defense-d157899505.html
2. https://wqreytuk.github.io/Patrick+Engebretson+The+Basics+of+Hacking+and+Penetratio n+Testi ng,+Second+Edition+%282013%29.pdf

MOOCs

1. https://www.udemy.com/course/learn-ethical-hacking-from-scratch/?couponCode=ST20MT50724
2. https://www.coursera.org/learn/ethical-hacking-essentials-ehe



Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO704B.1					2			2				2	1	
CO704B.2	2	3	2		2			2				2	1	
CO704B.3	2	3	2		2			2				2	1	
CO704B.4	2	3	2		2			2				2	1	
CO704B.5	2	3	2		2			2				2	1	
Average	2	3	2		2			2				2	1	

Low-1: Medium-2: High-3

Scheme of Evaluation:

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 four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

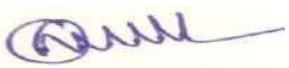
Continuous Internal Evaluation (CIE):

Three tests are to be conducted for 40 marks each. Average of all three tests marks is added to the test component. In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the Alternative Assessment Tool (AAT). The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices. Possible AATs are – seminar / assignments / term paper / open ended experiments / mini-projects/group activity or any other.

Table: Distribution of weightage for CIE & SEE

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	AAT	**5**	
	AAT	**5**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

SEMESTER – VII



SUBJECT: INDUSTRIAL IOT

Subject Code	**CML23704C**	**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 key skills employed in the IIoT & IoRT space building applications.
CLO2	Design suitable network architecture and use appropriate learning algorithm.
CLO3	Comprehend IOT protocols
CLO4	Implement digital Twin
CL05	Implement IOT systems for robotics

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Introduction IIoT; Market Size and Potential:** Definition, IoT v IIoT, Next Generation Sensors, Sensor's calibration and validate sensor measurements, placement of IoT devices, sensors, low-cost communication system design, Top application areas include manufacturing, oil & gas, Embedded systems in the Automotive and Transportation market segment. **Text book:1 Chapter:1.1 to 1.9**	8 L3
MODULE 2 **IIoT Methodology:** Top operating systems used in IIoT deployments, Networking and wireless communication protocols used in IIoT deployments. Smart Remote Monitoring Unit, components of monitoring system, control and management, Wireless Sensor Network (WSN). **Text book:1 Chapter: 4.1 to 4.8**	8 L3
MODULE 3 **Data driven Analytics of IIoT:** Implementing of industrial IoT Data flow, big data and how to prepare data for machine learning algorithms, Machine Learning algorithms, supervised learning & Un-supervised learning algorithms, Basics of neural network, activation functions, back-propagation. **Text book:1 Chapter:6.1 to 6.9**	8 L3

MODULE 4 **Implementing Digital Twin:** Develops a physics-based and data-driven digital equipment model to monitor assets and systems, Introduction to device localization and tracking; different types of localization techniques, Radio-Frequency Identification (RFID) and fingerprinting, Device diversity/heterogeneity issue in IIoT networks **Text book:1 Chapter :10**	8 L3
MODULE 5 **Internet of Robotic Things (IoRT):** Introduction to stationary and mobile robots, Brief introduction to localization, mapping, planning, and control of robotic systems; Introduction to cloud-enabled robotics; Applications of IIoT in robotics; Architectures for IoRT, Examples and case studies: Open issues and challenges. **Text book:1 Chapter :13**	8 L3

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

CO704C.1	Understand the basic concepts of Industry 4.0 and the other related fields
CO704C.2	Understand cyber physical system and the emerging applications
CO704C.3	Analyze the different energy storage systems
CO704C.4	Implement the industry 4.0 to solve engineering problems
CO704C.5	Design of smart vehicle and analyze its performance

Text books:

1. "Industry 4.0: The Industrial Internet of Things" Alasdair Gilchrist, Apress, 2016

Reference Books:

1. "Introduction to Industrial Internet of Things and Industry 4.0", Sudip Misra, Chandana Roy, Anadarup Mukherjee Press,2021
2. "Hands on Industrial Internet of Things", Giacomo Veneri, Antonio Capasso, Packt Press, 2018.

MOOCs

1. https://www.coursera.org/learn/industrial-iot-markets-security
2. https://www.coursera.org/learn/iot-systems-and-industrial-automation-course-1

E-Books:

1. https://www.amazon.in/Industry-4-0-Industrial-Internet-Things/dp/1484220463

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO704C.1	3	2	3											2
CO704C.2	3	2	1										1	
CO704C.3	3	2	1		2			1					1	
CO704C.4	3	2	2										1	2
CO704C.5	2	2	1										1	
Average	**3**	**2**	**2**		**2**			**1**			**2**		**1**	**2**

Low-1: Medium-2: High-3

Scheme of Evaluation:

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 four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three tests are to be conducted for 40 marks each. Average of all three tests marks is added to the test component. In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the Alternative Assessment Tool (AAT). The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices. Possible AATs are – seminar / assignments / term paper / open ended experiments / mini-projects/group activity or any other.

Table: Distribution of weightage for CIE & SEE

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	AAT	**5**	
	AAT	**5**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

SEMESTER – VII

SUBJECT: BUSINESS INTELLIGENCE & ANALYTICS

Subject Code	**CML23704D**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**3hrs**
No. of Credits: 3			

Course Learning Objectives:

The course will enable students to:

CLO1	Explain the Decision Support systems and Business Intelligence framework.
CLO2	Illustrate the significance of computerized Decision Support, and understand the mathematical modeling behind decision support.
CLO3	Explain Data warehousing, its architecture and Extraction, Transformation, and Load (ETL) Processes.
CLO4	Explore knowledge management; explain its activities, approaches and its implementation.
CLO5	Describe the Expert systems, areas suitable for application of expert's system

CONTENTS	# of Hours / RBT Levels
MODULE 1 Decision Support and Business Intelligence: Opening Vignette, Changing Business Environments and Computerized Decision Support, Managerial Decision Making, information system Support for Decision Making, An Early Framework for Computerized Decision Support, The Concept of Decision Support Systems (DSS), A framework for Business Intelligence (BI). **Text book:1 Chapter 1.1 to 1.7**	**8** **L2**
MODULE 2 Computerized Decision Support: Decision Making, Models, Phases of the Decision- Making Process, The Intelligence Phase, The Design Phase, The Choice Phase, The Implementation Phase, How Decisions Are Supported. Decision Support Systems: Capabilities, DSS Classifications, Components of Decision Support Systems. **Text book:1 Chapter 2.2 to 2.11**	**8** **L2**

MODULE 3 Modeling and Analysis: Decision support system modelling, Structure of Mathematical Models for Decision Support, Certainty, Uncertainty, and Risk, Management Support Systems, Multiple Goals, Sensitivity Analysis, What-If Analysis, and Goal Seeking. Decision Analysis with Decision Tables and Decision Trees **Text book:1 Chapter 9.2 to 9.4,9.7 to 9.8**	**8** **L2**
MODULE 4 Expert Systems: Basic Concepts of Expert Systems, Applications of Expert Systems, Structure of Expert Systems, Knowledge Engineering, Problem Areas Suitable for Expert Systems, Development of Expert Systems, Benefits, Limitations, and Critical Success Factors of Expert Systems **Text book:1 Chapter 11.4 to 11.9**	**8** **L2**
MODULE 5 Knowledge Management: Introduction to Knowledge Management, Organizational Learning and Transformation, Knowledge Management Activities, Approaches to Knowledge Management, Information Technology (IT) In Knowledge Management, Knowledge Management Systems Implementation **Text book:1 Chapter 12.2 to 12.4**	**8**

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

CO704D.1	Apply the basics of data and business to understand Decision Support systems and Business Intelligence framework
CO704D.2	Describe the significance of Computerized Decision Support
CO704D.3	Apply the basics of mathematics to Understand the mathematical modeling behind decision Support
CO704D.4	Describe the Expert systems and analyze its development, discuss areas suitable for application of expert system.
CO704D.5	Analyze the importance of knowledge management and explain its activities, approaches and Its implementation

Textbooks:

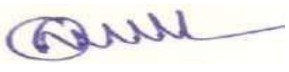
1. Business Intelligence, A managerial Perspective on Analytics. Sharda, R, Delen D, Turban E.Pearson. 2014

Reference Books:

1. Data Mining Techniques. For Marketing, Sales and Customer Relationship Management Berry M.&Linoff G. Wiley Publishing Inc 2004
2. Data Science for Business, Foster Provost and Tom Fawcett, O'Reilly Media,Inc2013

E-Books / Web References

1. https://www.youtube.com/watch?v=3DTFmMNiGlg
2. https://www.youtube.com/watch?v=Hg8zBJ1DhLQ



MOOCs

1. https://online-em.isb.edu/applied-business-analytics

2. https://www.udemy.com/course/the-business-intelligence-analyst-course-2018

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO704D.1	3	2	2						2		2		1	
CO704D.2	3	2	2						2		2		1	
CO704D.3	3	2	2						2		2		1	
CO704D.4	3	2	2						2		2		1	
CO704D.5	3	2	2						2		2		1	
Average	**3**	**2**	**2**						**2**		**2**		**1**	

Low-1: Medium-2: High-3

Scheme of Evaluation:

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 four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three tests are to be conducted for 40 marks each. Average of all three tests marks is added to the test component. In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the Alternative Assessment Tool (AAT). The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices. Possible AATs are – seminar / assignments / term paper / open ended experiments / mini-projects/group activity or any other.

Table: Distribution of weightage for CIE & SEE

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	AAT	**5**	
	AAT	**5**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

SEMESTER – VII

SUBJECT: R PROGRAMMING

Subject Code	**CML23705A**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**3hrs**
No. of Credits: 3			

Course Learning Objectives:

The course will enable students to:

CLO1	Explore and understand how R and R Studio interactive environment.
CLO2	To learn and practice programming techniques using R programming.
CLO3	Read Structured Data into R from various sources.
CLO4	Understand the different data Structures, data types in R.
CLO5	To develop small applications using R Programming

CONTENTS	# of Hours / RBT Levels
MODULE 1 Numeric, Arithmetic, Assignment, and Vectors: R for Basic Math, Arithmetic, Variables, Functions, Vectors, Expressions and assignments Logical expressions. **Textbook 1: Chapter 2(2.1 to 2.7)**	**8** **L3**
MODULE 2 Matrices and Arrays: Defining a Matrix, Sub-setting, Matrix Operations, Conditions and Looping: if statements, looping with for, looping with while, vector-based programming. **Textbook 1: Chapter 2- 2.8, chapter 3- 3.2 to 3.5**	**8** **L3**
MODULE 3 Lists and Data Frames: Data Frames, Lists, Special values, The apply family. **Textbook 1: Chapter 6- 6.2 to 6.4**	**8** **L3**
MODULE 4 Functions: Calling functions, scoping, Arguments matching, writing functions: The function command, Arguments, specialized function. **Textbook 1: Chapter 5- 5.1 to 5.6**	**8** **L3**
MODULE 5 Pointers: packages, frames, de bugging, manipulation of code, compilation of the code. **Textbook 1: Chapter 8- 8.1 to 8.8**	**8** **L3**

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

CO705A.1	To understand the fundamental syntax of R through readings, practice exercises,
CO705A.2	To demonstrations, and writing R code using arrays and matrix.
CO705A.3	To apply critical programming language concepts such as data types, iteration.
CO705A.4	To understand control structures, functions, and Boolean operators by writing R programs and through examples
CO705A.5	To import packages and frames and debugging R program

Textbooks:

1. Jones, O.Maillardet. R. and Robinson, A. (2014). Introduction to Scientific Programming and Simulation Using R. Chapman & Hall/CRC, The R Series

Reference Books:

1. Michael J. Crawley, "Statistics: An Introduction using R", Second edition, Wiley,2015 .

E-Books / Web References

1. Wickham, H. & Grolemund, G. (2018). for Data Science. O'Reilly: New York. Available for free at http://r4ds.had.co.nz

MOOCs

1. https://onlinecourses.nptel.ac.in/noc19_ma33/preview

2. https://www.coursera.org/learn/r-programming

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO705A.1	3	3	3						2				2	2
CO705A.2	3	3	3						2				2	2
CO705A.3	3	3	3						2				2	2
CO705A.4	3	3	3						2				2	2
CO705A.5	3	3	3						2				2	2
Average	**3**	**3**	**3**						**2**				**2**	**2**

Low-1: Medium-2: High-3

Scheme of Evaluation:
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 four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three tests are to be conducted for 40 marks each. Average of all three tests marks is added to the test component. In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the Alternative Assessment Tool (AAT). The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices. Possible AATs are – seminar / assignments / term paper / open ended experiments / mini-projects/group activity or any other.

Table: Distribution of weightage for CIE & SEE

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	AAT	**5**	
	AAT	**5**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

SEMESTER – VII

SUBJECT: JAVA PROGRAMMING

Subject Code	**CML23705B**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**3hrs**
No. of Credits: 3			

Course Learning Objectives:

The course will enable students to:

CLO1	Learn fundamental features of object-oriented language and JAVA.
CLO2	To create, debug and run simple Java programs.
CLO3	Learn object-oriented concepts using programming examples.
CLO4	Study the concepts of importing of packages and exception handling mechanism.
CLO5	Discuss the String Handling examples with Object Oriented concepts

CONTENTS	**# of Hours / RBT Levels**
MODULE 1 **An Overview of Java:** Object-Oriented Programming, A First Simple Program, A Second Short Program, Two Control Statements, Using Blocks of Code, Lexical Issues, The Java Class Libraries. Data Types, Variables, and Arrays: Java Is a Strongly Typed Language, The Primitive Types, Integers, Floating-Point Types, Characters, Booleans, A Closer Look at Literals, Variables, Type Conversion and Casting, Automatic Type Promotion in Expressions, Arrays, A Few Words About Strings **Textbook 1: Ch 2,Ch 3**	**8** **L3**
MODULE 2 **Operators:** Arithmetic Operators, The Bitwise Operators, Relational Operators, Boolean Logical Operators, The Assignment Operator, The ? Operator, Operator Precedence, Using Parentheses, Control Statements: Selection Statements, Iteration Statements, Jump Statements. **Textbook 1: Ch 4, Ch 5.**	**8** **L3**

MODULE 3 **Introducing Classes:** Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, The this Keyword, Garbage Collection, The finalize( ) Method, A Stack Class. A Closer Look at Methods and Classes: Overloading Methods, Using Objects as Parameters, A Closer Look at Argument Passing, Returning Objects, Recursion, Introducing Access Control, understanding static, Introducing final, Arrays Revisited. Inheritance: Inheritance, Using super, Creating a Multilevel Hierarchy, When Constructors Are Called, Method Overriding **Textbook 1: Ch 6, Ch 7.1-7.9,Ch 8.1-8.5**	**8** **L3**
MODULE 4 **Packages and Interfaces:** Packages, Access Protection, Importing Packages, Interfaces. Exception Handling: Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, finally, Java's Built -in Exceptions, Creating Your Own Exception, Subclasses, Chained Exceptions, Using Exceptions **Textbook 1: Ch 9,Ch 10.**	**8** **L3**
MODULE 5 **Enumerations:** Enumerations, Type Wrappers. 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 , Additional String Methods, StringBuffer,StringBuilder. **Textbook 1: Ch 12.1,12.2,Ch 15**	**8** **L3**

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

CO705B.1	Develop JAVA programs using OOP principles and proper program structuring.
CO705B.2	Develop JAVA program using packages, inheritance and interface.
CO705B.3	Develop JAVA programs to implement error handling techniques using exception handling
CO705B.4	Demonstrate string handling concepts using JAVA.
CO705B.5	Experiment with JavaScript to develop dynamic web pages and validate forms.

Textbooks:

1. Herbert Schildt, Java The Complete Reference, 7th Edition, Tata McGraw Hill, 2007. (Chapters 2, 3, 4, 5, 6,7, 8, 9,10, 12,15)

Reference Books:

1. Mahesh Bhave and Sunil Patekar, "Programming with Java", First Edition, Pearson Education,2008, ISBN:9788131720806.

2. Rajkumar Buyya,S Thamarasiselvi, xingchen chu, Object oriented Programming with java, Tata McGraw Hill education private limited.
3. E Balagurusamy, Programming with Java A primer, Tata McGraw Hill companies.
4. Anita Seth and B L Juneja, JAVA One step Ahead, Oxford University Press, 2017.

E-Books / Web References

1. https://www.iitk.ac.in/esc101/share/downloads/javanotes5.pdf
2. https://www.freebookcentre.net/JavaTech/Free-Java-Basic-books-download.html

MOOCs

1. https://onlinecourses.nptel.ac.in/noc19_cs84/preview
2. https://www.udemy.com/course/the-complete-java-course-go-from-begginer-to- advanced/?couponCode=IND21PM

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO705B.1	3	3	2									2	3	
CO705B.2	3	3	2									2	3	
CO705B.3	3	3	2									2	3	
CO705B.4	3	3	2									2	3	
CO705B.5	3	3	2									2	3	
Average	**3**	**3**	**2**									**2**	**3**	

Low-1: Medium-2: High-3

Scheme of Evaluation:

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 four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three tests are to be conducted for 40 marks each. Average of all three tests marks is added to the test component. In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the Alternative Assessment Tool (AAT). The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices. Possible AATs are – seminar / assignments / term paper / open ended experiments / mini-projects/group activity or any other.

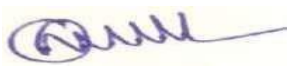


Table: Distribution of weightage for CIE & SEE

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	AAT	**5**	
	AAT	**5**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

SEMESTER – VII

SUBJECT: FUNDAMENTALS OF IOT

Subject Code	**CML23705C**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	SEE Marks	**50**
Total Hours	**40**	**Examination Hours**	**3**
No. of Credits: 3			

Course Learning Objectives:

The course will enable students to:

CLO1	To introduce the terminology, technology and its applications
CLO2	To introduce the concept of M2M (machine to machine) with necessary protocols
CLO3	To introduce the Python Scripting Language which is used in many IoT devices
CLO4	To introduce the Raspberry PI platform, that is widely used in IoT applications

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Introduction to Internet of Things** Definition and Characteristics of IoT, Physical Design of IoT IoT Protocols, IoT communication models, Iot Communication APIs IoT enabled Technologies Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Templates Domain Specific IoTs Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle **Text Book:1 Chapter:1.1 to 1.9**	8 L3
MODULE 2 **IoT and M2M** Software defined networks, network function virtualization, difference between SDN and NFV for IoT Basics of IoT System Management with NETCOZF, YANG- NETCONF, YANG, SNMP NETOPEER **Text Book:1 Chapter:2.1 to 2.5 and 3.1 to 3.3**	8 L3
MODULE 3 **Communication:** Machine-to-Machine Communications, Difference between IoT and M2M, Interoperability in IoT, Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino **Text Book:1 Chapter: 4.1 to 4.8**	8 L3

MODULE 4 **IoT Physical Devices and Endpoints -** Introduction to Raspberry PI-Interfaces (serial, SPI, I2C) Programming Python program with Raspberry PI with focus of interfacing external gadgets, controlling output, reading input from pins **Text Book:1 Chapter:5.1 to 5.9**	8 L3
MODULE 5 IoT Physical Servers and Cloud Offerings,Introduction to Cloud Storage models and communication APIs Webserver Web server for IoT, Cloud for IoT, Python web application framework Designing a RESTful web API **Text Book:1 Chapter:7.1 to 7.8**	8 L3

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

CO705C.1	Interpret the impact and challenges posed by IoT networks leading to new architectural models
CO705C.2	Compare and contrast the deployment of smart objects and the technologies to connect them to network
CO705C.3	Appraise the role of IoT protocols for efficient network communication
CO705C.4	Elaborate the need for Data Analytics and Security in IoT
CO705C.5	Illustrate different sensor technologies for sensing real world entities and identify the applications of IoT in Industry

Text books:

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti,UniversitiesPress, 2015, ISBN: 9788173719547

References Book:

1. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350229759

MOOCs

1. https://www.udemy.com/course/internet-of-things-iot-fundamentals/

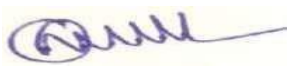
2. https://www.coursera.org/specializations/iot

3. https://www.coursera.org/courses?query=internet%20of%20things%20(iot)

E-Books:

1. https://books.google.co.in/books/about/Internet_of_Things.html?id=JPKGBAAAQBAJ&printsec=frontc over&source=kp_read_button&redir_esc=y#v=onepage&q&f=false

Mapping of CO-PO:



CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO705C.1	3	2	3											2
CO705C.2	3	2	1										1	
CO705C.3	3	2	1		2			1					1	
CO705C.4	3	2	2										1	2
CO705C.5	3	3	3		2			1					1	2
Average	**3**	**2**	**2**		**2**			**1**			**2**		**1**	**2**

Low-1: Medium-2: High-3

Scheme of Evaluation:

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 four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three tests are to be conducted for 40 marks each. Average of all three tests marks is added to the test component. In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the Alternative Assessment Tool (AAT). The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices. Possible AATs are – seminar / assignments / term paper / open ended experiments / mini-projects/group activity or any other.

Table: Distribution of weightage for CIE & SEE

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	AAT	**5**	
	AAT	**5**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

SEMESTER – VII

SUBJECT: DIGITAL IMAGE PROCESSING

Subject Code	**CML23705D**	**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	Provide the student with the fundamentals of digital image processing
CLO2	Image segmentation using Open CV.
CLO3	Introduce the students to some advanced topics in digital image processing
CLO4	Give the students a useful skill base that would allow them to carry out further study should they be interested and to work in the field

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Introduction to Image processing:** overview, Nature of IP, IP and its related fields, Digital Image representation, types of images. **Digital Image Processing Operations:** Basic relationships and distance metrics, Classification of Image processing Operations. **Text book 1: Chapter :1.1 to 1.10**	8 L3
MODULE 2 **Image Segmentation:** Introduction, classification, detection of discontinuities, Edge detection (up to canny edge detection(included)). **Image Enhancement:** Frequency and Spatial Domain, Colour transformation and segmentation, Error free and lossy compression. **Text Book 2: Chapter 9: 9.1 to 9.8**	8 L3

MODULE 3 **Digital image fundamentals & Image Transforms:** Digital Image fundamentals, Sampling and quantization, Relationship between pixels. Image Transforms: 2-D FFT, Properties. Walsh transform, Hadamard Transform, Discrete cosine Transform, Discrete Wavelet Transform **Text Book-1 Chapter :2.1 to 2.8**	8 L3
MODULE 4 **Morphological Image Processing:** Detection of discontinuities. Edge linking and boundary detection, Thresholding, Region oriented segmentation Morphological Image Processing: Dilation and Erosion, Dilation, Structuring Element Decomposition, Erosion, Combining Dilationand Erosion, Opening and Closing, The Hit or Miss Transformation. **Text Book-1 Chapter :6.1 to 6.9**	8 L3
MODULE 5 Image Compression: Redundancies and their Removal Methods, Fidelity Criteria, Image Compression Models, Huffman and Arithmetic Coding, Error Free Compression, Lossy Compression, Lossy and Lossless Predictive Coding, Transform Based Compression, JPEG 2000 Standards **Text Book-1 Chapter :8.1 to 8.9**	8 L3

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

CO705D.1	Apply OpenCV for developing Image processing applications
CO705D.2	Apply Image segmentation techniques along with programming, using OpenCV, for developing simple applications.
CO705D.3	Be able to implement basic image processing algorithms in MATLAB
CO705D.4	Understanding that is the foundation for most of the work currently underway in this field
CO705D.5	Implementation of image coding algorithms for vision

Text books:

1. Digital Image Processing- Rafeal C. Gonzalez, Richard E. Woods, 3rd Edition, Pearson, 2008
2. S. Sridhar, Digital Image Processing, second edition, Oxford University press 2016.

Reference Books:

1. Introduction to Digital Image Processing with Matlab, Alasdair McAndrew, Thomson Course Technology
2. Fundamentals of Digital Image Processing-A.K. Jain, PHI,1989
3. Digital Image Processing and computer Vision-Somka, Halavac, Boyle - Cengage learning (Indian edition)2008

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/

E-Books:

2. https://sde.uoc.ac.in/sites/default/files/sde_videos/Digital%20Image%20Processing%203rd%20ed.%20-%20R.%20Gonzalez, %20R.%20Woods-ilovepdf-compressed.pdf

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO705D.1	2	3	3		3				3					
CO705D.2	2	3	3		3				3					
CO705D.3	2	3	3		3				3					
CO705D.4	2	3	3		3				3					3
CO705D.5	2	3	3		3				3					3
Average	**2**	**3**	**3**		**3**				**3**					**3**

Low-1: Medium-2: High-3

Scheme of Evaluation:
Semester End Examination (SEE):

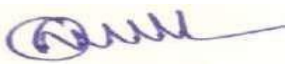
SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full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

Continuous Internal Evaluation (CIE):

Three tests are to be conducted for 40 marks each. Average of all three tests marks is added to the test component. In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the Alternative Assessment Tool (AAT). The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices. Possible AATs are – seminar / assignments / term paper / open ended experiments / mini-projects/group activity or any other.

Table: Distribution of weightage for CIE & SEE

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	AAT	**5**	
	AAT	**5**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**



SEMESTER –VII

Major Project Phase-II

Semester:	**07**	**CIE Marks:**	**100**
Course Code:	**CMLP23706**	**SEE Marks:**	**100**
Hours/Week (L: T: P):	**12 Hous/Week**	**Duration of SEE (hours):**	**3**
Credits: 06			

Course Learning Objectives: The students will be able to	
1.	Acquire the ability to make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task.
2.	Acquire the skills to communicate effectively and to present ideas clearly and coherently to a specific audience in both written and oral forms.
3.	Acquire collaborative skills through working in a team to achieve common goals.
4.	Self-learn, reflect on their learning and take appropriate action to improve it.
5.	Prepare schedules and budgets and keep track of the progress and expenditure.

CIE procedure for Project Work Phase - II:

a. 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 phase -2, shall be based on the evaluation of project work phase -2 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 using Rubrics.

b. 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 phase -2, shall be based on the evaluation of project work phase -2 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 as per Rubrics covering all Program Outcomes.

SEE for Project Work Phase - II:

a. Single discipline: Contribution to the project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted at the department.

b. Interdisciplinary: Contribution to the project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted separately at the departments to which the student/s belong.

Course Outcomes of Major Project:	
1	Apply knowledge of mathematics, science and engineering to solve respective engineering domain problems.
2	Design, develop, present and document innovative/multidisciplinary modules for a complete engineering system.
3	Use modern engineering tools, software and equipment to solve problem and engage in life-long learning to follow technological developments.
4	Function effectively as an individual, or leader in diverse teams, with the understanding of professional ethics and responsibilities.

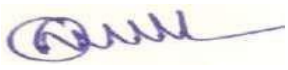


Table 1: Distribution of weightage for CIE & SEE

	Component	Marks	Total Marks
CIE	Review-1	**100**	**100**
	Review-2		
SEE	Semester End Examination	**100**	**100**
Grand Total			200

SEMESTER –VIII

INTERNSHIP

Course Code:	**CMLI23803**	**CIE Marks:**	**100**
Hours/Week (L: T: P):	**0:0:12**	**SEE Marks:**	**100**
Credits:	**10**	**SEE Duration:**	**3 Hrs**
Type of Course:	**INT**		

Guidelines for Internship

1. The duration of the internship shall be for a period of 14-20 weeks on full time basis after VII semester final exams.
2. The student must submit letters from the industry clearly specifying his / her name and the duration of the internship on the company letter head with authorized signature.
3. Internship must be related to the field of specialization of the respective UG programme in which the student has enrolled.
4. Students undergoing internship training are advised to report their progress and submit periodic progress reports to their respective guides.
5. Students have to present the internship activities carried out to the departmental committee and only upon approval by the committee, the student can proceed to prepare and submit the hard copy of the final internship report. However, interim or periodic reports as required by the industry / organization can be submitted as per the format acceptable to the respective industry /organizations.
6. The reports shall be printed on A4 size with 1.5 spacing and Times New Roman with font size 12, outer cover of the report (wrapper) has to be Ivory color for UG circuit Programs and Light Blue for Non-Circuit Programs.
7. The broad format of the internship final report shall be as follows
    - Cover Page
    - Certificate from College
    - Certificate from Industry / Organization
    - Acknowledgement
    - Synopsis
    - Table of Contents
    - Chapter 1 - Profile of the Organization: Organizational structure, Products, Services, Business Partners, Financials, Manpower, Societal Concerns, Professional Practices,
    - Chapter 2 - Activities of the Department
    - Chapter 3 - Tasks Performed: summaries the tasks performed
    - Chapter 4 – Reflections: Highlight specific technical and soft skills that you acquired during internship
    - References & Annexure

Course Outcomes:

Upon successful completion of internship the student will be able to

CO1	Apply engineering and management principles
CO2	Analyze real-time problems and suggest alternate solutions
CO3	Communicate effectively and work in teams
CO4	Imbibe the practice of professional ethics and need for lifelong learning.

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

High-3: Medium-2: Low-1

Scheme of Evaluation:

The evaluation committee shall consist of Guide, Professor/Associate Professor and Assistant Professor. The committee shall assess the presentation and the progress reports in two reviews.

The evaluation criteria shall be as per the rubrics given below:

Continuous Internal Evaluation (CIE):

Reviews	**Activity**	**Weightage**
Review-I	Explanation of the application of engineering knowledge in industries, ability to comprehend the functioning of the organization/ departments	45%
Review- II	Importance of resource management, environment and sustainability presentation skills and report writing	55%

Semester End Evaluation (SEE):

The SEE examination shall be conducted by an external examiner (domain expert) and an internal examiner. Evaluation shall be done in batches, not exceeding 6 students per batch.

ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ
("ವಿ ಟಿ ಯು ಅಧಿನಿಯಮ 1994"ರ ಅಡಿಯಲ್ಲಿ ಕರ್ನಾಟಕ ಸರ್ಕಾರದಿಂದ ಸ್ಥಾಪಿತವಾದ ರಾಜ್ಯ ವಿಶ್ವವಿದ್ಯಾಲಯ)
VISVESVARAYA TECHNOLOGICAL UNIVERSITY
(State University of Government of Karnataka Established as per the VTU Act, 1994)
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REGISTRAR
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Fax: (0831) 2405467

REF: VTU/BGM/BoS/Internship/609/2023-24/ 2080 DATE: - 6 AUG 2024

CIRCULAR

Sir/ Madam,

Subject: Modified 2022 Scheme to provide options for INTERNSHIP regarding

Reference:

1. Joint Board of Studies proceedings dated 03.01.2024
2. Special Committee to decide the guideline for one-year duration Internship leading to project proceeding dated 31.01.2024
3. Joint Board of Studies proceedings dated 21.06.2024
4. 174th EC 07.10.2023 SEC in place of Internship
5. 178th EC dated 17.07.2024 Proceeding no. 2.2.1
6. The Hon'ble Vice-Chancellor's approval dated: 06.08.2024

Internships are crucial for connecting academic learning with professional employment. They provide valuable experiences and opportunities for career exploration, contributing to personal development, skill acquisition, educational enhancement, professional growth, career clarity, and job market readiness.

Considering the recommendations of the Joint Board of Studies, the 2022 curriculum for the 7th and 8th semesters has been modified to include the option of internships as listed below:

1. **Scheme A:** According to the teaching and examination plan, the Professional Elective Courses (online), Open Elective Courses (online), and a 14–15-week Internship (Bxx803) are scheduled for the eighth semester. Meanwhile, the Project Work (Bxx786) and other theory courses (Bxx701–703, 714x, and 755x) are allocated to the seventh semester. (**Annexure-I**)
    a. However, students who do not secure an internship can opt for **Skill Enhancement Courses (SEC)**, which offer credits equivalent to those of the internship. These SECs are available at online.vtu.ac.in (as per the 174th EC proceeding).
    b. Students choosing Skill Enhancement Courses (SEC) are **not eligible** to take up Scheme B.
    c. Scheme A: **Swappable VII and VIII semesters** to accommodate all the students for the internship. In the ODD semester, 50% of the final-year students can choose to take eighth-semester courses (PEC, OEC, and internship). In contrast, the remaining students can take project work along with the theory courses of the seventh semester. In the EVEN semester, the roles are reversed.
    d. The students with the backlogs or without backlogs are eligible to take up scheme A.

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2. **Scheme B:**This scheme is designed for the following aspirants (**Annexure-I**);
    a. Students who would like to pursue a minimum two-semester **industry internship that leads to project work.**
    b. Students who would like to pursue a minimum two-semester **industry internship that leads to a start-up**.
    c. Students who seek a minimum two-semester **research internship** that leads to project work, with paper publications in **UGC journals / Scopus-indexed journals**.
    d. Students can also register if they are selected by the university or college placement cell for a one-year salaried internship at a company, industry, or organization that will result in job confirmation. Such students complete the project work individually under the guidance of a guide or mentor, along with placement training.
3. Students who **do not have any backlog** courses or subjects from previous semesters and whose **CGPA is 6.0** when they take admission to the 5th semester are eligible for Scheme B. All subjects in the 1st to 4th semesters must have been passed on the first attempt.
4. In the present 2022 scheme, for the 7th-semester subjects (BXX701, 702, 703, and 714x), students must take subjects in the 5th semester, complying with registration **clause** 20OB3.6.2(maximum credits to register is 28 credits). The remaining subjects can be taken in the 6th semester (or only subject 703 in the 6th semester and 714x, the professional elective courses, can be opted for as online courses in the 7th semester). Students must study and pass these courses or subjects before being admitted to the 7th semester. The credits for these subjects are recorded in the 7th-semester grade card.
5. If students are not able to pass BXX701, 702, and 703, they are not eligible for Scheme B. They can continue with Scheme A; however, if they pass one or two of the subjects BXX701, 702, and 703, they do not need to retake and qualify in the 7th semester again. Passed subject credits will be recorded in the 7th-semester grade card.
6. The student(s) can take an internship leading to the project work for the duration of the 7th and 8th semesters, following the guidelines given for the same (**AnnexureII**).
7. Students must take the examination for the internship and project work at the end of the 8th semester, according to the examination timetable published by the university. They must also study and pass the BoS-recommended online courses available at www.online.vtu.ac.in in place of two Professional Elective Courses (PEC) and two Open Elective Courses (OEC) during the 7th or 8th semester.

All principals of affiliated or constituent engineering colleges and chairpersons of university departments are requested to take note of this information and ensure that the content of the Notification and Annexure-I is communicated to all students.

Sd/-

REGISTRAR

To,

All the Principals of Engineering Colleges under the ambit of the University
All the Chairpersons/Program Coordinators of University Departments at Kalburgi, Mysuru, Bengaluru, and Belagavi

Copy to

- The Hon'ble Vice-Chancellor through the secretary to VC for information
- The Registrar (Evaluation) for information and needful
- The Director, ITI,SMU,VTU Belagavi for information and needful also request to upload the circular on the University website
- The Special Officer QPDS section of VTU Belagavi for information and needful
- Special Officer, COE Mysuru for information and upload the circular on thewebsite online.vtu.ac.in
- Office copy

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REGISTRAR 6/12/24