South Indian Education Society's

Graduate School of Technology

NAAC 'A+', NBA Accredited (EXTC, CE, IT)

Autonomous Institute Affiliated to University of Mumbai

Department of Computer Science and Engineering
(IoT and Cyber Security including Blockchain Technology)

Curriculum Structure FE to B.E

and

Second Year Syllabi

Board of Studies
Department of Computer Science and Engineering (IoT and Cyber Security including Blockchain Technology)

Academic Council
SIES Graduate School of Technology

Effective from: AY 2025-26

PREAMBLE

Dear Students and Stakeholders,

It is with great pleasure and honor to introduce the newly developed autonomous curriculum at the SIES Graduate School of Technology's Department of Computer Science & Engineering (IoT & Cyber Security including Blockchain Technology). This cutting-edge program is designed to equip students with the knowledge and skills required to excel in this dynamic and rapidly evolving field.

The curriculum has been meticulously crafted using a top-down approach. It begins with a well-defined set of learning objectives, followed by content design that aligns with these objectives. The integration of experiential learning through projects, skill laboratories, internships, and industry collaborations is a key feature. Additionally, the program outcomes have been mapped to specific courses, setting the stage for continuous evaluation and improvement. The process starts with stakeholder consultation to identify industry requirements, leading to the introduction of four honors/minor tracks: AIML, Data Science, Augmented Reality and Virtual Reality, and Robotics.

Aligned with the transformative vision of the National Education Policy (NEP) 2020, our program aims to provide students with a comprehensive understanding of core areas like Cyber Security, IoT, and Blockchain Technology. Through multidisciplinary courses, skill labs, and specialized laboratory courses, students acquire the skills needed to tackle complex challenges. Independent laboratory courses teach practical engineering concepts such as Cryptocurrency Technology, Security in Computing, and High-Performance Computing. The curriculum also offers electives in diverse areas like Mobile Security and Penetration Testing, Data Analytics and Visualization, and Natural Language Processing to cater to a broad range of interests.

The autonomous curriculum provides educators with numerous opportunities to innovate and enhance the student learning experience. Collaborations with industry associations are encouraged to enrich the curriculum with relevant projects, internships, and guest lectures. Overall, curriculum autonomy empowers educators to play a significant role in shaping how students learn within the field of Computer Science & Engineering, with a focus on IoT, Cyber Security, and Blockchain Technology.

Our goal is to nurture graduates who are prepared to lead, innovate, and serve as global ambassadors of excellence in IoT, Cyber Security, and Blockchain Technology. By fostering creativity, resilience, and curiosity, we aim to equip them to face the challenges of the digital world, contribute to technological advancements, and play a crucial role in securing our interconnected future. We invite all stakeholders to join us in redefining engineering education as we embark on this transformative journey. Together, let's strive for excellence, innovation, and a lasting societal impact.

Chairperson
Board of Studies
Department of Computer Science & Engineering
(IoT & Cyber Security including Blockchain Technology)
SIES Graduate School of Technology

Chairperson
Academic Council
SIES Graduate School of Technology

HEAD of the Department
Computer Science & Engineering
(IOT & Cyber Security Including Block Chain Technology)
SIES. Graduate School of Technology
Sri Chandrasekarendra Saraswathy Vidyapuram
Plot-1-C & E, Sector-V, Nerul, Navi Mumbai-400706

PRINCIPAL
S.I.E.S. GRADUATE SCHOOL OF TECHNOLOGY (AUTONOMOUS)
Plot 1C/D/E, Sri Chandrasekarendra Saraswathy Vidyapuram
Sector V, Nerul, Navi Mumbai - 400 706.

SIES Graduate School of Technology
Department of Computer Science and Engineering
(IoT and Cyber Security including Blockchain Technology)
Bachelor of Engineering

Semester wise Credit distribution structure for Four Year UG Engineering Program - Computer Science and Engineering

(IoT and Cyber Security including Blockchain Technology): One Major, One Minor

Semester		I	II	III	IV	V	VI	VII	VIII	Total Credits
Basic Science Course (BSC)	BSC/ESC	7	6	--	--	--	--	--	--	13
Engineering Science Course (ESC)		9	10	--	--	--	--	--	--	19
Programme Core Course (PCC)	Program Courses	--	--	17	11	12	11	04	--	55
Programme Elective Course (PEC)		--	--	--	--	03	04	07	--	14
Multidisciplinary Minor MDM)	Multidisciplinary Courses	--	--	--	03	04	04	04	--	15
Open Elective (OE) Other than a particular program		--	--	--	--	--	--	03	03	06
Vocational and Skill Enhancement Course VSEC)	Skill Courses	01	01	02	02	--	02	--	--	08
Ability Enhancement Course (AEC -01, AEC-02)	Humanities Social Science and Management (HSSM)	--	02	--	--	02	--	--	--	04
Entrepreneurship/Economics/ Management Courses		--	--	02	02	--	--	--	--	04
Indian Knowledge System (IKS)		--	02	--	--	--	--	--	--	02
Value Education Course (VEC)		--	--	--	02	--	--	--	--	02
Research Methodology (RM)	Experiential Learning Courses	--	--	--	--	--	--	--	03	03
Community Engagement Project (CEP) / Field Project (FP)		--	--	01	01	--	--	--	--	02
Project		--	--	--	--	01	01	02	02	06
Internship/On Job Training (OJT)		--	---	--	--	--	--	--	09	09
Co-curricular Courses (CC)	Liberal Learning Courses	04	--	--	--	--	--	--	--	04
Total Credits (Major)		**21**	**21**	**22**	**21**	**22**	**22**	**20**	**17**	**166**

CURRICULUM STRUCTURE

R-2024

FE - BE
Department of CSE (IoT&CSIBCT)
Academic Year 2025-26

Nomenclature of the courses in the curriculum	
Abbreviation	**Title**
BSC	Basic Science Courses
ESC	Engineering Science Courses
PCC	Program Core Courses
MDM	Multidisciplinary Minor
PEC	Program Elective Course
OE	Open Elective
VSEC	Vocational and Skill Enhancement Course
AEC	Ability Enhancement Course
IKS	Indian Knowledge System
VEC	Value Education Course
RM	Reaserche Methodology
CEP/FP	Community Engagement Project / Field Project
OJT	Internship/On Job Training
CC	Co-curricular Courses
ISE	In Semester Examination
MSE	Mid Semester Examination
ESE	End Semester Examination
CIAP	Continuous Internal Assessment Practical
ESEP	End Semester Examination Practical

SIES Graduate School of Technology
Department of Computer Science and Engineering
(IoT and Cyber Security including Blockchain Technology)
Bachelor of Engineering

Program Structure for First Year Engineering
W.E.F. A.Y. 2024-25
Semester I

Course Code	Course Name	Category	Teaching Scheme (Contact Hours)			Credits Assigned			
			Theory	Pract	Tut.	Theor	Pract.	Tut.	Total
FEC101	Applied Mathematics -I	BSC	3	--	--	3	--	--	3
FEC1021/ FEC1022	Applied Physics/ Applied Chemistry @	BSC	3	--	--	3	--	--	3
FEC103	Basic Electrical & Electronics Engineering	ESC	2	--	--	2	--	--	2
FEC104	C-Programming	ESC	2	--	--	2	--	--	2
FEC105	Applied Mechanics and Robot Dynamics	ESC	2	--	--	2	--	--	2
FEL1011/ FEL1012	Applied Physics Lab/ Applied Chemistry Lab @	BSC	--	1	--	--	0.5	--	0.5
FEL102	Basic Electrical & Electronics Engineering Lab	ESC	--	2	--	--	1	--	1
FEL103	C-Programming Lab	ESC	--	2	--	--	1	--	1
FEL104	Applied Mechanics and Robot Dynamics Lab	ESC	--	2	--	--	1	--	1
FEL105	Engineering Workshop-I	VSEC	--	2	--	--	1	--	1
FEL106	Health, Wellness and Mindfulness	CC	--	2#+2	--	--	2	--	2
FEL107	Induction Cum Universal Human Values	CC	--	5*	--	--	2.5	--	2.5
	Total		**12**	**18**	--	**12**	**9**	--	**21**

Examination Scheme-FY Semester-I

Course Code	Course Name	Examination Scheme						
		Theory				CIAP	ESEP	Total
		Internal Assessment		ESE$	Exam Duration (Hrs.)			
		ISE	MSE					
FEC101	Applied Mathematics -I	20	20	60	3	--	--	100
FEC1021/ FEC1022	Applied Physics/ Applied Chemistry @	20	20	60	3	--	--	100
FEC103	Basic Electrical & Electronics Engineering	15	15	45	2	--	--	75
FEC104	C-Programming	15	15	45	2	--	--	75
FEC105	Applied Mechanics and Robot Dynamics	15	15	45	2	--	--	75
FEL1011/ FEL1012	Applied Physics Lab/ Applied Chemistry Lab@	--	--	--	--	25	--	25
FEL102	Basic Electrical & Electronics Engineering Lab	--	--	--	--	25	25	50
FEL103	C-Programming Lab	--	--	--	--	25	25	50
FEL104	Applied Mechanics and Robot Dynamics Lab	--	--	--	--	25	25	50
FEL105	Engineering Workshop-I	--	--	--	--	25	--	25
FEL106	Health, Wellness and Mindfulness	--	--	--	--	25	--	25
FEL107	Induction Cum Universal Human Values	--	--	--	--	25	--	25
Total		**85**	**85**	**255**		**175**	**75**	**675**

@Physics/Chemistry in one semester.
$ ESE of duration 3 hours are of 80 marks and scaled to 60. ESE duration of 2 hours are of 60 marks and scaled to 45.
Theory 1 credit for 1 hour and practical 1 credit for 2 hours.
*Indicates workload of a learner for UHV. Faculty Load: ½ hour per week per four groups
Two hours of practical class to be conducted for full class as demo/ discussion.
ISE: In Semester Examination: To be conducted in any of these forms - Assignment/ Quiz/ Presentation/ Class Test etc. of 20/15 marks.
MSE: Mid Semester Examination: To be conducted as written examination for 20/15 marks of duration 1 Hr.
ESE: End Semester Examination
CIAP: Continuous Internal Assessment Practical. Term work will be assessed as Continuous Internal Assessment Practical (CIAP).
ESEP: End Semester Examination Practical. Oral/Practical Examination will be conducted as End Semester Examination Practical (ESEP).

SIES Graduate School of Technology (Autonomous)
RISE WITH EDUCATION
NAAC A+

SIES Graduate School of Technology
Department of Computer Science and Engineering
(IoT and Cyber Security including Blockchain Technology)
Bachelor of Engineering

Program Structure for First Year Engineering
W.E.F. A.Y. 2024-25
Semester II

Course Code	Course Name	Category	Teaching Scheme (Contact Hours)			Credits Assigned			
			Theory	Pract.	Tut.	Theor	Pract	Tut.	Total
FEC201	Applied Mathematics -II	BSC	3	--	--	3	--	--	3
FEC2021/ FEC2022	Applied Physics/ Applied Chemistry[@]	BSC	3	--	--	3	--	--	3
FEC203	Engineering Graphics	ESC	2	--	--	2	--	--	2
FEC204	Digital System Design	ESC	3	--	--	3	--	--	3
FEC205	Professional Communication Techniques	AEC	2	--	--	2	--	--	2
FEL2011/ FEL2012	Applied Physics Lab/ Applied Chemistry Lab[@]	BSC	--	1	--	--	0.5	--	0.5
FEL202	Engineering Graphics Lab	ESC	--	2	--	--	1	--	1
FEL203	Digital System Design Lab	ESC	--	2	--	--	1	--	1
FEL204	Professional Communication Techniques Lab	AEC	--	1	--	--	0.5	--	0.5
FEL205	Object Oriented Programming Methodology Lab	ESC	--	2*+2	--	--	2	--	2
FEL206	Engineering Workshop-II	VSEC	--	2	--	--	1	--	1
FEL207	Indian Knowledge System	HSSM	--	2*+2	--	--	2	--	2
	Total		**13**	**16**	--	**13**	**8**	--	**21**

Examination Scheme-FY Semester-II

Course Code	Course Name	Examination Scheme						
		Theory				CIAP	ESEP	Total
		Internal Assessment		ESE[$]	Exam Duration (Hrs.)			
		ISE	MSE					
FEC201	Applied Mathematics -II	20	20	60	03	--	--	100
FEC2021/ FEC2022	Applied Physics/ Applied Chemistry[@]	20	20	60	03	--	--	100
FEC203	Engineering Graphics	15	15	45	03	--	--	75
FEC204	Digital System Design	20	20	60	03	--	--	100
FEC205	Professional Communication Techniques	15	15	45	02	--	--	75
FEL2011/ FEL2012	Applied Physics Lab/ Applied Chemistry Lab[@]	--	--	--	--	25	--	25
FEL202	Engineering Graphics Lab	--	--	--	--	25	25	50
FEL203	Digital System Design Lab	--	--	--	--	25	25	50
FEL204	Professional Communication Techniques Lab	--	--	--	--	25	--	25
FEL205	Object Oriented Programming Methodology Lab	--	--	--	--	25	25	50
FEL206	Engineering Workshop-II	--	--	--	--	25	--	25
FEL207	Indian Knowledge System	--	--	--	--	25	--	25
Total		**90**	**90**	**270**	--	**175**	**75**	**700**

[@]Physics/Chemistry in one semester.
* Two hours of practical class to be conducted for full class as demo/ discussion.
# Course evaluation is an activity based which may be an individual or group of students.
$ ESE of duration 3 hours are of 80 marks and scaled to 60. ESE duration of 2 hours are of 60 marks and scaled to 45.
Theory 1 credit for 1 hour and practical 1 credit for 2 hours.
ISE: In Semester Examination**:** To be conducted in any of these forms - Assignment/ Quiz/ Presentation/ Class Test etc. of 20/15 marks.
MSE: Mid Semester Examination: To be conducted as written examination for 20/15 marks of duration 1 Hr.
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Department of Computer Science and Engineering
(IoT and Cyber Security including Blockchain Technology)
Bachelor of Engineering

Program Structure for Second Year
W.E.F. A.Y. 2025-26
Semester III

Course Code	Course Name	Category	Teaching Scheme (Contact Hours)			Credits Assigned			
			Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
CSEC301	Applied Mathematics III	PCC	3	--	--	3	--	--	3
CSEC302	Data Structures and Algorithms	PCC	3	--	--	3	--	--	3
CSEC303	Discrete Structure and Automata Theory	PCC	3	--	--	3	--	--	3
CSEC304	Database Management System	PCC	3	--	--	3	--	--	3
CSEC305	Computer Organization and Architecture	PCC	2	--	--	2	--	--	2
CSEC306	Engineering Economics	HSSM	2	--	--	2	--	--	2
CSEL301	Data Structures and Algorithms Lab	PCC	--	2	--	--	1	--	1
CSEL302	Database Management System Lab	PCC	--	2	--	--	1	--	1
CSEL303	Computer Organization and Architecture Lab	PCC	--	2	--	--	1	--	1
CSEL304	Skill Base Lab Course (Python Programming)	VSEC	--	2*+2	--	--	2	--	2
CSEM301	Mini Project 1A	CEP	--	2#	--	--	1	--	1
Total			**16**	**12**	**--**	**16**	**6**	**--**	**22**

Examination Scheme - CSE (IoT&CSIBCT) Semester-III

Course Code	Course Name	Examination Scheme						
		Theory				CIAP	ESEP	Total
		Internal Assessment		ESE$	Exam Duration (Hrs.)			
		ISE	MSE					
CSEC301	Applied Mathematics III	20	20	60	3	--	--	100
CSEC302	Data Structures & Algorithms	20	20	60	3	--	--	100
CSEC303	Discrete Structure and Automata Theory	20	20	60	3	--	--	100
CSEC304	Database Management System	20	20	60	3	--	--	100
CSEC305	Computer Organization and Architecture	15	15	45	2	--	--	75
CSEC306	Engineering Economics	50		--	--	--	--	50
CSEL301	Data Structures & Algorithms Lab	--	--	--	--	25	25	50
CSEL302	Database Management System Lab	--	--	--	--	25	25	50
CSEL303	Computer Organization and Architecture Lab	--	--	--	--	25	--	25
CSEL304	Skill Base Lab Course(Python Programming)	--	--	--	--	25	25	50
CSEM301	Mini Project 1A	--	--	--	--	25	25	50
Total		**145**	**95**	**285**	**--**	**125**	**100**	**750**

* Two hours of practical class to be conducted for full class as demo/ discussion.
# Indicates workload of a learner (Not faculty) for Mini Project 1A. Faculty Load: ½ hour per week per four groups
$ ESE of duration 3 hours are of 80 marks and scaled to 60. ESE duration of 2 hours are of 60 marks and scaled to 45.

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Bachelor of Engineering

Program Structure for Second Year
W.E.F. A.Y. 2025-26
Semester IV

Course Code	Course Name	Category	Teaching Scheme (Contact Hours)			Credits Assigned			
			Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
CSEC401	Applied Mathematics IV	PCC	3	--	--	3	--	--	3
CSEC402	Operating System	PCC	3		--	3	--	--	3
CSEC403	Computer Network	PCC	3		--	3	--	--	3
CSEC404	Critical Design Thinking	HSSM	2	--	--	2	--	--	2
MDMC40X1	Multidisciplinary Minor (MDM-I)	MDM	3	--	--	3	--	--	3
CSEL401	Operating System Lab	PCC	--	2	--	--	1	--	1
CSEL402	Computer Network Lab	PCC	--	2	--	--	1	--	1
CSEL403	Skill Base Lab Course (Web Technology)	VSEC	--	2*+2	--	--	2	--	2
CSEL404	Value Education Course (UHV)	HSSM (VEC)	--	4	--	--	2	--	2
CSEM401	Mini Project 1B	CEP	--	2#	--	--	1	--	1
Total			**14**	**14**	**--**	**14**	**7**	**--**	**21**

Examination Scheme – CSE(IoT&CSIBCT) Semester-IV

Course Code	Course Name	Examination Scheme						
		Theory				CIAP	ESEP	Total
		Internal Assessment		ESE$	Exam Duration (Hrs.)			
		ISE	MSE					
CSEC401	Applied Mathematics IV	20	20	60	3	--	--	100
CSEC402	Operating System	20	20	60	3	--	--	100
CSEC403	Computer Network	20	20	60	3	--	--	100
CSEC404	Critical Design Thinking	15	15	45	2	--	--	75
MDMC40X1	Multidisciplinary Minor (MDM-I)	20	20	60	3	--	--	100
CSEL401	Operating System Lab	--	--	--	--	25	25	50
CSEL402	Computer Network Lab	--	--	--	--	25	25	50
CSEL403	Skill Base Lab Course (Web Technology)	--	--	--	--	25	25	50
CSEL404	Value Education Course (UHV)	--	--	--	--	50	--	50
CSEM401	Mini Project 1B					25	25	50
Total		**95**	**95**	**285**	**--**	**150**	**100**	**725**

* Two hours of practical class to be conducted for full class as demo/ discussion.
# Indicates workload of a learner (Not faculty) for Mini Project 1B. Faculty Load: ½ hour per week per four groups
$ ESE of duration 3 hours are of 80 marks and scaled to 60. ESE duration of 2 hours are of 60 marks and scaled to 45.

SIES Graduate School of Technology
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Bachelor of Engineering

Program Structure for Third Year
W.E.F. A.Y. 2026-27
Semester V

Course Code	Course Name	Category	Teaching Scheme (Contact Hours)			Credits Assigned			
			Theory	Pract	Tut.	Theory	Pract.	Tut.	Total
CSEC501	Cryptography and Network Security	PCC	3	--	--	3	--	--	3
CSEC502	IoT Architecture and Protocols	PCC	3	--	--	3	--	--	3
CSEC503	Introduction to Blockchain Technology	PCC	3	--	--	3	--	--	3
MDMC50X2	Multidisciplinary Minor (MDM-II)	MDM	3	--	--	3	--	--	3
CSEPEC501X	Program Elective-I	PEC	3	--	--	3	--	--	3
CSEL501	Cryptography and Network Security Lab	PCC	--	2	--	--	1	--	1
CSEL502	IoT Architecture and Protocols Lab	PCC	--	2	--	--	1	--	1
CSEL503	Blockchain Technology Lab	PCC	--	2	--	--	1	--	1
CSEL504	Principle of Communication Ethics	HSSM (AEC)	--	2*+2	--	--	2	--	2
MDML50X1	Multidisciplinary Minor -1 Lab	MDM	--	2	--	--	1	--	1
CSEM501	Mini Project 2A	MP	--	2#	--	--	1	--	1
Total			**15**	**14**	**--**	**15**	**7**	**--**	**22**

Examination Scheme - CSE (IoT&CSIBCT) Semester-V

Course Code	Course Name	Examination Scheme						
		Theory				CIAP	ESEP	Total
		Internal Assessment		ESE$	Exam Duration (Hrs.)			
		ISE	MSE					
CSEC501	Cryptography and Network Security	20	20	60	3	--	--	100
CSEC502	IoT Architecture and Protocols	20	20	60	3	--	--	100
CSEC503	Introduction to Blockchain Technology	20	20	60	3	--	--	100
MDMC50X2	Multidisciplinary Minor (MDM-II)	20	20	60	3	--	--	100
CSEPEC501X	Program Elective-I	20	20	60	3	--	--	100
CSEL501	Cryptography and Network Security Lab	--	--	--	--	25	25	50
CSEL502	IoT Architecture and Protocols Lab	--	--	--	--	25	25	50
CSEL503	Blockchain Technology Lab	--	--	--	--	25	25	50
CSEL504	Principle of Communication Ethics	--	--	--	--	50	--	50
MDML50X2	Multidisciplinary Minor ((MDM-II) Lab	--	--	--	--	25	--	25
CSEM501	Mini Project 2A	--	--	--	--	25	25	50
Total		**100**	**100**	**300**	**--**	**175**	**100**	**775**

* Two hours of practical class to be conducted for full class as demo/ discussion.
# Indicates workload of a learner (Not faculty) for Mini Project 2A. Faculty Load: ½ hour per week per four groups
$ ESE of duration 3 hours are of 80 marks and scaled to 60. ESE duration of 2 hours are of 60 marks and scaled to 45.

Program Elective – I

Technology Bucket			
IoT	**Blockchain Technology**	**Cyber Security**	**Data Science**
CSEPEC5011: IoT Systems Processors	**CSEPEC5012:** Bitcoin & Cryptocurrency	**CSEPEC5013:** Malware Analysis	**CSEPEC5014:** Data ware housing and Mining

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W.E.F. A.Y. 2026-27
Semester VI

Course Code	Course Name	Category	Teaching Scheme (Contact Hours)		Credits Assigned		
			Theory	Pract.	Theory	Pract.	Total
CSEC601	Internet Of Everything	PCC	3	--	3	--	3
CSEC602	Advance Blockchain	PCC	3	--	3	--	3
CSEC603	Ethical Hacking	PCC	3	--	3	--	3
MDMC60X3	Multidisciplinary Minor (MDM-III)	MDM	3	--	3	--	3
CSEPEC601X	Program Elective-II	PEC	3	--	3	--	3
CSEL601	Internet Of Everything Lab	PCC	--	2	--	1	1
CSEL602	Ethical Hacking Lab	PCC	--	2	--	1	1
CSEL603	Cloud Computing and Cloud Security Lab	VSEC	--	2*+2	--	2	2
MDML60X3	Multidisciplinary Minor (MDM-III) Lab	MDM	--	2	--	1	1
CSEPEL601X	Program Elective-II Lab	PEC	--	2	--	1	1
CSEM601	Mini Project 2B	MP	--	2#	--	1	1
Total			**15**	**14**	**15**	**7**	**22**

Examination Scheme - CSE(IoT&CSIBCT) Semester-VI

Course Code	Course Name	Examination Scheme						
		Theory				CIAP	ESE P	Total
		Internal Assessment		ESE[$]	Exam Duration (Hrs.)			
		ISE	MSE					
CSEC601	Internet Of Everything	20	20	60	3	--	--	100
CSEC602	Advance Blockchain	20	20	60	3	--	--	100
CSEC603	Ethical Hacking	20	20	60	3	--	--	100
MDMC60X3	Multidisciplinary Minor (MDM-III)	20	20	60	3	--	--	100
CSEPEC601X	Program Elective-II	20	20	60	3	--	--	100
CSEL601	Internet Of Everything Lab	--	--	--	--	25	25	50
CSEL602	Ethical Hacking Lab	--	--	--	--	25	25	50
CSEL603	Cloud Computing and Cloud Security Lab	--	--	--	--	25	25	50
MDML60X3	Multidisciplinary Minor (MDM-III) Lab	--	--	--	--	25	--	25
CSEPEL601X	Program Elective-II Lab	--	--	--	--	25	25	50
CSEM601	Mini Project 2B	--	--	--	--	25	25	50
Total		**100**	**100**	**300**	--	**150**	**125**	**775**

* Two hours of practical class to be conducted for full class as demo/ discussion.
#Indicates workload of a learner (Not faculty) for Mini Project 2B. Faculty Load: ½ hour per week per four groups
$ ESE of duration 3 hours are of 80 marks and scaled to 60. ESE duration of 2 hours are of 60 marks and scaled to 45.

Program Elective – II

Technology Bucket			
IoT	**Blockchain Technology**	**Cyber Security**	**Data Science**
CSEPEC6011: Industrial IoT	**CSEPEC6012:** NFT & DeFI	**CSEPEC6013:** Mobile Security and Penetration Testing	**CSEPEC6014:** Data Analytics and Visualization

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W.E.F. A.Y. 2027-28
Semester VII

Course Code	Course Name	Category	Teaching Scheme (Contact Hours)		Credits Assigned		
			Theory	Pract.	Theory	Pract.	Total
CSEC701	Edge / Fog Computing	PCC	3	--	3	--	3
MDMC70X4	Multidisciplinary Minor (MDM-IV)	MDM	3	--	3	--	3
CSEPEC701X	Program Elective -III	PEC	3	--	3	--	3
CSEPEC702X	Program Elective -IV	PEC	3	--	3	--	3
OEC701X	Open Elective-I	OE	3	--	3	--	3
CSEL701	Edge / Fog Computing Lab	PCC	--	2	--	1	1
MDML70X4	Multidisciplinary Minor (MDM-IV) Lab	MDM	--	2	--	1	1
CSEPEL701X	Program Elective –III Lab	PEC	--	2	--	1	1
CSEP701	Major project Stage-I	MJP	--	4#	--	2	2
Total			**15**	**10**	**15**	**5**	**20**

Examination Scheme - CSE (IoT&CSIBCT) Semester-VII

Course Code	Course Name	Examination Scheme						
		Theory				CIAP	ESEP	Total
		Internal Assessment		ESE$	Exam Duration (Hrs.)			
		ISE	MSE					
CSEC701	Edge / Fog Computing	20	20	60	3	--	--	100
MDMC70X4	Multidisciplinary Minor (MDM-IV)	20	20	60	3	--	--	100
CSEPEC701X	Program Elective -III	20	20	60	3	--	--	100
CSEPEC702X	Program Elective -IV	20	20	60	3	--	--	100
OEC701X	Open Elective-I	20	20	60	3	--	--	100
CSEL701	Edge / Fog Computing Lab	--	--	--	--	25	25	50
MDML70X4	Multidisciplinary Minor (MDM-IV) Lab	--	--	--	--	25	25	50
CSEPEL701X	Program Elective –III Lab	--	--	--	--	25	25	50
CSEP701	Major Project Stage-I	--	--	--	--	25	25	50
Total		**100**	**100**	**300**	--	**100**	**100**	**700**

# Indicates workload of Learner (Not faculty), for Major Project
Project Guide Load = ½ hour per week per project group
$ ESE of duration 3 hours are of 80 marks and scaled to 60. ESE duration of 2 hours are of 60 marks and scaled to 45.

Program Elective-III

Technology Bucket			
IoT	**Blockchain Technology**	**Cyber Security**	**Data Science**
CSEPEC7011: IoT for Smart Cities	**CSEPEC7012:** Design A Blockchain Application Architecture	**CSEPEC7013:** Security in Cloud Computing	**CSEPEC7014:** Big Data Analysis

Program Elective-IV

Technology Bucket			
IoT	**Blockchain Technology**	**Cyber Security**	**Data Science**
CSEPEC7021: High Performance Computing	**CSEPEC7022:** Blockchain Ecosystem	**CSEPEC7023:** Writing Secure Code	**CSEPEC7024:** Social Media Analytics

Open Elective -I

Course Code	Course Name
OEC7011	Project Management
OEC7012	Finance Management
OEC7013	Management Information System
OEC7014	Entrepreneurship Development and Management
OEC7015	Operation Research
OEC7016	Disaster Management and Mitigation Measures
OEC7017	Product Design

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Bachelor of Engineering

Program Structure for Fourth Year
W.E.F. A.Y. 2027-28
Semester VIII

Course Code	Course Name	Category	Teaching Scheme (Contact Hours)		Credits Assigned		
			Theory	Pract.	Theory	Pract.	Total
CSEC801	Research Methodology	RM	3	--	3	--	3
OEC801X	Institute Elective-II	OE	3	--	3	--	3
CSEP801	Major project- Stage II	MJP	--	4#	--	2	2
CSEINT801	Internship/ Project /Research	Internship	--	--	--	9	9
Total			**6**	**4**	**6**	**11**	**17**

Examination Scheme – CSE (IoT&CSIBCT) Semester-VIII

Course Code	Course Name	Examination Scheme						
		Theory				CIAP	ESEP	Total
		Internal Assessment		ESE[$]	Exam Duration (Hrs.)			
		ISE	MSE					
CSEC801	Research Methodology	20	20	60	3	--	--	100
OEC801X	Open Elective-II	20	20	60	3	--	--	100
CSEP801	Major Project- Stage II	--	--	--	--	100	50	150
CSEINT801	Internship/ Project /Research	--	--	--	--	200	--	200
Total		**40**	**40**	**120**	**--**	**300**	**50**	**550**

# indicates workload of Learner (Not faculty), for Major Project Project Guide Load = ½ hour per week per project group

$ ESE of duration 3 hours are of 80 marks and scaled to 60. ESE duration of 2 hours are of 60 marks and scaled to 45.

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Open Elective -II

Course Code	Course Name
OEC8011	Enterprise Resource Planning
OEC8012	Cyber Security and Laws
OEC8013	Energy Audit and Management
OEC8014	IPR and Patenting
OEC8015	Environmental Management
OEC8016	Digital Business Management
OEC8017	Human Resource Management

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Multidisciplinary Minor (MDM)

Track	Minor Track	Partner Institute if any	Module	Code	Eligible
1	Machine Learning	SIES GST	Artificial Intelligence	MDMC4011	IT/EXTC/CSE IOT
			Machine Learning	MDMC5012	
			Natural Language Processing	MDMC6013	
			Deep Learning	MDMC7014	
2	Data Science	SIES GST	Statistical Foundation for Data Science	MDMC4021	ECS/CE/EXTC
			Data Analytics & Visualization	MDMC5022	
			Decision Making & Business Intelligence	MDMC6023	
			Big Data Analytics	MDMC7024	
3	Embedded Systems	SIES GST	Microprocessor and Microcontrollers	MDMC4031	CE/AIDS/AIML
			RTOs and Embedded systems	MDMC5032	
			Sensor Technology	MDMC6033	
			Industrial Internet of Things	MDMC7034	
4	Cyber Security	SIES GST	Computer Network	MDMC4041	AIDS/AIML
			Cryptography & System Security	MDMC5042	
			Cloud Computing and Security	MDMC6043	
			Digital Forensics	MDMC7044	
5	System Programming	SIES GST	Advance Data Structure	MDMC4051	CSEIOT/ECS/IT
			Advance Algorithm	MDMC5052	
			System Programming and Compiler Construction	MDMC6053	
			Distributed Systems	MDMC7054	
6	Management	SIESSBS	Cost Management	MDMC4061	EXTC/CE/IT/ECS/AIDS/ AIML/CSE IOT
			Supply Chain Management	MDMC5062	
			HR & Organization	MDMC6063	
			Marketing Management	MDMC7064	

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Bachelor of Engineering

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
CSEC301	Applied Mathematics-III	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE$			
		ISE	MSE				
CSEC301	Applied Mathematics-III	20	20	60	--	--	100

Pre- requisite:

1. FEC101- Applied Mathematics I
2. FEC201 - Applied Mathematics II

Program Outcomes Addressed

1. PO1: Engineering Knowledge
2. PO2: Problem analysis
3. PO3: Design/development of solutions
4. PO4: Conduct investigation of complex problems

Course Objectives:

1. To learn the Laplace transform of various functions and its applications.
2. To learn Inverse Laplace Transform of various functions and its applications.
3. To understand the concept of Fourier Series, its complex form and enhance the problem-solving skill.
4. To understand the concept of complex variables, C-R equations, harmonic functions and their conjugate and mapping in complex plan.
5. To familiarize with the concepts of statistics for data analysis.
6. To acquaint with the concepts of probability, random variables with their distributions and expectations.

Course Outcomes: Learners will be able to

1. Apply the properties of Laplace transform to the functions. Describe the various functions of Physical Layer.
2. Determine inverse Laplace transform using convolution theorem and partial fraction method.
3. Construct the Fourier series of periodic functions for real life problems and complex engineering problems.
4. Apply the concept of complex numbers, complex functions, and their significance in data science and engineering.
5. Evaluate the strength and direction of relationships between variables using correlation and Regression techniques.
6. Apply the concepts of probability and expectation for getting the spread of the data and distribution of the data.

Module No.	Unit No.		Hrs.	CO
1.0		**Laplace Transform**	**07**	
	1.1	Definition of Laplace transform: Condition of Existence of Laplace transform, Laplace Transform (L) of Standard Functions like $e^{at}, \sin(at), \cos(at)$, $\sin h(at)$, $\cos h(at)$ and t^n , $n \geq 0$.		**CO1**
	1.2	Properties of Laplace Transform: Linearity, First shifting theorem, Second Shifting Transform, Change of Scale property, Multiplication by t, Division by t, Laplace Transform of derivatives and integrals (Properties without proof).		
	1.3	Evaluation of integrals for particular value of 's' by using Laplace Transformation.		
		Self-Learning : Heaviside's Unit Step function, Laplace Transform of Periodic functions, Dirac Delta Function.		
2.0		**Inverse Laplace Transform**	**06**	
	2.1	Introduction of Inverse Laplace Transform, Linearity property, Use of standard formulae to find inverse Laplace Transform, finding Inverse Laplace transform using derivatives.		**CO2**
	2.2	Partial fractions method to find inverse Laplace transform		
	2.3	Inverse Laplace transform using Convolution theorem (without proof).		
	2.4	Applications to solve initial and boundary value problems involving ordinary differential equations.		
		Self-Learning : Applications to solve simultaneous initial and boundary value problems involving ordinary differential equations.		
3.0		**Fourier Series**	**07**	
	3.1	Dirichlet's conditions, Definition of Fourier series.		**CO3**
	3.2	Fourier series of periodic functions with period 2π and 2l.		
	3.3	Fourier series of even and odd functions (No examples on Parseval Identity)		
	3.4	Half range Sine and Cosine Series.		
		Self-Learning : Complex form of Fourier Series, Orthogonal and orthonormal set of functions. Fourier Transform.		
4.0		**Complex Variables**	**07**	
	4.1	Function f(z) of complex variable, limit, continuity and differentiability off(z) Analytic function, necessary and sufficient conditions for f(z) to be analytic (without proof).		**CO4**
	4.2	Cauchy-Riemann equations in cartesian coordinates (without proof).		

	4.3	Milne-Thomson method to determine analytic function f (z) when real part (u) or Imaginary part (v) or its combination (u+v or u-v) is given.		
	4.4	Harmonic function, Harmonic conjugate and orthogonal trajectories.		
		Self-Learning : Conformal mapping, linear, bilinear mapping, cross ratio, fixed points and standard transformations.		
5.0		**Statistical Techniques**	**06**	
	5.1	Karl Pearson's Coefficient of correlation (r) and related concepts with problems.		**CO5**
	5.2	Spearman's Rank correlation coefficient (R) (Repeated & non repeated ranks with problems).		
	5.3	Lines of regression.		
		Self-Learning : Covariance.		
6.0		**Probability Theory**	**06**	
	6.1	Total Probability theorem and Bayes' theorem.		**CO6**
	6.2	Discrete and continuous random variable with probability distribution and probability density function.		
	6.3	Expectation, Variance, Laws of expectation.		
	6.4	Moment generating function, Raw and central moments up to 4th order.		
		Self-Learning : Skewness and Kurtosis of distribution (data).		
		Total	**39**	

Textbooks:

1. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley Eastern Limited, 10th Edition 2023-24.
2. Higher Engineering Mathematics, Dr. B. S. Grewal, Khanna Publication, 45th edition.

Reference books:

1. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Narosa Publication, 5th edition.
2. Complex Variables and Applications, Brown and Churchill, McGraw-Hill Education, 9th edition.
3. Probability, Statistics and Random Processes, T. Veerarajan, McGraw-Hill Eduction.
4. Theory and Problems of Fourier Analysis with applications to BVP, Murray Spiegel, Schaum's Outline Series.
5. Advanced Engineering Mathematics – H. K. Dass, S. Chand Publications, 2007.

Online References:

1. https://nptel.ac.in/courses
2. https://www.coursera.org/courses?query=advanced%20engineering%20mathematics

Course Assessment:

ISE:

- To be conducted in any of these forms - Assignment/ Quiz/ Presentation/ Class Test/ Case study etc. of 20 marks.
- ISE 20 marks = 05 marks for attendance + 15 marks for activities.

MSE:

- To be conducted as written examination for 20 marks (on 40% - 50% syllabus)
-

End Semester Examination:

$ ESE of duration 03 hours are of 80 marks and scaled to 60.

1. Question paper will comprise of 03 questions.
2. Question1 (20 marks): - Solve any 04 out of 06. All questions carry 05 marks each.
3. Question 2 (40 marks): - Solve any 04 out of 06. All questions carry 10 marks each.
4. Question3 (20 marks):- Solve any 04 out of 06. All questions carry 05 marks each.
5. All COs should be mapped as per the weightage in the syllabus.

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
CSEC302	Data Structures and Algorithms	03	-	-	03	-	-	03

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE$			
		ISE	MSE				
CSEC302	Data Structures and Algorithms	20	20	60	--	--	100

Pre-requisite:

1. FEC104 -Programming in C

Program Outcome:

1. PO1: Engineering knowledge
2. PO2: Problem analysis
3. PO3: Design/Development of solutions
4. PO4: Conduct investigations of complex problems
5. PO10: Communication
6. PO12: Life-long learning

Course Objectives:

1. To describe linear and Nonlinear data structures.
2. To apply various operations on data structures and select the appropriate one to solve a specific real-world problem.
3. To understand various graph concepts.
4. To discuss searching and Hashing techniques.
5. To analyze algorithms using various methods.
6. To apply algorithmic techniques to solve real-world computational problems.

Course Outcomes:

After successful completion of the course, students will be able to:

1. Illustrate Linear and Non-Linear data structures and Discuss operations on stack and queue.
2. Apply operations like searching, insertion, deletion in the tree.
3. Analyze various operations of graph.
4. Apply various searching and hashing operations.
5. Solve optimization problems using greedy strategy and analyze the complexity.
6. Explain backtracking strategy.

Module No.	Unit No.		Hrs.	CO
1		**Stacks, Queues, and Linked Lists**	**08**	
	1.1	Introduction to Data Structures: Linear and Non-Linear, Static and Dynamic.		**CO1**
	1.2	Types of Asymptotic Notations in Complexity Analysis of Algorithms.		
	1.3	Concept of Stack and Queue, Array Implementation of Stack and Queue, Circular Queue, Double-Ended Queue, Priority Queue.		
	1.4	Concept of Linked Lists: Singly, Doubly, and Circular Linked Lists.		
	1.5	Insertion, Deletion, Update, and Copying Operations with Linked Lists, Reversing a Singly Linked List.		
	1.6	Linked List Implementation of Stack and Queue.		
		Self-Learning : Skip Lists, XOR Linked Lists, Comparison of Linked Lists in Python vs C/C++, Applications in Real-Time Systems.		
2		**Trees**	**08**	
	2.1	Introduction to Trees: Terminology, Types of Binary Trees.		**CO2**
	2.2	Non-Recursive Preorder, Inorder, and Postorder Traversal.		
	2.3	Creation of Binary Trees from Traversal.		
	2.4	Binary Search Tree (BST): Traversal, Searching, Insertion, and Deletion.		
	2.5	Threaded Binary Tree: Inorder Successor and Predecessor, Insertion, and Deletion.		
	2.6	AVL Tree: Searching, Traversing, Rotations (Right, Left), Insertion, and Deletion.		
	2.7	B-Tree and B+ Tree: Searching, Insertion, Deletion.		
		Self-Learning : Trie, Segment Trees, Tree Implementations in Python, Red-Black Trees, Applications in Databases and File Systems.		
3		Graphs	**05**	
	3.1	Introduction to Graphs: Undirected Graph, Directed Graph, Terminology.		**CO3**
	3.2	Connectivity in Undirected and Directed Graphs, Spanning Tree.		
	3.3	Representation of Graphs: Adjacency Matrix, Adjacency List, Transitive Closure, and Path Matrix.		
	3.4	Traversals: Breadth-First Search (BFS), Depth-First Search (DFS).		
		Self-Learning : Graph Applications in Social Networks,		

		GPS, Topological Sorting		
4		Searching and Sorting	**06**	
	4.1	Searching: Sequential Search, Binary Search.		**CO4**
	4.2	Hashing: Hash Functions (Truncation, Mid-Square, Folding, Division).		
	4.3	Collision Resolution: Open Addressing (Linear Probing, Quadratic Probing, Double Hashing), Separate Chaining.		
	4.4	Sorting: Insertion Sort, Selection Sort, Merge Sort, Quick Sort, Radix Sort.		
		Self-Learning : External Sorting, Consistent Hashing, Sorting in Python, Timsort, Introsort, Hashing in Cryptography and Blockchain, Complexity Analysis.		
5		Greedy Method Approach	**06**	
	5.1	General Method, Single source shortest path: Dijkstra Algorithm, Fractional Knapsack problem, Job sequencing with deadlines, Minimum cost spanning trees: Kruskal and Prim's algorithms		**CO5**
		Self-Learning : Graph representations: adjacency matrix and adjacency list, Optimal storage on tape algorithm.		
6		Backtracking and Branch and bound	**06**	
	6.1	General Method, Backtracking: N-queen problem, Sum of subsets, Graph coloring		**CO6**
	6.2	Branch and Bound: Travelling Salesperson Problem, 15 Puzzle problem		
		Self-Learning: Rat in a Maze, Hamiltonian Cycle		
		Total	**39**	

Textbooks:

1. Aaron M Tenenbaum, Yedidyah Langsam, Moshe J Augenstein," Data Structures Using C", 1 st Edition, 2019, Pearson Publication.
2. Reema Thareja," Data Structures using C", 2 nd Edition, 2014, Oxford Press.
3. Richard F. Gilberg and Behrouz A. Forouzan," Data Structures: A Pseudocode Approach with C", 2nd Edition, 2007, CENGAGE Learning.
4. T. H. Cormen, C.E. Leiserson, R. L. Rivest, and C. Stein, "Introduction to algorithms", PHI Publication 2nd Edition in 2005.
5. Horo Ellis Horowitz, Sartaj Sahni, S. Rajasekaran, "Fundamentals of computer algorithms" published by Orient Black Swan second edition, in 2008.

Reference books:

1. Data Structures using C, E Balagurusamy, 1st Edition, 2013, McGraw-Hill Education India
2. Data Structures using C and C++, Rajesh K Shukla, 1st Edition, 2009, Wiley-India
3. Sanjoy Dasgupta, Christos Papadimitriou, Umesh Vazirani, "Algorithms", Tata McGraw- Hill Edition in 2006.
4. S. K. Basu, "Design Methods and Analysis of Algorithms", PHI Learning Pvt. Ltd. in 2005.

Online References:

1. https://nptel.ac.in/courses/106/102/106102064/
2. https://www.coursera.org/specializations/data-structures-algorithms
3. https://www.edx.org/course/data-structures-fundamentals
4. https://swayam.gov.in/nd1_noc19_cs67/preview
5. https://nptel.ac.in/courses/106/106/106106131/
6. https://swayam.gov.in/nd1_noc19_cs47/preview
7. https://www.coursera.org/specializations/algorithms

Course Assessment:

ISE: To be conducted in any of these forms - Assignment/ Quiz/ Presentation/ Class Test/ Case study etc. of 20 marks.

MSE: To be conducted as written examination for 20 marks (on 40% - 50% syllabus)

End Semester Examination:

$ ESE of duration 03 hours are of 80 marks and scaled to 60.

1. Question paper will comprise of 03 questions.
2. Question1 (20 marks): - Solve any 04 out of 06. All questions carry 05 marks each.
3. Question 2 (40 marks): - Solve any 04 out of 06. All questions carry 10 marks each.
4. Question3 (20 marks):- Solve any 04 out of 06. All questions carry 05 marks each.

All COs should be mapped as per the weightage in the syllabus

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
CSEC303	Discrete Structure and Automata Theory	03	-	-	03	-	-	03

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE$			
		ISE	MSE				
CSEC303	Discrete Structure and Automata Theory	20	20	60	--	--	100

Pre-requisite:

1. FEC 101 Applied Mathematics –I

Program Outcomes addressed:

PO1: Engineering knowledge.
PO2: Problem analysis.
PO3: Design/ Development of solution.

Course Objectives:

1. To cultivate clear thinking and creative problem solving.
2. To acquire conceptual understanding of fundamentals of grammar and languages.
3. To build concepts of theoretical design of deterministic and non-deterministic finite automata
4. To understand the concept of push down automata.
5. To develop understanding of different types of Turing machines and applications.
6. To understand the concept of undecidability.

Course Outcomes:

Upon completion of the course, learners will be able to:

1. Understand the notion of mathematical thinking, mathematical proofs and to apply them in problem solving.
2. Understand concepts of Theoretical Computer Science, difference and equivalence of DFA and NFA, languages described by finite automata and regular expressions.
3. Illustrate the equivalence of languages described by finite automata and regular expressions.
4. Device regular and context-free grammar while identifying strings and tokens.
5. Design pushdown automata to recognize the language.
6. Develop an understanding of computation through Turing Machine and understanding of decidability and undecidability acquire fundamental.

Module No.	Unit No.		Hrs.	CO
1.0		**Foundations of Logic and Functions**	**02**	
	1.1	**Logic and Proofs:** Introduction to Discrete Mathematics and its applications, Propositional Logic: Statements, Logical Connectives, Truth Tables, Predicate Logic: Quantifiers (Universal & Existential), Logical Inference.		**CO1**
	1.2	**Relations and Functions:** Basic Set Theory: Union, Intersection, Cartesian Product, Relations: Definition, Types (Reflexive, Symmetric, Transitive), Functions: Definition and Types (Injective, Surjective, Bijective.		
		Self-Learning : Normal Forms, Equivalence Classes.		
2.0		**Basics of Automata & Finite Automata (FA)**	**09**	
	2.1	**Introduction to Theoretical Computer Science**: Importance of Automata Theory, Alphabets, Strings, Languages, Closure Properties.		**CO2**
	2.2	**Finite Automata (FA) & Finite State Machines (FSM): Deterministic** Finite Automata (DFA): Definition, Transition Diagrams, Language Recognizers, Nondeterministic Finite Automata (NFA): Definition, Equivalence with DFA,NFA to DFA Conversion, Minimization of DFA,FSM Moore & Mealy Machines, Applications& Limitations of FA.		
		Self-Learning: Myhill Nerode theorem.		
3.0		**Regular Expressions & Regular Languages**	**07**	
	3.1	**Regular Expressions (RE) & Their Equivalence with FA:** Definition &Examples, Arden's Theorem, Applications of RE.		**CO3**
	3.2	**Regular Languages (RL): Closure** Properties, Decision Properties, Pumping Lemma for Regular Languages.		
		Self-Learning: Regular Expression to DFA minimization		
4.0		**Grammars & Context-Free Languages (CFL)**	**08**	
	4.1	**Chomsky Hierarchy of Grammars**: Regular Grammar (RG), Equivalence of Left & Right Linear Grammar, Equivalence of RG & FA.		**CO4**
	4.2	**Context-Free Grammars (CFG)**: Definition, Sentential Forms, Leftmost & Rightmost Derivations, Parse Trees & Ambiguity in CFG, Simplification of CFG, Normal Forms: Chomsky Normal Form (CNF) & Greibach Normal Form (GNF),Context-Free Languages (CFL),Closure Properties & Pumping Lemma.		
		Self-Learning: Case study: Application in compiler design.		

5.0		**Pushdown Automata (PDA)**	**04**	
	5.1	Definition of PDA, PDA as Generator, Decider & Acceptor of CFG, Deterministic PDA vs. Non-Deterministic PDA, Applications of PDA.		**CO5**
		Self-Learning : building CFG for PDA.		
6.0		**Turing Machines (TM) and Undecidability**	**09**	
	6.1	Definition & Concept of Turing Machines, Designing TM as Generator, Decider & Acceptor, Variants of TM: Multitrack TM, Multitape TM, Universal TM.		**CO6**
	6.2	Applications & Limitations of TMs, Decidability vs. Undecidability, Recursive& Recursively Enumerable. Languages, Halting Problem & Rice's Theorem, Post Correspondence Problem.		
		Self-Learning: churchs Thesis theorem.		
		Total	**39**	

Textbooks:

1. Bernad Kolman, Robert Busby, Sharon Cutler Ross, Nadeem-ur-Rehman, "Discrete Mathematical Structures", Pearson Education.
2. John E. Hopcroft, Rajeev Motwani, Jeffery D. Ullman, "Introduction to Automata Theory, Languages and Computation", 3rd Edition, Pearson Education, 2008.
3. Michael Sipser, "Theory of Computation", 3rd Edition, Cengage learning. 2013.
4. Vivek Kulkarni, "Theory of Computation", Illustrated Edition, Oxford University Press, (12 April 2013) India.
5. Peter Linz, "An Introduction to Formal Languages and Automata", Jones & Bartlett Learning, Sixth Edition, 2016
6. Javier Esparza and Michael Blondin, "Automata Theory", MIT Press, First Edition, 2023

Reference books:

1. Y N Singh, "Discrete Mathematical Structures", Wiley-India.
2. J. L. Mott, A. Kandel, T. P. Baker, "Discrete Mathematics for Computer Scientists and Mathematicians", Second Edition 1986, Prentice Hall of India.
3. J. P. Trembley, R. Manohar "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill Publishing Company.
4. . J. C. Martin, "Introduction to Languages and the Theory of Computation", 4 th Edition, Tata McGraw Hill Publication, 2013.
5. Kavi Mahesh, "Theory of Computation: A Problem-Solving Approach", Kindle Edition, Wiley-India, 2011.
6. Alexander Meduna, "Formal Languages and Computation: Models and Their Applications", CRC Press, First Edition, 2014

Online References

1. https://www.edx.org/learn/discrete-mathematics.
2. https://www.coursera.org/specializations/discrete-mathematics.
3. https://nptel.ac.in/courses/106106094.
4. https://swayam.gov.in/nd1_noc19_cs67/preview.

Course Assessment

ISE: To be conducted in any of these forms - Assignment/ Quiz/ Presentation/ Class Test/ Case study etc. of 15 marks and 5 marks attendance.
MSE: To be conducted as written examination for 20 marks (on 50% syllabus).

End Semester Examination:

$ ESE of duration 03 hours are of 80 marks and scaled to 60.

1. Question paper will comprise of 03 questions.
2. Question1 (20 marks): - Solve any 04 out of 06. All questions carry 05 marks each.
3. Question 2 (40 marks): - Solve any 04 out of 06. All questions carry 10 marks each.
4. Question3 (20 marks):- Solve any 04 out of 06. All questions carry 05 marks each.
5. All COs should be mapped as per the weightage in the syllabus.

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
CSEC304	Database Management System	03	-	-	03	-	-	03

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE$			
		ISE	MSE				
CSEC304	Database Management System	20	20	60	--	--	100

Pre- requisite:

1. FEC104 C- Programming

Program Outcomes Addressed

1. PO1: Engineering Knowledge
2. PO2: Problem analysis
3. PO3: Design/development of solutions
4. PO11: Lifelong learning

Course Objectives:

1. To understand the basics of database systems.
2. To develop an entity-relationship data model and its mapping to a relational model.
3. To learn relational algebra and formulate SQL queries.
4. To apply normalization techniques to normalize the database.
5. To understand the concept of transactions, concurrency control, and recovery techniques.
6. To learn and explore recent databases and their applications.

Course Outcomes: Learners will be able to

1. Identify the purpose of the database management system and its operational details.
2. Construct an ER/EER diagram, a relational model, and formulate relational algebra queries.
3. Apply SQL queries to the given database.
4. Apply normalization techniques for relational database design.
5. Illustrate the concepts of transaction management, concurrency control and database recovery.
6. Understand the fundamentals of recent databases and their uses.

Module No.	Unit No.		Hrs.	CO
1.0		**Introduction Database Concepts and Data modeling**	**08**	
	1.1	Introduction, Characteristics of databases, File system vs. Database system, Data abstraction and data Independence, DBMS system architecture, Applications of databases. The Entity-Relationship (ER) Model: Entity types: Weak and strong entity sets, entity sets, types of attributes, keys, and relationship constraints: Cardinality and Participation, Extended Entity-Relationship (EER) Model: Generalization, Specialization, and Aggregation.		**CO1**
		Self-Learning : Database storage structures		
2.0		**Relational Model and Relational Algebra**	**05**	
	2.1	Introduction to the Relational Model, relational schema. Mapping the ER and EER models to the relational model. Relational algebra - Operators and algebra queries.		**CO2**
		Self-Learning : Relational Calculus		
3.0		**Structured Query Language (SQL)**	**08**	
	3.1	Overview of SQL, Data Definition Commands, Integrity constraints: key constraints, Domain Constraints, Referential integrity, check Constraints Data Manipulation commands, Data Control commands, Set and string operations, aggregate function-group by, having, Views in SQL, joins, Nested and complex queries, Triggers.		**CO3**
		Self-Learning : Stored Procedures, Introduction to PL/SQL		
4.0		**Database Normalization**	**06**	
	4.1	Pitfalls in relational database designs, Concept of normalization, Function Dependencies, First Normal Form, 2NF, 3NF, BCNF, 4NF.		**CO4**
		Self-Learning : 5NF		
5.0		**Transactions Management, Concurrency Control and Recovery**	**08**	
	5.1	Transaction concept, Transaction states, ACID properties, Transaction Control Commands, Concurrent Executions, Serializability-Conflict and View, Concurrency Control: Lock-based, Timestamp-based protocols, Recovery System: Log-based recovery, Deadlock handling		**CO5**
		Self-Learning : Deadlock handling		
6.0		**Introduction to Emerging databases**	**04**	
	6.1	Limitations of conventional databases, Multimedia databases: data types, contents of multimedia databases, Cloud databases:		**CO6**

		Introduction, Design Steps, Distributed databases: types, storage methods		
		Self-Learning : Object-oriented database, NoSQL databases.		
		Total	**39**	

Textbooks:

1. Database System Concepts, Korth, Silberchatz, Sudarshan, 6th Edition, McGraw Hill, 2010.
2. Fundamentals of Database Systems, Elmasri and Navathe, 5th Edition, Pearson Education, 2006.
3. Database Management Systems, Raghu Ramakrishnan and Johannes Gehrke, 3rd Edition, TMH (McGraw-Hill), 2002.

Reference books:

1. Database Systems: Design, Implementation, and Management, Peter Rob and Carlos Coronel, 9th Edition, Thomson Learning, 2009.
2. SQL and PL/SQL for Oracle 10g, Black Book, Dr. P.S. Deshpande, Dream Tech Press, 2007.
3. Database Management Systems, G. K. Gupta, McGraw Hill, 2012.

Online References:

1. https://swayam.gov.in/nd1_noc19_cs46/preview
2. https://www.coursera.org/learn/database-design-postgresql
3. https://www.classcentral.com/course/swayam-database-management-system-9914
4. https://www.mooc-list.com/tags/dbms

Course Assessment:

ISE:

- To be conducted in any of these forms - Assignment/ Quiz/ Presentation/ Class Test/ Case study etc. of 20 marks.
- ISE 20 marks = 05 marks for attendance + 15 marks for activities.

MSE:

- To be conducted as written examination for 20 marks (on 40% - 50% syllabus)

End Semester Examination:

$ ESE of duration 03 hours are of 80 marks and scaled to 60.

1. Question paper will comprise of 03 questions.
2. Question1 (20 marks): - Solve any 04 out of 06. All questions carry 05 marks each.
3. Question 2 (40 marks): - Solve any 04 out of 06. All questions carry 10 marks each.
4. Question3 (20 marks) :- Solve any 04 out of 06. All questions carry 05 marks each.
5. All COs should be mapped as per the weightage in the syllabus.

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
CSEC305	Computer Organization and Architecture	02	-	-	02	-	-	02

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE$			
		ISE	MSE				
CSEC305	Computer Organization and Architecture	15	15	45	--	--	75

Pre-requisite:
1. FEC204 – Digital System Design

Program Outcomes Addressed:
1. PO1: Engineering Knowledge
2. PO2: Problem Analysis
3. PO3: Design/Development of Solutions
4. PO5: Engineering Tool Usage
5. PO6: The Engineer and The World
6. PO11: Life-Long Learning

Course Objectives:
The course aims to provide students with:
1. A comprehensive understanding of computer architecture and organization, including functional units and number representations.
2. Knowledge of processor architecture, instruction formats, and control unit design.
3. Insights into memory hierarchy, virtual memory, and cache memory concepts.
4. An understanding of I/O organization, peripheral interfacing, and data transfer mechanisms.
5. Exposure to advanced processor principles, including parallel processing and multi-core architectures.
6. Practical problem-solving skills related to instruction execution, memory management, and system performance optimization.

Course Outcomes:
Upon completion of this course, learners will be able to:
1. Describe the basic organization of a computer system, including functional units.
2. Apply data representation techniques and arithmetic algorithms for efficient computation and problem-solving in computer architecture.
3. Analyze processor architectures, instruction formats, addressing modes, arithmetic algorithms, and

control unit design for efficient instruction execution.

4. Examine memory hierarchy, virtual memory management techniques, and cache organization for performance optimization.
5. Apply I/O interfacing concepts and peripheral device communication.
6. Differentiate advanced processor concepts, parallel processing, and system bus architectures.

Module No.	Unit No.		Hrs.	CO
1.0		**Introduction**	**03**	
	1.1	Introduction to computer architecture and organization. Basic organization of computer. Block-level description of the functional units. **Self-Learning :** Performance measure of computer architecture, Amdahl's law		**CO1**
2.0		Data Representation and Arithmetic Algorithms	**03**	
	2.1	Booth's algorithm Division of integers: Restoring and non-restoring division Floating point representation: IEEE 754 floating point number representation. **Self-Learning :** Floating point arithmetic: Addition, Subtraction, Multiplication, Division, ALU and Shifters.		**CO2**
3.0		Processor Architecture and Organization	**08**	
	3.1	Von Neumann model Harvard architecture 8086 architectures. Register Organization, instruction formats, addressing modes, instruction cycle Instruction interpretation and sequencing		**CO3**
	3.2	Hardwired control unit design methods: State table, Delay element. Microprogrammed control Unit: Microinstruction. sequencing and execution. Micro operations. Examples of microprograms. **Self-Learning :** Hardwired control unit design method: Sequence Counter.		
4.0		Memory Organization	**06**	
	4.1	Memory hierarchy: Cost and performance measurement. Virtual Memory: Concept, Segmentation and Paging, Address translation mechanism. Interleaved and Associative memory.		**CO4**
	4.2	Cache memory concepts. Locality of reference. Design problems based on mapping techniques, Cache		

		coherency, Write policies.		
		Self-Learning: Virtual memory in modern operating systems.		
5.0		I/O Organization and Peripherals	**03**	
	5.1	Input/output systems, I/O module-need & functions 8255-PPI block diagram. Operating modes.		**CO5**
	5.2	Interfacing with 8086.		
		Self-Learning: Direct Memory Access (DMA), Interrupt types.		
6.0		Advanced Processor Principles and Buses	**03**	
	6.1	Introduction to parallel processing, Flynn's classification Instruction pipelining. Introduction to Multi-core processor architecture.		**CO6**
	6.2	Concept of superscalar architecture.		
		Self-Learning: Very Long Instruction Word (VLIW) processor, Pipeline hazards.		
		Total	**26**	

Textbooks:

1. William Stallings, "Computer Organization and Architecture: Designing for Performance", Pearson Publication, 11th Edition, 2022.
2. John P. Hayes, "Computer Architecture and Organization", 3rd Edition, McGraw-Hill, 2017.
3. B. Govindarajulu, "Computer Architecture and Organization: Design Principles and Applications", Second Edition, McGraw-Hill (India), 2017.
4. John Uffenbeck, "8086/8088 family: Design Programming and Interfacing", PHI, 1986.
5. K. M. Bhurchandani and A. K. Ray, "Advanced Microprocessors and Peripherals", 3rd Edition, McGraw Hill, 2017.

Reference books:

1. Andrew S. Tanenbaum, "Structured Computer Organization", Pearson, Sixth Edition, 2016.
2. Morris Mano, "Computer System Architecture", 3rd Edition, Pearson Publication, 2017.
3. Kai Hwang, Fayé Alayé Briggs, "Computer architecture and parallel processing", McGraw Hill, 2017.
4. P. Pal Chaudhuri, "Computer Organization and Design", 3rd Edition, Prentice Hall India, 2008.
5. Dr. M. Usha, T.S. Shrikant, "Computer System Architecture and Organization", Wiley India, 2019.
6. Douglas Hall, "Microprocessor and Interfacing", 3rd Edition, Tata McGraw Hill, 2017.

Online References:

1. https://onlinecourses.nptel.ac.in/noc21_cs61/preview
2. https://www.udemy.com/course/computer-organization-and-architecture-j/?couponCode=ST4MT240225A
3. https://www.coursera.org/learn/comparch
4. https://www.udemy.com/course/8086-microprocessor-architecture-programming/?couponCode=ST4MT240225A
5. https://onlinecourses.nptel.ac.in/noc21_ee41/preview

Course Assessment:

ISE: To be conducted in any of these forms - Assignment/ Quiz/ Presentation/ Class Test/ Case study etc. of 10 marks and 5 marks attendance.

MSE: To be conducted as a written examination for 15 marks (on 50% syllabus)

End Semester Examination:

$ ESE duration of 02 hours are of 60 marks and scaled to 45

Question paper will comprise of 3 questions.
Question1 (15 marks): - Solve any 03 out of 04. All questions carry 05 marks each.
Question 2 (30 marks): - Solve any 03 out of 05. All questions carry 10 marks each.
Question3 (15 marks):- Solve any 03 out of 04. All questions carry 05 marks each.
All COs should be mapped as per the weightage in the syllabus.

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
CSEC306	Engineering Economics	02	-	-	02	-	-	02

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE$			
		ISE	MSE				
CSEC306	Engineering Economics	50		--	--	--	50

Pre- requisite:

1. Principles of Basic Mathematics

Program Outcomes Addressed

1. PO1: Engineering Knowledge
2. PO2: Problem analysis
3. PO10: Project Management and Finance
4. PO11: Lifelong Learning

Course Objectives:

1. To introduce students to the basic principles of economics and their application to engineering decision-making.
2. To Explore the Role of Trade in a Modern Economy
3. To develop student's analytical skills in assessing consumer behavior and the determinants of demand and supply across different market structures, including price elasticity.
4. To enable students to understand cost analysis, pricing, project evaluation.
5. To develop the ability to make informed decisions regarding engineering projects based on economic criteria.
6. To Understand the Concept of Interest Rates and Their Role in the Economy

Module No.	Unit No.		Hrs.	CO
1.0		**Introduction to Economics**	03	
	1.1	**Economics** - Nature, Scope, Basic problems of an economy, Micro Economics and Macro Economics, The three problems of Economics Organization. Introduction to Engineering Economics.		CO1
		Self-Learning: Basic Economic Concepts: Cost, Benefit, Profit.		

2.0		**Market and Government in Modern Economy**	**03**	
	2.1	**Modern Economy** - Market Definition, How market solve three economics problems, Trade, Money & Capital, The economic role of Government.		**CO2**
		Self-Learning: Market Economy vs. Planned Economy, The Role of Private vs. Public Sectors		
3.0		**Supply, Demand and Product market**	**06**	
	3.1	**Basic Elements of Supply and Demand -** The determination of Demand and Supply, The Demand Schedule, The Supply Schedule, Equilibrium of supply and demand. Application of Supply and Demand.		**CO3**
	3.2	**Elasticity of Demand and Supply -** Price elasticity of Demand, Elasticity and Revenue, Price elasticity of Supply.		
	3.3	**Demand and Consumer behavior -** Choice and utility theory, Equimarginal principle, An alternative approach: substitution effect and income effect, From Individual to market demand.		
		Self-Learning: Case Study on demand and supply.		
4.0		**Production and Cost Theory**	**05**	
	4.1	**Production** - Production function, Laws of returns: Law of variable proportion, Law of returns to scale.		**CO4**
	4.2	**Cost and Revenue Concepts -** Total Costs, Fixed cost, Variable cost, Average cost and Marginal cost, The Link between production and costs, Analysis of cost minimization.		
		Self-Learning: Read case studies about businesses optimizing their production costs and making strategic production decisions.		
5.0		**Time value and Project evaluation with money**	**04**	
	5.1	**Time Value of Money -** Interest - Simple and compound, nominal and effective rate of interest, Cash flow diagrams, Principles of economic equivalence.		**CO5**
	5.2	**Evaluation of Engineering Projects -**Present worth method, Future worth method, Annual worth method, Internal rate of return method.		
		Self-Learning: Learn to use financial calculators or Excel functions for quick calculations of TVM.		
6.0		**Money, Banking and Financial Markets**	**05**	
	6.1	**Money and Interest Rates -** The Evolution of Money, Functions of Money, Interest rates, Price of Money, Demand for money.		**CO6**
	6.2	**Banking and the supply of money** - Banking		

		definition, Types of Banks, Banking as as a business, The process of Deposits creations.		
	6.3	**Financial Economics** - Financial assets, Risk and return on different assets, The stock market, Personal financial strategies.		
		Self-Learning : The evolution of financial market.		
		Total	**26**	

Textbooks:

1. Paul A. Samuelson and William D. Nordhaus, "Economics", Tata McGraw Hill, 20th edition, 2019.
2. L. Blank and A. Tarquin, *Engineering Economy*, 9th ed., McGraw-Hill, 2024.

Reference books:

1 J. V. O'Connor, Introduction to Engineering Economics, 5th ed., Pearson, 2013.
2 W S Jawadekar, "Management Information Systems," TMH, 6th edition, 2020.
3 C. S. Park, Fundamentals of Engineering Economics, 4th edition, Pearson, 2018.

Online References:

1. https://www.mheducation.com/highered/product/Engineering-Economy-Blank.html.
2. https://archive.org/details/engineeringecono0000blan_t5b6.
3. https://www.liberty.edu/online/courses/ENGI220.
4. https://online.stanford.edu/courses/cee146s-engineering-economics-and-sustainability.

ISE:

- To be conducted in any of these forms - Assignment/ Quiz/ Presentation/ Class Test/ Case study etc. of 25 marks.
- ISE 50 marks = 10 marks for attendance + 40 marks for activities.

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
CSEL301	Data Structures and Algorithms Lab	--	02	--	--	01	-	01

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE			
		ISE	MSE				
CSEL301	Data Structures and Algorithms Lab	--	--	--	25	25	50

Pre-requisite:

1. FEL103- Knowledge of C programing

Program Outcomes Mapped:

1. PO1: Engineering Knowledge
2. PO2: Problem Analysis
3. PO3: Design and development of solutions
4. PO4: Conduct investigations of complex problems
5. PO9: Individual and team work
6. PO10: Communication
7. PO11: Lifelong Learning

Lab Objectives:

1. To implement basic data structures such as arrays, linked lists, stacks and queues.
2. To Solve problem involving graphs, and trees.
3. To Select an appropriate data structure for the given problem.
4. To introduce the methods of designing and analyzing algorithms.
5. To design and implement efficient algorithms for a specified application.
6. To strengthen the ability to identify and apply a suitable algorithm for the given real-world problem.

Lab Outcomes:

Upon completion of this course, the learner will be able to:

1. Apply various linear data structures to perform operations like insertion, deletion, searching and traversing on them.
2. Apply various nonlinear data structures & be able to handle operations like insertion, deletion, searching and traversing on them.
3. Choose appropriate data structure and apply it in various problems.
4. Compare the complexity of the algorithms for specific problems.
5. Use appropriate algorithms to solve computational problems.

6. Implement advanced problem-solving techniques like backtracking and branch & bound.

Suggested Experiments: Students are required to complete at least 10 experiments.		
All 10 experiments should cover all 6 LOs mentioned above.		
Sr. No.	**Title of Experiments**	**LO**
1	Implement Stack ADT using array.	LO1
2	Convert an Infix expression to Postfix expression using stack ADT.	LO1
3	Evaluate Postfix Expression using Stack ADT.	LO1, LO3
4	Implement Circular Queue ADT using array.	LO1, LO3
5	Implement Circular Linked List ADT.	LO1
6	Implement Doubly Linked List ADT.	LO2
7	Implement Priority Queue ADT using array.	LO3
8	Implement Singly Linked List ADT.	LO2
9	Implement Binary Search Tree ADT using Linked List.	LO3
10	Implement Graph Traversal techniques a) Depth First Search b) Breadth First Search	LO2
11	Implementation of selection sort and insertion sort.	LO4
12	Implementation of merge sort and quick sort.	LO4
13	Implementation of fractional knapsack problem using greedy approach.	LO5
14	Implementation of Dijkstra's algorithm for single source shortest path.	LO5
15	Implementation of N-Queen Problem using Backtracking.	LO6
16	Implementation of sum of subsets using Backtracking.	LO6

Text Books:

1. Data Structures using C, Reema Thareja, 2 nd Edition, 2014, Oxford Press.
2. Data Structures Using C, Aaron M Tenenbaum, Yedidyah Langsam, Moshe J Augenstein, 1 st Edition, 2019, Pearson Publication.
3. Data Structures: A Pseudocode Approach with C, Richard F. Gilberg and Behrouz A. Forouzan, 2nd Edition, 2007, CENGAGE Learning.
4. Jean Paul Tremblay, P. G. Sorenson, "Introduction to Data Structure and Its Applications", McGraw-Hill Higher Education 2nd Edition
5. Data Structures Using C, ISRD Group, 2ndEdition, Tata McGraw-Hill
6. T. H. Cormen, C.E. Leiserson, R. L. Rivest, and C. Stein, "Introduction to algorithms", PHI Publication 2nd Edition in 2005.
7. Horo Ellis Horowitz, Sartaj Sahni, S. Rajasekaran, "Fundamentals of computer algorithms" published by Orient Black Swan second edition, in 2008.

Reference Books:

1. Data Structures using C, E Balagurusamy, 1st Edition, 2013, McGraw-Hill Education India
2. Data Structures using C and C++, Rajesh K Shukla, 1st Edition, 2009, Wiley-India.
3. Algorithms by Sanjoy Dasgupta, Christos Papadimitriou, and Umesh Vazirani was published by McGraw-Hill Education in 2006.
4. S. K. Basu, "Design Methods and Analysis of Algorithms", PHI Learning Pvt. Ltd. in 2005.

Online Resources:

1. www.leetcode.com
2. www.hackerrank.com
3. www.cs.usfca.edu/~galles/visualization/Algorithms.html
4. www.codechef.com
5. https://nptel.ac.in/courses/106/106/106106131/
6. https://swayam.gov.in/nd1_noc19_cs47/preview
7. https://www.coursera.org/specializations/algorithms

Term Work:
Term work should consist of at least 10 experiments.
Journal must include at least 2 assignments.

The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. The assignments should be students' centric and an attempt should be made to make assignments more meaningful, interesting and innovative. Term work will be assessed as Continuous Internal Assessment Practical (CIAP).

Term work Marks (CIAP):

25 Marks (Total Marks) =15 Marks (Experiment) + 05 Marks (Assignments) + 05 Marks

(Attendance)

The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.

Practical Exam: (2 hours/ 25 Marks)
End-semester Practical and oral exam will be held based on the above syllabus and will be conducted as End Semester Examination Practical (ESEP).

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
CSEL302	Database Management System Lab	--	02	--	--	01	-	01

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE			
		ISE	MSE				
CSEL302	Database Management System Lab	--	--	--	25	25	50

Pre-requisite:

1. FEC104 C- Programming

Program Outcomes addressed :

1. PO2: Problem analysis
2. PO3: Design / Development of Solutions.
3. PO5: Modern Tool Usage
4. PO7: Ethics
5. PO8: Individual and Collaborative Team Work
6. PO9: Communication
7. PO11: Lifelong learning

Lab Objectives:

1. To explore the design and development of a relational model.
2. To write SQL basic and complex queries.
3. To learn transaction processing and concurrent data access.

Lab Outcomes:

Upon completion of the course, Learners will be able to:

1. Design an ER/EER diagram and convert it to a relational model for the real-world application.
2. Apply DDL, DML, DCL, and TCL commands.
3. Implement simple and complex queries.
4. Implement triggers and procedures.
5. Demonstrate the concept of concurrent transaction execution.
6. Illustrate the front-end-backend connectivity.

Suggested List of Experiments:		LO
Sr. No.	Title of Experiments	
1	Identify the case study and detail the statement of the problem. Design an entity-relationship (ER) / extended entity-relationship model.(Use Lucidchart/Draw.io/UML tool)	LO 1
2	Mapping ER/EER to a relational schema model.	LO 1
3	Design a database using Data Definition Language (DDL) and apply integrity constraints for the specified system.	LO 2
4	Apply DML commands for the specified system.	LO 2
5	Implement Simple queries, string manipulation operations, and aggregate functions.	LO 3
6	Implement various join operations.	LO 3
7	Implement Nested and Complex queries.	LO 3
8	Implement DCL and TCL commands.	LO 2
9	Implement procedures and functions.	LO 4
10	Implementation of views and triggers.	LO 4
11	Implementation and demonstration of transaction and concurrency control techniques using locks.	LO 5
12	Demonstrate database connectivity.	LO 6
13	Implementation of Graph Query Language	LO3

Text Books:

1. Database System Concepts, Korth, Silberchatz, Sudarshan, 6th Edition, McGraw Hill, 2010.
2. Fundamentals of Database Systems, Elmasri and Navathe, 5th Edition, Pearson Education, 2006.
3. Database Management Systems, Raghu Ramakrishnan and Johannes Gehrke, 3rd Edition, TMH (McGraw-Hill), 2002

Reference Books:

1. Database Systems: Design, Implementation, and Management, Peter Rob and Carlos Coronel, 5th Edition, Thomson Learning, 2002.
2. SQL and PL/SQL for Oracle 10g, Black Book, Dr. P.S. Deshpande, Dream Tech Press, 2007.
3. Database Management Systems, G. K. Gupta, McGraw Hill, 2012.

Online References:

Useful Links:

1. https://www.w3schools.com/sql/
2. https://www.tutorialspoint.com/sql/index.htm
3. https://learn.microsoft.com/en-us/sql/?view=sql-server-ver16

Term Work:
The term work should include 10 experiments: At least 02 assignments covering the entire syllabus must be given on the content of theory and practicals of "Database Management System". The assignments should be student' centric and an attempt should be made to make assignments more meaningful, interesting, and innovative. Term work will be assessed as Continuous Internal Assessment Practical (CIAP).

Term work Marks:
25 Marks (Total Marks) = 15 Marks (Experiment) + 05 Marks (Assignments) + 05 Marks (Attendance)
The final certification and acceptance of term work ensure satisfactory performance of laboratory work and minimum passing marks in term work.

Practical Exam: (2 hours/ 25 Marks)
End-semester practical and oral exams will be held based on the above syllabus and will be conducted as End-Semester Examination Practical (ESEP).

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
CSEL303	Computer Organization and Architecture Lab	--	02	--	--	01	-	01

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE			
		ISE	MSE				
CSEL303	Computer Organization and Architecture Lab	--	--	--	25		25

Pre-requisite:

FEL203 -Digital System Design Lab

Program Outcomes Addressed:

1. PO1: Engineering Knowledge
2. PO2: Problem Analysis
3. PO3: Design/Development of Solutions
4. PO5: Engineering Tool Usage
5. PO7: Ethics
6. PO8: Individual and Collaborative Team Work
7. PO11: Life-Long Learning

Lab Objectives:

The course aims to equip students with the ability to:

1. Understand fundamental arithmetic algorithms, including Booth's algorithm and division algorithms, through implementation.
2. Develop skills in designing and simulating ALU, memory, and cache memory using appropriate simulation tools.
3. Apply assembly programming concepts for arithmetic operations, data transfer, and code conversions using 8086 programming tools (Debug/TASM/MASM/8086kit).
4. Demonstrate proficiency in array manipulation techniques such as sorting, finding the minimum/maximum value, and computing GCD/LCM using 8086 assembly language.
5. Perform data transfer operations and control unit functionalities using 8086 assembly programming.
6. Interface peripheral devices like 8255 for read/write operations and waveform generation.

Lab Outcomes:

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

1. Apply Booth's multiplication algorithm and restoring/non-restoring division algorithms using assembly language.

2. Design and simulate ALU, memory, and cache memory structures using a simulator.
3. Solve arithmetic operations on 8-bit and 16-bit data using assembly programming tools.
4. Develop assembly programs for code conversion (Hex-BCD, ASCII-BCD), data transfer, and factorial calculation using 8086.
5. Apply array-based algorithms, such as sorting and finding the GCD, LCM, minimum, and maximum values using 8086 assembly language.
6. Illustrate interfacing of 8255 PPI with 8086 to perform read/write operations and square wave generation.

Suggested List of Experiments:		**LO Mapped**
Sr. No.	**Title of Experiments**	
1	To implement Booth's algorithm.	LO1
2	To implement restoring division algorithm.	LO1
3	To implement non restoring division algorithm.	LO1
4	To implement ALU design using simulator.	LO2
5	To implement memory design using simulator.	LO2
6	To implement cache memory design using simulator.	LO2
7	Use of programming tools (8086kit/ Emulator 8086) to perform basic arithmetic operations on 8-bit data.	LO3
8	Use of programming tools (8086kit/ Emulator 8086) to perform basic arithmetic operations on 16-bit data.	LO3
9	Code conversion (Hex to BCD and BCD to Hex)/ (ASCII to BCD and BCD to ASCII) using 8086.	LO4
10	To transfer a block of data using 8086.	LO4
11	Assembly program to find the GCD/ LCM of two numbers.	LO4
12	Assembly program to sort numbers in ascending/ descending order.	LO5
13	Assembly program to find minimum/ maximum number from a given array.	LO5
14	Calculate the factorial of a given number using 8086.	LO4
15	Program for interfacing 8355 for Read/Write operation/ Square wave generation.	LO6

Textbooks:

1. William Stallings, "Computer Organization and Architecture: Designing for Performance", Pearson Publication, 10th Edition, 2013.
2. John P. Hayes, "Computer Architecture and Organization", McGraw-Hill, 1988.
3. B. Govindarajulu, "Computer Architecture and Organization: Design Principles and Applications", Second Edition, McGraw-Hill (India).
4. John Uffenbeck, "8086/8088 family: Design Programming and Interfacing", PHI.
5. K. M. Bhurchandani and A. K. Ray, "Advanced Microprocessors and Peripherals", McGraw Hill

Reference books:

1. Andrew S. Tanenbaum "Structured Computer Organization", Pearson, Sixth Edition.
2. Morris Mano. "Computer System Architecture" Pearson Publication, 3rd Edition, 2007.
3. Kai Hwang, Fayé Alayé Briggs. "Computer architecture and parallel processing", McGraw Hill.
4. P. Pal Chaudhuri. "Computer Organization and Design" Prentice Hall India, 2004.
5. Dr. M. Usha, T.S. Shrikant. "Computer System Architecture and Organization" Wiley India, 2014.
6. Douglas Hall, "Microprocessor and Interfacing", Tata McGraw Hill.

Online Resources:

1. http://vlabs.iitkgp.ernet.in/coa/#
2. https://emu8086-microprocessor-emulator.en.softonic.com/

Term Work:

The term work shall include a total of **10 experiments**. Students must perform **any five experiments** from experiment numbers **1 to 6** and **any four experiments** from experiment numbers **7 to 14**. Additionally, **experiment 15 is compulsory** for all.
At least 02 assignments covering the entire syllabus must be given on the content of theory and practicals of "Computer Organization and Architecture". The assignments should be students' centric and an attempt should be made to make assignments more meaningful, interesting and innovative. Term work will be assessed as Continuous Internal Assessment Practical (CIAP).

Term work Marks:

- 25 Marks (Total Marks) =15 Marks (Experiment) + 05 Marks (Assignments) + 05 Mark (Attendance).
- The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
CSEL304	Skill Lab (Python Programming)	--	2*+2	--	--	02	-	02

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE			
		ISE	MSE				
CSEL304	Skill Lab (Python Programming)	--	--	--	25	25	50

Pre-requisite:

Programming Languages

1. FEC104: C – Programming
2. FEL205: Object Oriented Programming Methodology Lab

Program Outcomes Addressed:

1. PO1: Engineering Knowledge
2. PO2: Problem Analysis
3. PO3: Design/Development of Solutions
4. PO4: Conduct investigation of complex problems
5. PO5: Engineering Tool Usage
6. PO6: The Engineer and The World
7. PO7: Ethics
8. PO8: Individual and Collaborative Team Work
9. PO9: Communication
10. PO10: Project Management and Finance
11. PO11: Life-Long Learning

Lab Objectives:

1. To provide a comprehensive understanding of Python programming, covering both fundamental and advanced concepts.
2. To solve real-world applications using Data Structure and Multi-threading concept.
3. To introduce OOP principles for efficient coding practices.
4. To enhance knowledge of data analysis and visualization.
5. To prepare students for building Python-based applications involving GUI with database connectivity and networking.
6. To prepare students for analysing and visualizing real time data.

Lab Outcomes:
Upon completion of course, learners will be able to:

1. Apply Python fundamentals, including data types, operators, and control structures to develop simple program.
2. Illustrate OOP concepts, files handling, directories, and text processing operations using Python.
3. Analyze different types of data structures such as linked lists, stacks, queues, and dequeues to solve computational problems effectively.
4. Apply multithreading concepts using Python for efficient concurrent execution.
5. Apply skills in integrating Python with GUI applications, networking, and database systems.
6. Apply data analysis and visualization techniques using tools like Pandas, NumPy, Matplotlib, and Seaborn

Module No.	Unit No.		Hrs.	CO
1		**Python basics**	**06**	**LO1**
	1.1	Introduction, Features, Python Identifiers, Keywords, Variables and Comments Indention, Operators in python, Input and print functions.		
	1.2	Control flow statement- Conditional statements (if, if…else, nested if), Looping in Python (while loop, for loop, nested loops), Loop manipulation using continue, pass, break.		
	1.3	Data Types in python: Number, Arrays in python, String and Character in python, Functions, Data Structures - List and Tuples, Dictionaries, Sets.		
	1.4	Functions- Types, parameters, arguments: positional arguments, keyword arguments, parameters with default values, functions with arbitrary arguments, Recursion, Scope of variables- Local and global scope, anonymous functions.		
		Self-learning: Iterators and Generators		
2		**Advanced Python- OOP, File Handling and Exception Handling**	**05**	**LO2**
	2.1	Introduction to OOP – Classes and Objects: Creating Classes, Creating Instance Objects, Access Modifiers, Inheritance, Polymorphism, Operator Overloading, Abstract Classes, Overriding Methods.		
	2.2	Files in Python, Directories, Building Modules, Packages, Text Processing, Regular expression in python.		
	2.3	Exception handling: Compile time errors, Runtime errors, exceptions, types of exception, try statement, except block, raise statement, User - Defined Exceptions.		
		Self-learning: Experiment to Build a Personal Notes App (File-Based Storage), Automate Daily Tasks with Python**.**		
3		**Data Structure in Python**	**02**	**LO3**
	3.1	Linked List, Stack, Queue, Dequeue.		
		Self-learning: polynomial representation and operations using linked		

		list, Task Queues in Web Servers.		
4		**Python Integration Primer**	**04**	**LO4**
	4.1	Graphical User interface, Python database connectivity, Introduction to APIs: Fetching Data from Web Services. Django web application Framework.		
		Self-learning: Fetch weather data from a public API and display it.		
5		**Multithreading**	**03**	**LO5**
	5.1	Thread and Process, starting a thread, threading module, Synchronizing threads.		
	5.2	Socket Programming.		
		Self-learning: Multithreaded Priority Queue.		
6		**Data Analysis and Visualization libraries**	**06**	**LO6**
	6.1	NumPy - Creating NumPy arrays, Indexing and slicing in NumPy, Dimensions of Arrays, Attribute of array, manipulating array shapes, working with multi-dimensional arrays, Indexing and slicing in multi-dimensional arrays, Matrices in NumPy, Mathematical Functions of NumPy.		
	6.2	Pandas - Creating Data Frame from an Excel Spreadsheet, .csv File, Python Dictionary and Python List of Tuples, Operations on Data Frames, Series and Data Frames.		
	6.3	Matplotlib, Seaborn - Introduction to Matplotlib library, Line properties, Plots and subplots, Types of Plots, Introduction to Seaborn. Bar Graph, Histogram, Pie Chart, Line Graph.		
		Self-learning: Creating array views copies, Aggregating, Merge Data Frames, Interactive Visualization with Plotly.		
		Total	**26**	

Textbooks:

1. Dr. R. Nageswara Rao, “Core Python Programming”, Dreamtech Press,2021.
2. James Payne, “Beginning Python: Using Python 2.6 and Python 3.1”, Wrox Publication, 2011.
3. Anurag Gupta, G. P. Biswas, “Python Programming”, McGraw-Hill, 2019
4. E. Balagurusamy, “Introduction to computing and problem-solving using Python,” McGraw Hill Education, 2017.

Reference Books:

1. Zed A. Shaw, “Learn Python the Hard Way", Addison-Wesley Professional 2024.
2. Laura Cassell, Alan Gauld, “Python Projects”, Wrox Publication, 2015.

Software Tools:

1. Python IDLE
2. PyCharm,
3. Visual Studio Code (VS Code)
4. Jupyter Notebook
5. Google Colab
6. Notepad++

Online Repository:

1. Google Drive
2. GitHub
3. Code Guru

Online Resources:

1. https://docs.python.org/release/3.0.1/tutorial/
2. https://www.perl.org/books/beginning-perl/
3. https://spoken-tutorial.org/
4. https://starcertification.org/Certifications/Certificate/python
5. https://onlinecourses.nptel.ac.in/noc22_cs32/preview

Suggested List of Programming Assignments/laboratory Work:		LO
Sr. No.	**Name of the Experiment**	
1	Exploring basics of python like data types (strings, list, array, dictionaries, set, tuples) and control statements.	LO1
2	Creating functions, classes and objects using python. Demonstrate exception handling and inheritance.	LO1, LO2
3	Exploring Files and directories Python program to append data to existing file and then display the entire file Python program to count number of lines, words and characters in a file. Python program to display file available in current directory	LO2
4	Menu driven program for data structure using built in function for linked list, stack and queue.	LO3
5	Creating GUI with python containing widgets such as labels, textbox, radio, checkboxes and custom dialog boxes. Program to demonstrate CRUD (**create, read, update and delete)** operations on database (SQLite/ MySQL) using python.	LO4
6	To learn how to make API requests in Python using the requests module and fetch data from a public web service.	LO4
7	Programs on Threading using python.	LO5
8	To implement client server communication using socket programming	LO5
9	To explore the basics of NumPy methods and demonstrate the use of NumPy array objects for performing efficient numerical computations, including array creation, operations, and manipulations.	LO6
10	To explore and understand the functionalities of **Pandas Series and Data Frames**, including their creation, manipulation, and grouping using the groupby () function in Python.	LO6
11	Program to demonstrate Data Series and Data Frames using Pandas.	LO6
12	Graphical representation and analysis of the data using python to analyze and visualize a given dataset using Python by applying various graphical techniques.	LO6
13*	Program to send email and read content of URL.	LO5

Term Work

1. Term work should consist of 12 experiments and performance of 13th Experiment is optional
2. Journal must include at least 02 assignments
3. Mini Project based on the content of the syllabus (Group of maximum 2-3 students)
4. The final certification and acceptance of term work ensures that satisfactory performance oflaboratory work and minimum passing marks in term work.
5. Total 25-Marks (Experiments: 10-marks, Assignment: 05-marks, Attendance: 05-marks,Mini Project: -5-marks)
6. The assignments should be students' centric and an attempt should be made to make assignments more meaningful, interesting and innovative. Term work will be assessed as Continuous Internal Assessment Practical (CIAP)

Oral & Practical exam

Based on the entire syllabus of **CEL304: Skill Lab (Python Programming)** will be conducted as End Semester Examination Practical (ESEP).

The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
CSEM301	Mini Project 1A	--	02	--	--	01	-	01

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE			
		ISE	MSE				
CSEM301	Mini Project 1A	--	--	--	25	25	50

Program Outcomes addressed:

1. PO1: Engineering knowledge
2. PO2: Problem Analysis
3. PO3: Design/Development of Solutions
4. PO4: Conduct investigations of complex problems
5. PO5: Engineering Tool Usage
6. PO6: The Engineer and The World
7. PO7: Ethics
8. PO8: Individual and Collaborative Team work
9. PO9: Communication
10. PO10: Project Management & Finance
11. PO11: Life-long learning

Objectives

1. To acquaint with the process of identifying the needs and converting it into the problem.
2. To familiarize the process of solving the problem in a group.
3. To acquaint with the process of applying basic engineering fundamentals to attempt solutions to the problems.
4. To inculcate the process of Self-Learning and research.

Outcome: Upon completion of this course, learners will be able to…

1. Identify problems based on societal /research needs.
2. Apply Knowledge and skill to solve societal problems in a group.
3. Develop interpersonal skills to work as a member of a group or leader.
4. Deduce the proper inferences from available results through theoretical/ experimental /simulations.
5. Analyze the impact of solutions in societal and environmental context for sustainable development.
6. Apply standard norms of engineering practices.
7. Develop skills in written and oral communication.

8. Illustrate capabilities of Self-Learning in a group, which leads to life long learning.
9. Explain project management principles during project work.

Guidelines for Mini Project

1. Students shall form a group of 3 to 4 students, while forming a group shall not be allowed for less than three or more than four students, as it is a group activity.
2. Students should do survey and identify needs, which shall be converted into problem statement for mini project in consultation with faculty supervisor/head of department/internal committee of faculties.
3. Students shall submit implementation plan in the form of Gantt/PERT/CPM chart, which will cover weekly activity of mini project.
4. A logbook to be prepared by each group, wherein group can record weekly work progress, guide/supervisor can verify and record notes/comments.
5. Faculty supervisors may give input to students during mini project activity; however, focus shall be on Self-Learning.
6. Students in a group should understand problems effectively, propose multiple solutions and select best possible solution in consultation with guide/ supervisor.
7. Students shall convert the best solution into working model using various components of their domain areas and demonstrate.
8. The solution to be validated with proper justification and report to be compiled in standard format of University of Mumbai.
9. With the focus on Self-Learning, innovation, addressing societal problems and entrepreneurship quality development within the students through the Mini Projects, it is preferable that a single project of appropriate level and quality to be carried out in two semesters by all the groups of the students. i.e. Mini Project 1 in semester III and IV. Similarly, Mini Project 2 in semesters V and VI.
10. However, based on the individual students or group capability, with the mentor's recommendations, if the proposed Mini Project adhering to the qualitative aspects mentioned above gets completed in odd semester, then that group can be allowed to work on the extension of the Mini Project with suitable improvements/modifications or a completely new project idea in even semester. This policy can be adopted on case-by-case basis.

Guidelines for Assessment of Mini Project: Term Work

- The review/ progress monitoring committee shall be constituted by head of departments of each institute. The progress of mini project to be evaluated on continuous basis, minimum two reviews in each semester.
- In continuous assessment focus shall also be on each individual student, assessment based on individual's contribution in group activity, their understanding and response to questions.
- Distribution of Term work marks for both semesters shall be as below.
  1. Marks awarded by guide/supervisor based on logbook: 10
  2. Marks awarded by review committee 10
  3. Quality of Project report 05

The review/progress monitoring committee may consider following points for assessment based on either one year or half year project as mentioned in general guidelines.

One-year project:

- In the first semester entire theoretical solution shall be ready, including components/system selection and cost analysis. Two reviews will be conducted based on the presentation given by the students' group.
  - First shall be for finalization of problem
  - Second shall be on finalization of proposed solution of problem.
- In the second semester the expected work shall be procurement of component's/systems, building of working prototype, testing and validation of results based on work completed in an earlier semester.
  - The first review is based on the readiness of building a working prototype to be conducted.
  - Second review shall be based on poster presentation cum demonstration of working model in last month of the said semester.

Half-year project:

- In this case in one semester students' group shall complete project in all aspects including,
  - Identification of need/problem
  - Proposed final solution
  - Procurement of components/systems
  - Building prototype and testing
- Two reviews will be conducted for continuous assessment,
  - First shall be for finalization of problem and proposed solution
  - Second shall be for implementation and testing of solution.

Assessment criteria of Mini Project

Mini Project shall be assessed based on the following criteria;

1. Quality of survey/ need identification
2. Clarity of Problem definition based on need.
3. Innovativeness in solutions
4. Feasibility of proposed problem solutions and selection of best solution
5. Cost effectiveness
6. Societal impact
7. Innovativeness
8. Cost effectiveness and Societal impact
9. Full functioning of working model as per stated requirements
10. Effective use of skill sets
11. Effective use of standard engineering norms
12. Contribution of an individual's as member or leader
13. Clarity in written and oral communication

- In **one year, project**, first semester evaluation may be based on first six criteria's and remaining may be used for second semester evaluation of performance of students in mini project.
- In the case of **half year project** all criteria's in generic may be considered for evaluation of performance of students in mini project.

Guidelines for Assessment of Mini Project Practical/Oral Examination:

- The report should be prepared as per the guidelines issued by the University of Mumbai.
- Mini Project shall be assessed through a presentation and demonstration of working model by the student project group to a panel of Internal and External Examiners preferably from industry or research organization's having experience of more than five years approved by head of Institution.
- Students shall be motivated to publish a paper based on the work in Conferences/students competitions.

Mini Project shall be assessed based on the following points.

1. Quality of problem and Clarity
2. Innovativeness in solutions
3. Cost effectiveness and Societal impact
4. Full functioning of working model as per stated requirements
5. Effective use of skill sets
6. Effective use of standard engineering norms
7. Contribution of an individual's as member or leader
8. Clarity in written and oral communication

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
CSEC401	Applied Mathematics-IV	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE			
		ISE	MSE				
CSEC401	Applied Mathematics-IV	20	20	60	--	--	100

Module No.	Unit No.		Hrs.	CO
1.0		**Linear Algebra (Theory of Matrices)**	06	
	1.1	Characteristic Equation, Eigenvalues and Eigenvectors, and properties (without proof). Cayley-Hamilton Theorem (without proof), verification and reduction of higher degree polynomials.		CO1
	1.2	Similarity of matrices, diagonalizable and non-diagonalizable matrices.		
	1.3	Functions of Square Matrix, Derogatory and non-derogatory matrices.		
		Self-Learning: Coding and encoding of matrices.		
2.0		**Complex Integration**	07	
	2.1	Line Integral, Cauchy's Integral theorem for simple connected and multiply connected regions (without proof), Cauchy's Integral formula (without proof).		CO2
	2.2	Taylor's and Laurent's series (without proof).		
	2.3	Definition of Singularity, Zeroes, poles of f(z), Residues, Cauchy's Residue Theorem (without proof).		
		Self-Learning: Application of Residue Theorem to evaluate real integrations		
3.0		**Probability Distribution and Sampling Theory**	07	
	3.1	Probability Distribution: Poisson and Normal distribution.		CO3
	3.2	Sampling distribution, Testing of Hypothesis, Level of Significance, Critical region, One-tailed, and two-tailed test, Degree of freedom.		
	3.3	Large Sampling with test of single mean and difference of means.		
	3.4	Students' t-distribution (Small sample). Test the significance of mean and Difference between the means of two samples.		
		Self-Learning: Large sampling with testing for parameters.		

4.0		**Test of Hypothesis- Chi square Distribution and ANOVA**	**07**	
	4.1	Chi-Square Test: Test of goodness of fit.		**CO4**
	4.2	Independence of attributes, Contingency table.		
	4.3	Analysis of Variance (F-Test): One way classification, Two-way classification (short-cut method).		
		Self-Learning: Other types of non-parametric tests.		
5.0		**Linear Programming Problems**	**06**	
	5.1	Types of solutions, Standard and Canonical of LPP, Basic and Feasible solutions, slack variables, surplus variables, Simplex method.		**CO5**
	5.2	Artificial variables, Big-M method (Method of penalty).		
	5.3	Dual Simplex Method.		
		Self-Learning: Principle of Duality, Dual of LPP.		
6.0		**Nonlinear Programming Problems**	**06**	
	6.1	NLPP with one equality constraint (two or three variables) using the method of Lagrange's multipliers.		**CO6**
	6.2	NLPP with One inequality constraint: Kuhn-Tucker conditions.		
	6.3	NLPP with two inequality constraint: Kuhn-Tucker conditions.		
		Self-Learning: NLPP with two equality constraints.		
		Total	**39**	

Textbooks:

1. Higher Engineering Mathematics, Dr. B. S. Grewal, Khanna Publication, 45th edition.
2. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley Eastern Limited, 10th Edition 2023-24.
3. Higher Engineering Mathematics: B V Ramna; Tata McGraw Hill Publication
4. Fundamentals of Mathematical Statistics – S. C. Gupta & V. K. Kapoor, 12th edition, 2020.

Reference books:

1. **Matrices** – Shanti Narayan, S. Chand Publications, Revised edition.
2. Foundations of Complex Analysis, S. Ponnusamy, Narosa Publications.
3. **Advanced Engineering Mathematics** – H. K. Dass, S. Chand Publications, 2007.
4. J. K. Sharma, "Operation Research", S. Chand Publications, 6th edition 2017.
5. T. Veerarjan, "Engineering Mathematics", Tata McGraw Hill Publication 2007.

Online References:

Course on Advanced Engineering Mathematics

- https://nptel.ac.in/courses
- https://www.coursera.org/courses?query=advanced%20engineering%20mathematics

Course Assessment:

ISE: To be conducted in any of these forms - Assignment/ Quiz/ Presentation/ Class Test/ Case study etc. of 15 marks and 5 marks attendance.

MSE: To be conducted as written examination for 20 marks (on 50% syllabus)

End Semester Examination

ESE duration of 03 hours and 80 marks and to be scaled down to 60

The question paper will comprise of 03 questions.

Question1 (20 marks): - Solve any 04 out of 06. All questions carry 05 marks each.

Question 2 (40 marks): - Solve any 04 out of 06. All questions carry 10 marks each.

Question3 (20 marks):- Solve any 04 out of 06. All questions carry 05 marks each.

All COs should be mapped as per the weightage in the syllabus.

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
CSEC402	Operating System	03	-	-	03	-	-	03

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE$			
		ISE	MSE				
CSEC402	Operating System	20	20	60	--	--	100

Pre-requisite:

1. CEC305- Computer Organization and Architecture

Program Outcomes addressed:

1. PO1: Engineering Knowledge
2. PO2: Problem analysis
3. PO3: Design/development of solutions
4. PO4: Conduct investigation of complex problems
5. PO5: Modern Tool Usage
6. PO6: The Engineer and Society

Course Objectives:

1. To understand the basic concepts of Operating System, its functions and services.
2. To introduce the concept of a process and its management like transition, scheduling, etc
3. To understand basic concepts related to Inter-process Communication (IPC) like mutual exclusion, deadlock, etc. and role of an Operating System in IPC.
4. To understand the concepts and implementation of memory management policies and virtual memory.
5. To understand the functions of Operating System for storage management and device management.
6. To study the need and fundamentals of special-purpose operating system with the advent of new emerging technologies.

Course Outcomes: Upon completion of this course, learners will be able to…

1. Identify the importance of operating system, its functions and services.
2. Compare process scheduling algorithms to ensure efficient execution of processes.
3. Apply concept of process synchronization and deadlocks.
4. Analyse memory management algorithms in effective allocation of main memory usage.
5. Discuss various File management methods and analyse I/O management algorithms for performance and quality criterion.
6. Compare the functions of various special-purpose Operating Systems.

Module No.	Unit No.		Hrs.	CO
1.0		**Operating system Overview**	**03**	
	1.1	Introduction, Objectives, Functions and Evolution of Operating System		**CO1**
	1.2	Operating system structures: Layered, Monolithic and Microkernel		
	1.3	Linux Kernel, Shell and System Calls		
	1.4	Introduction and Types IoT OS		
	1.5	Introduction to Real Time OS(RTOS) and Types of OS		
		Self-Learning: Self-Learning Topics: Resource Manager view, process view, Virtual Machine, Applications of IoT OS		
2.0		**Process Management and Scheduling**	**07**	
	2.1	**Process:** Basic Concepts of Process; Process State Model and Transition; Operation on Process; Process Control Block, Context switching		**CO2**
	2.2	**Threads:** Introduction to Threads; Types of Threads		
	2.3	**Uniprocessor Scheduling:** Basic Concepts of Scheduling; Types of Schedulers scheduling algorithms.		
		Self-Learning : Multithreading Models, Thread libraries, Performance comparison of Scheduling Algorithms		
3.0		**Process Synchronization and Deadlock**	**10**	
	3.1	**Process Synchronization:** Basic Concepts of Inter-process Communication and Synchronization; Race Condition; Critical Region and Problem; Peterson's Solution; Synchronization Hardware and Semaphores; Classic Problems of Synchronization; Message Passing		**CO3**
	3.2	**Deadlocks Management:** System Model, Deadlock Characterization; Deadlock Detection and Recovery; Deadlock Prevention; Deadlock Avoidance(Bankers Algorithm and Dining Philosopher Problem)		
		Self-Learning : Barber's shop problem , real time case study for Deadlock detection and recovery		
4.0		**Memory Management**	**09**	
	4.1	**Memory Management:** Basic Concepts of Memory Management; Swapping; Contiguous Memory Allocation; Paging; Structure of Page Table; Segmentation.		**CO4**
	4.2	**Virtual Memory:** Basic Concepts of Virtual Memory; Demand Paging, Copy-on Write; Page Replacement		

		Algorithms; Thrashing		
		Self-Learning : Concept of memory management in Linux & Windows NT/XP		
5.0		**File and I/O Management**	**06**	
	5.1	**File Management:** Basic Concepts of File System; File Access Methods; Directory Structure; File-System Implementation; Allocation Methods; Free Space Management; Overview of Mass- Storage Structure		**CO5**
	5.2	**I/O Management:** I/O devices, Organization of the I/O Function, Disk Organization, I/O Management and Disk Scheduling: FCFS, SSTF, SCAN, CSCAN, LOOK, C-LOOK.		
		Self-Learning : NTFS File system, RAID structure		
6.0		**Operating Systems Security**	**04**	
	6.1	**Overview of Security and Protection:** Goals of Security and Protection, Security and Protection Threats.		**CO6**
	6.2	**Protection Structure:** Granularity of Protection, Access control Matrix, Access Control Lists (ACLs), Capability Lists(C-Lists), Protection Domain. Introduction to Raspberry Pi concept related to OS.		
		Self-Learning: Classification of Computer Security, Security Attacks.		
		Total	**39**	

Textbooks:

1. A. Silberschatz, P. Galvin, G. Gagne, Operating System Concepts, 10th ed., Wiley, 2018.
2. W. Stallings, Operating Systems: Internal and Design Principles, 9th ed., Pearson, 2018.
3. A. Tanenbaum, Modern Operating Systems, Pearson, 4th ed., 2015.
4. D.M Dhamdhere, Operating Systems: A Concept Based Approach, Mc-Graw Hill, 2009.

Reference books:

1. Achyut Godbole and Atul Kahate, Operating Systems, McGraw Hill Education, 3rdEdition, 2011.
2. N. Chauhan, Principles of Operating Systems, 1st ed., Oxford University Press, 2014.
3. A. Tanenbaum and A. Woodhull, Operating System Design and Implementation, 3rd ed., Pearson, 2006.
4. R. Arpaci-Dusseau and A. Arpaci-Dusseau, Operating Systems: Three Easy Pieces, CreateSpace Independent Publishing Platform, 1st ed., 2018.

Online References:

1. https://www.nptel.ac.in
2. https://archive.nptel.ac.in/courses/106/105/106105214/
3. https://archive.nptel.ac.in/courses/106/105/106105172/

Course Assessment:
ISE: To be conducted in any of these forms - Assignment/ Quiz/ Presentation/ Class Test/ Case study etc. of 20 marks.
MSE: To be conducted as a written examination for 20 marks (on 40% - 50% syllabus).

End Semester Examination
$ ESE of duration 3 hours are of 80 marks and scaled to 60.

1. Question paper will comprise of **6** questions, each carrying **20** marks.
2. The students need to solve a total of **4** questions.
3. Question No.1 will be compulsory and based on entire syllabus.
4. Remaining questions **(Q.2 to Q.6)** will be selected from all the modules.

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
CSEC403	Computer Network	03	-	-	03	-	-	03

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE$			
		ISE	MSE				
CSEC403	Computer Network	20	20	60	--	--	100

Pre- requisite: None

Program Outcomes Addressed

1. PO1: Engineering Knowledge
2. PO2: Problem analysis
3. PO3: Design/development of solutions
4. PO4: Conduct investigation of complex problems
5. PO5: Engineering Tool Usage
6. PO6: The Engineer and The World

Course Objectives:

1. To interpret the issues and challenges of protocols design while delving into TCP/IP protocol suite.
2. To introduce concepts and fundamentals of physical layer
3. To describe various functions of Data Link Layer (DLL).
4. To compare the strengths and weaknesses of various routing algorithms.
5. To discuss various transport layer protocols.
6. To discuss various application layer protocols.

Course Outcomes: Learners will be able to

1. Discuss the concepts of data communication at physical layer and Compare ISO – OSI model with TCP/IP model.
2. Describe the various functions of Physical Layer.
3. Illustrate different design issues and error detection and correction mechanisms at data link layer.
4. Construct networks using IP addressing and sub-netting / super-netting schemes.
5. Apply transport layer protocols and congestion control algorithms to network scenarios.
6. Interpret the protocols at application layer.

Module No.	Unit No.		Hrs.	CO
1.0		**Introduction to Networking**	**4**	
	1.1	Introduction to computer network, Network topology, protocol hierarchies, design issues for the layers, Evolution of networking models (OSI vs. TCP/IP) Overview of OSI and TCP/IP layers and functions.		**CO1**
	1.2	Wired vs. Wireless Networks - Differences, advantages, and challenges, Wired Media: Twisted Pair, Coaxial, Fiber Optic, Wireless Media: Radio Waves, Microwaves, Infrared		
		Self-Learning: Firewalls, VPNs		
2.0		**Physical Layer**	**5**	
	2.1	**Sensors and Actuators:** Definition, Classification and selection of sensor and actuators. **Ethernet and LAN Technologies** - IEEE 802.3 Standards, Wireless LAN Technologies (Wi-Fi, WPAN) Wi-Fi (IEEE 802.11), Bluetooth, Zigbee (IEEE 802.15), LoRaWAN, and IoT Connectivity.		**CO2**
		Self-Learning: Self-Learning: Wireless Communication Security, Physical Access Control		
3.0		**Data Link Layer**	**8**	
	3.1	DLL Design Issues (Services, Framing, Error Control, Flow Control), Error Detection and Correction (Hamming Code, CRC, Checksum), Elementary Data Link protocols, Stop and Wait, Sliding Window (Go Back N, Selective Repeat), Piggybacking.		**CO3**
	3.2	**Medium Access Control Sublayer:** Channel Allocation problem, Multiple access Protocol (Aloha, Carrier Sense Multiple Access (CSMA/CD)		
		Self-Learning: Link Layer Security		
4.0		**Network layer**	**10**	
	4.1	Network Layer design issues, Addressing – IPv4 & IPv6, CIDR, Subnetting, Supernetting, Private vs. Public IPs, NAT Communication Primitives: Unicast, Multicast, Broadcast.		**CO4**
	4.2	**Wired Routing:** Shortest Path (Dijkstra's), Link state routing, Distance Vector Routing, BGP **Wireless Routing:** Ad-hoc Networks (MANET, VANET, Mesh Networks), Dynamic Source Routing (DSR), Ad-hoc On-Demand		

		Distance Vector (AODV), 6LoWPAN for IoT		
	4.3	**Protocols –** ARP, RARP, ICMP, IGMP		
		Self-Learning: EIGRP (Enhanced Interior Gateway Routing Protocol).		
5.0		**Transport Layer**	**6**	
	5.1	**The Transport Service:** Transport service primitives, Berkeley Sockets, Connection Management (3- WayHandshake), UDP, TCP, TCP timers, TCP Flow control (sliding Window), TCP Congestion Control: Slow Start		**CO5**
	5.2	Issues of Transport Layer in wireless Networks, Modifications in Transport Protocols for Wireless, Impact of 5G on Transport Layer Protocols.		
		Self-Learning: Sockets, Packet Loss Handling & Retransmission Mechanisms.		
6.0		**Application Layer**	**6**	
	6.1	**DNS:** Name Space, Resource Record and Types of Name Server. HTTP, SMTP, Telnet, FTP, DHCP, MQTT, CoAP		**CO6**
		Self-Learning: DNS Caching & Performance Optimization, SMTP Security Threats (Phishing, Email Spoofing)		
		Total	**39**	

Textbooks:

1. A.S. Tanenbaum, **Computer Networks**,4th edition Pearson Education
2. B.A. Forouzan, **Data Communications and Networking**, 5th edition, TMH
3. James F. Kurose, Keith W. Ross, **Computer Networking, A Top-Down Approach Featuring the Internet**,6th edition, Addison Wesley
4. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, IoT Fundamentals Networking Technologies, Protocols, and Use Cases for the Internet of Things CISCO.

Reference books:

1 S.Keshav,**An Engineering Approach To Computer Networking**, Pearson
2 Natalia Olifer & Victor Olifer,**Computer Networks: Principles, Technologies & Protocols for Network Design**, Wiley India, 2011.
3 Larry L.Peterson, Bruce S.Davie, **Computer Networks: A Systems Approach**, Second Edition ,The Morgan Kaufmann Series in Networking

Online References:

1 https://www.netacad.com/courses/networking/networking-essentials
2 https://www.coursera.org/learn/computer-networking
3 https://nptel.ac.in/courses/106/105/106105081
4 https://www.edx.org/course/introduction-to-networking

Course Assessment:

ISE:

To be conducted in any of these forms - Assignment/ Quiz/ Presentation/ Class Test/ Case study etc. of 20 marks.

ISE 20 marks = 05 marks for attendance + 15 marks for activities.

MSE:

To be conducted as written examination for 20 marks (on 40% - 50% syllabus)

End Semester Examination:

$ ESE of duration 03 hours are of 80 marks and scaled to 60.

1. Question paper will comprise of 03 questions.
2. Question1 (20 marks): - Solve any 04 out of 06. All questions carry 05 marks each.
3. Question 2 (40 marks): - Solve any 04 out of 06. All questions carry 10 marks each.
4. Question3 (20 marks) :- Solve any 04 out of 06. All questions carry 05 marks each.
5. All COs should be mapped as per the weightage in the syllabus.

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
CSEC404	Critical Thinking & Design	02	-	-	02	-	-	02

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE$			
		ISE	MSE				
CSEC404	Critical Thinking and Design	15	15	45	--	--	75

Pre- requisite: None

Program Outcomes Addressed

1. PO2: Problem Analysis
2. PO3: Design/Development of Solutions
3. PO5: Engineering Tool Usage
4. PO6: The Engineer and The World
5. PO7: Ethics
6. PO8: Individual and Collaborative Team Work
7. PO9: Communication
8. PO10: Project Management and Finance
9. PO11: Life-Long Learning

Course Objectives:

1. To describe the fundamentals of critical thinking and fair-minded reasoning for effective decision-making.
2. To differentiate personal thinking stages and implement structured strategies for continuous cognitive growth.
3. To analyze key elements of thought and intellectual standards to enhance logical reasoning.
4. To examine the principles of design thinking and apply them to solve real-world problems through an iterative, user-centered approach.
5. To demonstrate hands-on experience with idea generation, customer insights, and problem framing to drive innovation.
6. To employ creative problem-solving techniques such as brainstorming, prototyping, and hypothesis validation to design user-centric solutions.

Course Outcomes: Learners will be able to

1. Interpret the fundamentals of critical thinking and fair-minded reasoning for effective decision-making.
2. Identify their cognitive development stage and implement structured strategies to progress as a critical thinker.
3. Apply intellectual standards like clarity, accuracy, and logic to improve reasoning and problem-solving

skills.
4. Integrate design thinking principles to create innovative, balanced, and user-centered solutions.
5. Develop a broad perspective in understanding customer needs and effectively define problem statements using diverse methodologies.
6. Implement creative solutions and enhance ideas through iterative prototyping and user feedback using brainstorming techniques.

Module No.	Unit No.		Hrs.	CO
1.0		**Introduction to Critical Thinking**	**4**	
	1.1	**Introduction:** Start-up definition of Critical Thinking how skilled are you as a Thinker? Hard Work, Concept of Critical Thinking, establish new habits of thoughts, Develop confidence		**CO1**
	1.2	**Fair-minded Thinker:** Weak Vs Strong Critical Thinking Requirement of Fair-mindedness Intellectual: Humility, Courage, Empathy, Integrity, Perseverance, Autonomy Interdependence of Intellectual Virtues		
		Self-Learning : Role of Intellectual Humility in Decision-Making		
2.0		**Four Stages of Development, Game Plan**	**3**	
	2.1	**Four Stages of Development:** Stage 1: Unreflective thinker, Stage 2: Challenged thinker, Stage 3: Beginning thinker, Stage 4: Practicing thinker		**CO2**
	2.2	**Game Plan:** Purpose & Key Components of Game Plan, Integrating of Game Plan Strategies		
	2.3	**Self-Learning:** Case Study: Explores how a student progresses through four stages using self-reflection& discipline.		
3.0		**Self-Understanding, Parts & Universal Standards**	**3**	
	3.1	**Three Distinctive Functions:** Recognize the Mind's Three Distinctive Functions; Special Relationship		**CO3**
	3.2	**Thoughts & Intellectual Standards:** Fundamental structures of thought, The elements of thought, Universal Intellectual Standards: Clarity, Accuracy, Precision, Relevance, Depth, Breadth, Logic, Significance, Fairness		
		Self-Learning: Recognizing biases and promoting ethical decision-making.		
4.0		**Design Thinking & its Key Tenets**	**5**	
	4.1	**Design Thinking Basics:** Traditional Model vs. Design Thinking, Five Stages: Inspire, Empathize, Define, Ideate, Prototype & Test Scale Thinking: Lean Thinking, Critical Thinking, Lateral Thinking, Design Thinking		**CO4**
	4.2	**Key Tenets:** Customer-Centric Approach, Thinking Beyond Products, Balancing Desirability, Feasibility & Viability, Broad & Compartmentalized Thinking, Visual Thinking & Hands-on		

		Approach		
		Self-Learning: Case Study: How a global brand used design thinking to enhance customer experience and increase engagement.		
5.0		**Inspire, Empathize and Define**	**5**	
	5.1	**Generating & Broadening Ideas:** Creating Stretch Goals, Power of Metaphors & Widening Perspectives, Importance of Diversity in Ideation		**CO5**
	5.2	**Empathize & Define:** New Channels for Customer Insights, Deep Customer Empathy & Stakeholder Analysis, Leveraging Technology for Insights, Mind Mapping: Stakeholders, Journey Mapping, Problem Framing		
		Self-Learning: Case Study: How Airbnb used empathy mapping and customer insights to redefine its business model.		
6.0		**Ideate, Prototype and Test**	**6**	
	6.1	Ideate: Brainstorming & Hybrid Ideation Techniques, Challenging Assumptions & Breaking Patterns, Cross-Industry Inspiration (Analogous Design), Designing for Extreme Users & Ideation Triggers		**CO6**
	6.2	Prototype & Test: Rapid Prototyping & Hypothesis Validation, Storyboarding & Scenario Visualization, Collecting Feedback & Managing Failed Prototypes		
		Self-Learning: Case Study: Explore Apple's iterative prototyping process in designing user-friendly products.		
		Total	**26**	

Textbooks:

1. Richard Paul, Linda Elder, “Critical Thinking: Tools for Taking Charge of Your Learning and Your Life”, Fourth Edition, 2022, Pearson Education
2. Pavan Soni, “Design Your Thinking: The Mindsets, Toolsets, and Skill Sets for Creative Problem-solving”,2020, Penguin Random House India Private Limited

Reference books:

1. Roger L. Martin,“The Design of Business: Why Design Thinking is the Next Competitive Advantage”,2009, Harvard Business Press
2. Richard Paul, Robert Niewoehner, Linda Elde,”The Thinker's Guide to Engineering Reasoning, 2019, Rowman & Littlefield Publishers, **ISBN-13:** 978-1538133798
3. Tilmann Lindberg, Christoph Meinel, Ralf Wagner, Christo, “Design Thinking: Creating a Culture of Innovation”, Springer
4. Brooke Noel Moore & Richard Parker,”Critical Thinking”13th Edition,2020,McGraw-Hill Education

Online References:

1. https://onlinecourses.nptel.ac.in/noc19_mg60/preview
2. https://onlinecourses.nptel.ac.in/noc20_de03/preview

3. https://onlinecourses.swayam2.ac.in/imb24_mg37/preview
4. https://www.coursera.org/learn/uva-darden-design-thinking-innovation

Course Assessment:

ISE:

- To be conducted in any of these forms - Assignment/ Quiz/ Presentation/ Class Test/ Case study etc. of 20 marks.
- ISE 20 marks = 05 marks for attendance + 15 marks for activities.

MSE:

- To be conducted as written examination for 20 marks (on 40% - 50% syllabus)

End Semester Examination:

ESE duration of 02 hours are of 60 marks and scaled to 45

1. Question paper will comprise of 3 questions.
2. Question1 (15 marks): - Solve any 03 out of 04. All questions carry 05 marks each.
3. Question 2 (30 marks): - Solve any 03 out of 05. All questions carry 10 marks each.
4. Question3 (15 marks):- Solve any 03 out of 04. All questions carry 05 marks each.
5. All COs should be mapped as per the weightage in the syllabus.

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
MDMC4011	Artificial Intelligence	03	-	-	03	-	-	03

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE$^{\$}$			
		ISE	MSE				
MDMC4011	Artificial Intelligence	20	20	60	--	--	100

Pre-requisite:

1. FEC101: Applied Mathematics -I
2. FEC201: Applied Mathematics -II

Program Outcomes addressed:

1. PO1: Engineering knowledge
2. PO2: Problem analysis
3. PO3: Design/Development of Solutions

Course Objectives:

1. To conceptualize the basic ideas and techniques underlying the design of intelligent systems.
2. To make students understand and explore the mechanism of mind that enables intelligent thought and action.
3. To make students understand advanced representation formalism and search techniques.
4. To make students understand how to deal with uncertain and incomplete information.

Course Outcomes:

After successful completion of the course, students will be able to:

1. to understand the fundamental concepts, evolution, and applications of AI.
2. to analyze intelligent agents, their structures, and problem-solving approaches using search methods.
3. to evaluate different AI problem-solving techniques, including uninformed, informed, and optimization-based search algorithms.
4. to apply logical reasoning and knowledge representation techniques for AI-based inference and decision-making.
5. to understand AI planning methods and different learning paradigms, including reinforcement learning.
6. to explore AI applications in real-world domains such as NLP, robotics, healthcare, retail, and banking.

Module No.	Unit No.		Hrs.	CO
1.0		**Introduction to AI**	**05**	**CO1**
	1.1	Introduction to Artificial Intelligence, Brief history and evolution of AI, Intelligent Systems: Categorization of Intelligent System, Components of AI Program, Foundations of AI, Sub-areas of AI		
		Self-Learning: Applications of AI, Current trends in AI		
2.0		**Intelligent Agents and Environments**	**09**	**CO2**
	2.1	Definition of an agent and its environment, Structure of Intelligent Agents, Types of agents, Learning Agent.		
	2.2	Solving problem by Searching: Problem Solving Agent, Formulating Problems, Example Problems.		
		Self-Learning: The concept of rationality		
3.0		**Problem Solving Techniques in AI**	**07**	**CO3**
	3.1	Uninformed search methods: Breadth-First Search (BFS) and Depth-First Search (DFS), Depth Limited Search, Depth First Iterative Deepening (DFID)		
	3.2	Informed Search Methods: Greedy best first Search, A* Search, Memory bounded heuristic Search.		
	3.3	Local Search Algorithms and Optimization Problems: Hill climbing search Simulated annealing, Genetic algorithms.		
		Self-Learning: Adversarial Search: Game Playing, Min-Max Search, Alpha Beta Pruning		
4.0		**Knowledge Representation and Logical Reasoning**	**07**	**CO4**
	4.1	Logical Agents: Knowledge based Agents, Fundamentals of logic: propositional logic basics, Representation of knowledge using rules, First Order Logic (FOL): Syntax and Semantic, Basic inference techniques: forward chaining and backward chaining, Simple rule-based systems and examples		
	4.2	Knowledge Engineering in First-Order Logic, Propositional vs. First-Order Inference, Unification, Resolution		
		Self-Learning: Representing knowledge in an uncertain domain, The semantics of belief network		
5.0		**Planning and Learning**	**05**	**CO5**
	5.1	The planning problem, Planning with state space search, Partial order planning, Hierarchical planning, Conditional Planning.		
	5.2	Learning: Forms of Learning, Theory of Learning, PAC learning. Introduction to statistical learning (Introduction only) Introduction to reinforcement learning: Learning from Rewards		
		Self-Learning: Passive and Active Reinforcement Learning		

6.0		AI Applications	06	CO6
	6.1	Introduction to NLP- Language models, Grammars, Parsing Robotics - Robots, Robot hardware, Problems Robotics can solve AI applications in Healthcare, Retail, Banking		
		Self-Learning: AI applications in Retail, Banking		
		Total	**39**	

Textbooks:

1. Stuart J. Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", 4th Edition" Pearson Education, 2020.
2. George F Luger, "Artificial Intelligence" Low Price Edition, Fourth edition, Pearson Education, 2005
3. Lavika Goel, "Artificial Intelligence: Concepts and Applications," Wiley 2021.

Reference books:

1. Saroj Kaushik, "Artificial Intelligence", Cengage Learning, First edition, 2011
2. Elaine Rich and Kevin Knight, "Artificial Intelligence", Third Edition, McGraw Hill Education,2017.
3. Nils J. Nilsson, Principles of Artificial Intelligence, Narosa Publication.
4. Deepak Khemani, A First Course in Artificial Intelligence, McGraw Hill Publication
5. Patrick H. Winston, Artificial Intelligence, 3rd edition, Pearson Education.

Course Assessment:

ISE: To be conducted in any of these forms - Assignment/ Quiz/ Presentation/ Class Test/ Case study etc. of 15 marks and 5 marks attendance.

MSE: To be conducted as written examination for 20 marks (on 50% syllabus)

End Semester Examination

$ ESE of duration 03 hours are of 80 marks and scaled to 60.

Question paper will comprise of 03 questions.
Question1(20 marks): - Solve any 04 out of 06. All questions carry 05 marks each.
Question 2 (40 marks): - Solve any 04 out of 06. All questions carry 10 marks each.
Question3(20 marks) :- Solve any 04 out of 06. All questions carry 05 marks each.
All COs should be mapped as per the weightage in the syllabus.

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
MDMC 4051	Advanced Data Structures	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE$^{\$}$			
		ISE	MSE				
MDMC 4051	Advanced Data Structures	20	20	60	--	--	100

Pre-requisite:

1. Data Structures and Algorithms

Program Outcomes addressed:

1. PO1: Engineering knowledge
2. PO2: Problem analysis
3. PO3: Design/ development of solutions:
4. PO4: Conduct investigations of complex problems:
5. PO5: Modern tool usage:
6. PO6: The engineer and society

Course Objectives:

1. Understand advanced data structures and their applications in solving computational problems.
2. Analyze and implement efficient hashing techniques for optimized search operations.
3. Explore priority queues and balanced trees to improve data retrieval and manipulation.
4. Apply graph algorithms for solving network, optimization, and traversal problems.
5. Design efficient string processing and pattern matching algorithms for text-based applications.
6. Implement real-world applications using advanced data structures for improved system performance.

Course Outcomes:

After successful completion of the course student will be able to…

1. Apply and analyze advanced hashing techniques for fast data retrieval and collision handling.
2. Implement and evaluate priority queues and balanced trees for efficient search and storage.
3. Solve problems using graph algorithms like Topological Sorting, Shortest Paths, and Maximum Flow.
4. Design efficient pattern matching algorithms using KMP, Rabin-Karp, and Suffix Trees.
5. Develop optimized memory management techniques using Tries, Skip Lists, and Segment Trees.
6. Implement real-world applications using advanced data structures in domains like AI, Blockchain, and Networking.

Module No.	Unit No.		Hrs.	CO
1		**Advanced Hashing Techniques**	**6**	
	1.1	Hashing Fundamentals: Hash functions, Properties, Load Factor.		**CO1**
	1.2	Collision Handling: Separate Chaining, Open Addressing (Linear, Quadratic, Double Hashing).		
	1.3	Advanced Hashing: Universal Hashing, Extendible Hashing, Perfect Hashing.		
	1.4	Applications: Hashing in Databases, Cryptographic Hashing, Hash Tables in Standard Libraries.		
		Self-Learning : Consistent Hashing, Cuckoo Hashing, Hashing in Blockchain.		
2		**Priority Queues and Balanced Trees**	**8**	
	2.1	Priority Queues: Definition, Binary Heaps,Heap Order property, Heap Operations insert, delete Percolate down .		**CO2**
	2.2	Binomial Heaps: Structure, Operations, Implementation.		
	2.3	Multi-Way Search Trees: B-Trees, B+ Trees, 2-3 Trees.		
	2.4	Red-Black Trees: Properties, Rotations, Insertions, Deletions.		
		Self-Learning : Fibonacci Heaps, Treaps, Applications in Databases.		
3		**Graph Algorithms**	**8**	
	3.1	Graph Representations: Adjacency Matrix, Adjacency List, Incidence Matrix.		**CO3**
	3.2	Graph Traversals: BFS, DFS, Connected Components, Bridges, Articulation Points.		
	3.3	Graph Applications: Topological Sorting, Shortest Paths (Dijkstra's, Bellman-Ford, Floyd-Warshall).		
	3.4	Minimum Spanning Trees: Kruskal's, Prim's Algorithm.		
		Self-Learning : Graph Coloring, Euler Circuits, Graph Databases (Neo4j).		
4		**String Processing and Pattern Matching**	**6**	
	4.1	Naïve String Matching: Brute Force Approach.		**CO4**
	4.2	Efficient Pattern Matching: Knuth-Morris-Pratt (KMP), Rabin-Karp Algorithm.		
	4.3	Suffix Trees and Arrays: Construction, Applications.		
	4.4	Aho-Corasick Algorithm: Multi-Pattern Matching.		
		Self-Learning : Boyer-Moore Algorithm, Text Searching in Big Data.		

5		**Applications of Advanced Data Structures**	**7**	
	5.1	Tries: Standard Tries, Compressed Tries, Suffix Tries.		**CO5**
	5.2	Skip Lists: Structure, Search, Insert, Delete.		
	5.3	Segment Trees: Range Queries, Lazy Propagation.		
	5.4	Disjoint Sets (Union-Find): Path Compression, Applications in Kruskal's Algorithm.		
		Self-Learning : Fenwick Trees (Binary Indexed Trees), Bloom Filters, Memory Pools.		
6		**Applications of Advanced Data Structures**	**4**	
	6.1	Blockchain Data Structures: Merkle Trees, DAGs in Cryptocurrencies.		**CO6**
	6.2	Big Data Processing: Hadoop Data Structures, Trie-Based Indexing.		
		Self-Learning : Real-World Implementations in Cloud Computing, Networking, and Bioinformatics.		
	Total		**39**	

Textbooks

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford SteinCormen, T. H., Leiserson, C. E., Rivest, R. L., & Stein, C, Introduction to Algorithms (Fourth Edition) 2024. MIT Press.
2. Goodrich, M. T., Tamassia, R., & Goldwasser, M. H. (2014). Data Structures and Algorithms in Java (6th ed.). Wiley.
3. Sahni, S. (2005). Data Structures, Algorithms, and Applications in C++ (2nd ed.). Universities Press.
4. Weiss, M. A. (2013). Data Structures and Algorithm Analysis in C++ (4th ed.). Pearson.

Reference Books

1. Knuth, D. E. (1997). The Art of Computer Programming, Volume 3: Sorting and Searching (2nd ed.). Addison-Wesley.
2. Kleinberg, J., & Tardos, É. (2005). Algorithm Design. Pearson.
3. Sedgewick, R., & Wayne, K. (2011). Algorithms (4th ed.). Addison-Wesley.
4. Dasgupta, S., Papadimitriou, C. H., & Vazirani, U. (2006). Algorithms. McGraw-Hill.

Online References:

NPTEL Courses:

1. https://nptel.ac.in/courses/106102064
2. https://nptel.ac.in/courses/106106133
3. https://onlinecourses.nptel.ac.in/noc22_cs92/preview

Coursera Courses:

1. https://www.coursera.org/specializations/data-structures-algorithms
2. https://www.coursera.org/learn/advanced-data-structures-rsa-and-quantum-algorithms
3. https://www.coursera.org/learn/advanced-data-structures

Course Assessment:

ISE: To be conducted in any of these forms - Assignment/ Quiz/ Presentation/ Class Test/ Case study etc. of 15 marks and 05 marks attendance.

MSE: To be conducted as written examination for 20 marks (on 50% syllabus).

End Semester Examination

$ ESE is of duration 03 hours and 80 marks and will be scaled down to 60.

The question paper will comprise of 03 questions.
Question1(20 marks): - Solve any 04 out of 06. All questions carry 05 marks each.
Question 2 (40 marks): - Solve any 04 out of 06. All questions carry 10 marks each.
Question3(20 marks):- Solve any 04 out of 06. All questions carry 05 marks each.
All COs should be mapped as per the weightage in the syllabus.

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
MDMC 4061	Cost Management	03	-	-	03	-	-	03

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE$^{\$}$			
		ISE	MSE				
MDMC 4061	Cost Management	20	20	60	--	--	100

Pre-requisite: Basic Accounting principles, Quantitative skills etc.

Program Outcomes addressed:

1. PO1: Engineering Knowledge
2. PO2: Problem Analysis
3. PO11: Life-Long Learning

Course Objectives: To acquire knowledge and understanding of the concepts, techniques, and practices of cost and management accounting and to develop skills for decision making.

Course Outcomes: Upon completion of this course, learners will be able to…

1: To understand and analyze different cost concept and methods.
2: To understand the Elements of Cost & Cost classification.
3: To apply various material concepts & classifications for preparation of cost sheet.
4: To analyze various techniques of costing and its application in Finance, budgets and budgetary control.
5: To develop requisite data for cost control and cost reduction.
6: To evaluate marginal costing techniques for decision making.

Module No.	Unit No.	Topics	Hrs.	CO
1.0		**Module 1: Introduction to Cost Accounting**	**04**	
	1.1	Meaning of Cost, Cost Accounting & its Objectives, Comparison between Cost accounting and Financial Accounting, Comparison between Cost Accounting and Management Accounting, Types of cost, Methods of costing & Techniques of costing.		**CO1**
		Self-Learning: Basic cost accounting concepts		
2.0		Classification of Costs and Cost Sheet	**05**	
	2.1	Elements of Cost, Classification of Costs, Cost center and cost unit, Preparation of Cost Sheet & Estimated Cost Sheet.		**CO2**
		Self-Learning: Purpose and importance of cost sheet.		
3.0		**Material Management and Accounting for materials**	**06**	
	3.1	Managing Purchase Functions, Cost of Material, Storing of materials – Inventory control methods, Costs associated with storing and ordering material, Economic Order Quantity, Fixation of levels and calculation of the same, Issue control-Pricing issues (LIFO, FIFO, Weighted Average), Material control -Objectives in Material Control, Stock Turnover, Material losses wastage, scrap, spoilage, defectives.		**CO3**
		Self-Learning: Basic flowchart for material flow in a company.		
4.0		**Accounting for labour and Overheads**	**08**	
	4.1	Accounting for labour: Types of Labour Cost, Methods of Remuneration, Treatment of overtime, fringe benefits, idle time etc. Accounting for overheads: Production overheads – Collection, Distribution to Production and service departments, Computation of Overheads Rate based on Machine Hour Rate method, Allocations and Apportionment, Absorption of overheads.		**CO4**
		Self-Learning: Types of labour, classification of overheads.		
5.0		**Cost Control and Cost Reduction**	**10**	
	5.1	Introduction, Comparison between cost control & cost reduction, Budgets and Budgetary Control, Meaning and Purpose of Budget, Objectives of Budgetary Control, Dangers of budget, Types of Budgets- Flexible Budget Standard Costing, Concept and development of standard costing, Variance analysis for cost, Direct Material variance- Cost, Price, usage, mix and yield variance Direct Labour Variance- Cost, Efficiency, usage, mix, yield and idle-time variance,		**CO5**

		Overhead Variance – Variable & Fixed Overhead variance, Sales variances – Value, rate, volume and mix variance.		
		Self-Learning: Differences and Interplay Between Cost Control and Cost Reduction.		
6.0		Marginal Costing & CVP Analysis	**06**	
	6.1	Nature and scope of Marginal Costing, Marginal Cost equation, Cost Profit volume analysis, Break Even point and Break-Even Analysis, Relevant cost analysis for decision making.		**CO6**
		Self-learning: Applications of Marginal Costing in Decision Making.		
		Total	**39**	

Textbooks:

1. B. Banerjee, *Cost Accounting: Theory and Practice*, 14th ed. New Delhi, India: PHI Learning Pvt. Ltd., 2021.
2. M. Y. Khan and P. K. Jain, *Management Accounting*, 8th ed. New Delhi, India: McGraw-Hill Education, 2021.

Reference books:

1. P. Shah, Management Accounting, 6th ed. New Delhi, India: Oxford University Press, 2015.
2. C. Drury, Management and Cost Accounting, 12th ed. Andover, U.K.: Cengage Learning, 2024.

Online References:

1. https://dynamicstudyhub.com/cost-management.
2. https://www.wallstreetmojo.com/cost-management

Course Assessment:

ISE: To be conducted in any of these forms - Assignment/ Quiz/ Presentation/ Class Test/ Case study etc. of 15 marks and 5 marks attendance.
MSE: To be conducted as written examination for 20 marks (on 50% syllabus)

End Semester Examination:

$ ESE of duration 03 hours are of 80 marks and scaled to 60.

1. Question paper will comprise of 03 questions.
2. Question1 (20 marks): - Solve any 04 out of 06. All questions carry 05 marks each.
3. Question 2 (40 marks): - Solve any 04 out of 06. All questions carry 10 marks each.
4. Question3 (20 marks) :- Solve any 04 out of 06. All questions carry 05 marks each.
5. All COs should be mapped as per the weightage in the syllabus.

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
CSEL401	Operating System Lab	--	02	--	--	01	-	01

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE			
		ISE	MSE				
CSEL401	Operating System Lab	--	--	--	25	25	50

Pre-requisite:

1. Knowledge on Operating system principles.

Program Outcomes addressed:

1. PO1: Engineering knowledge
2. PO2: Problem analysis
3. PO3: Design/Development of Solutions
4. PO4: Conduct investigations of complex problems
5. PO5: Engineering tool usage
6. PO8: Individual and Collaborative Team Work
7. PO10: Project Management and Finance

Lab Objectives:

1. To gain practical experience with designing and implementing concepts of operating systems such as system calls, CPU scheduling, process management, memory management, file systems and deadlock handling using C language in Linux environment.
2. To familiarize students with the architecture of Linux OS.
3. To provide necessary skills for developing and debugging programs in Linux environment.
4. To learn programmatically to implement simple operation system mechanisms.

Lab Outcomes:

Upon completion of this course, learners will be able to…

1. Illustrate basic Operating system Commands, Shell scripts, System Calls.
2. Simulate and implement various processes, scheduling algorithms and evaluate their performance.
3. Analyze and experiment various methods of synchronization and deadlocks.
4. Show various Memory Management techniques and evaluate their performance.
5. Illustrate and analyze concepts of virtual memory.
6. Implement and analyze concepts of file management and I/O management techniques.

Suggested List of Experiments

Sr. No.		Content	LO
1		**Explore Linux Commands**	**LO1**
	1.1	Explore usage of basic Linux Commands and system calls for file, directory and process management. For eg: (mkdir, chdir, cat, ls, chown, chmod, chgrp, ps. system calls: open, read, write, close, getpid, setpid, getuid, getgid, getegid, geteuid. sort.)	
	1.2	Implement any one basic commands of linux like ls, cp, mv and others using kernel APIs.	
2		**Linux shell script**	**LO1**
	2.1	To write shell script a. Write a grep/egrep script to find the number of words character, words and lines in a file. b. Write an awk script to develop a Fibonacci series. c. Write an awk script to display the pattern of given string or number. d. Write an egrep script to display list of files in directory	
	2.2	Write shell scripts to do the following: a. Display OS version, release number, kernel version b. Display top 10 processes in descending order c. Display processes with highest memory usage. d. Display current logged in user and log name. e. Display current shell, home directory, operating system type, current path setting, current working directory.	
3		**Linux- Process**	**LO1**
	3.1	a. Create a child process in Linux using the fork system call. From the child process obtain the process ID of both child and parent by using getpid and getppid system call. b. Explore wait and waitpid before termination of process.	
4		**Process Management: Scheduling**	**LO2**
	4.1	a. Write a program to demonstrate the concept of non-preemptive scheduling algorithms. b. Write a program to demonstrate the concept of preemptive scheduling algorithms	
5		**CPU-OS simulator**	**LO2**
	5.1	Using the **CPU-OS simulator** analyze and synthesize the following: a. Process Scheduling algorithms. b. Thread creation and synchronization. c. Deadlock prevention and avoidance.	
6		**Process Management: Synchronization**	**LO3**
	6.1	Write a C program to implement solution of Producer consumer	

		problem through Semaphore	
7		**Process Management: Deadlock**	**LO3**
	7.1	a. Write a program to demonstrate the concept of deadlock avoidance through Banker's Algorithm Write a program demonstrate the concept of Dining Philospher's Problem	
8		**Memory Management**	**LO4**
	8.1	a. Write a program to demonstrate the concept of MVT and MFT memory management techniques Write a program to demonstrate the concept of dynamic partitioning placement algorithms i.e. Best Fit, First Fit, Worst-Fit etc.	
9		**Memory Management: Virtual Memory**	**LO5**
	9.1	a. Write a program to demonstrate the concept of demand paging for simulation of Virtual Memory implementation Write a program in C demonstrate the concept of page replacement policies for handling page faults eg: FIFO, LRU etc.	
10		**File Management & I/O Management**	**LO6**
	10.1	a. Write a C program to simulate File allocation strategies typically sequential, indexed and linked files b. Write a C program to simulate file organization of multi-level directory structure. c. Write a program in C to do disk scheduling - FCFS, SCAN, C-SCAN. d. Raspberry Pi installation.	

Text Books:

1. William Stallings, Operating System: Internals and Design Principles, Prentice Hall, 8th Edition, 2014.
2. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, John Wiley &Sons, Inc., 9thEdition, 2016.
3. Linux Kernel Book, by Remy Card, Eric Dumas, Frank Mevel, Wiley India.
4. Unix Concepts and Applications, Sumitabha Das, McGraw Hill.

Reference Books:

1. Practicing Hand Book for Operating System Laboratory by Sathish Kumar Ravichandran, Archana Sasi.
2. Operating System Lab Programs: Guide to Shell and OS lab programs by S.Sydhani Begum
3. Maurice J. Bach, "Design of UNIX Operating System", PHI

Term Work will be assessed as **Continuous Internal Assessment Practical (CIAP).**

1. Term work should consist of 10 experiments covering all modules.
2. Journal must include at least 2 assignments on content of theory and practical of

"Operating System"

3. The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.
4. Total 25 Marks (Experiments: 15-marks, Attendance Theory& Practical: 05-marks, Assignments: 05-marks)

Practical Exam: (2 hours/ 25 Marks)

End-semester Practical and oral exam will be held based on the above syllabus and will be assessed as **End Semester Examination Practical (ESEP).**

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
CSEL402	Computer Network Lab	--	02	--	--	01	-	01

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE			
		ISE	MSE				
CSEL402	Computer Network Lab	--	--	--	25	25	50

Pre-requisite:

1. Knowledge of assembling of computer and identification of networking components (FEL105)

Program Outcomes addressed:

1. PO1: Engineering knowledge
2. PO2: Problem analysis
3. PO3: Design/Development of Solutions
4. PO4: Conduct investigations of complex problems
5. PO5: Engineering tool usage
6. PO6: The Engineer and The World
7. PO8: Individual and Collaborative Team Work
8. PO10: Communication
9. PO11: Lifelong Learning

Lab Objectives:

1. To practically explore various networking devices.
2. To compare OSI layers and understand the usage of simulation tools.
3. To discuss various MAC protocols in the Data Link Layer.
4. To explore socket programming applications.
5. To identify the various issues of a packet transfer from source to destination, and how they are resolved by the various existing protocols.
6. To observe various Application Layer Protocols

Lab Outcomes:

After successful completion of the course, students will be able to:

1. Simulate the functions of different networking devices and networking commands.
2. Examine the packet formats of each layer in TCP/IP model.
3. Interpret the functioning of MAC protocols of Data Link Layer.
4. Experiment socket programming on different applications.
5. Construct networks to implement network routing protocols.
6. Illustrate the working of Application Layer protocols

Suggested List of Experiments:		
Sr. No.	**Title of Experiments**	**LO**
1	Understand the working of networking devices.	LO1
2	Execute Basic networking commands in Linux.	LO1
3	Use Wire shark to understand the operation of TCP/IP layers: • Ethernet Layer: Frame header, Frame size etc. • Data Link Layer: MAC address, ARP (IP and MAC address binding) • Network Layer: IP Packet (header, fragmentation), ICMP (Query and Echo) • Transport Layer: TCP Ports, TCP handshake segments etc. Application Layer: DHCP, FTP, HTTP header formats	LO2
4	Design a network and understand the basic working of PING (ICMP) and ARP (DLL).	LO2
5	a) Setup a LAN network using Static/ Dynamic IPs and assign multiple IPs . b) Using netstat and route commands of Linux, do the following: • View current routing table • Add and delete routes • Change default gateway c) Perform packet filtering by enabling IP forwarding using IP tables in Linux.	LO1
6	Use simulator (Eg. NS2) to understand functioning of ALOHA, CSMA/CD	LO3
7	Configure a network and Implement Static Routing.	LO4
8	Configure a Network and Distance Vector Routing protocol (RIP).	LO4
9	Configure Network using Link State Vector Routing protocol (OSPF).	LO4
10	Create VLAN and perform inter VLAN routing.	LO4
11	An organization is granted a block of addresses with the beginning address 14.24.74.0/24. The organization needs to have 3 subblocks of addresses to use in its three subnets as shown below: • One subblock of 120 addresses. • One subblock of 60 addresses. One subblock of 10 addresses.	LO4
12	An organization is granted the block 130.34.12.64/26.The organization needs 4 subnets each with equal no hosts. Design the sub networks, find the information about each n/w and implement NAT.	LO4
13	Write a program to implement socket programming for chat application.	LO3
14	Perform File Transfer and Access using FTP.	LO5
15	Perform Remote login using Telnet server.	LO5

Online Resources:

1. https://www.coursera.org/projects/data-forwarding-computer-networks
2. https://www.edx.org/course/ilabx-the-internet-masterclass

Term Work:

The termwork must include 10 experiments using simulators like NS2 / Cisco packet Tracer / GNS3 / networking hardware (routers, switches). At least 02 assignments covering the entire syllabus must be given on the content of theory and practical's of "Computer Network". The assignments should be students' centric, and an attempt should be made to make assignments more meaningful, interesting and innovative. Term work will be assessed as Continuous Internal Assessment Practical (CIAP).

Term work Marks:

25 Marks (Total Marks) =15 Marks (Experiment) + 05 Marks (Assignments) + 05 Marks (Attendance)

The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.

Practical Exam: (2 hours/ 25 Marks)

End-semester Practical and oral exam will be held based on the above syllabus and will be conducted as End Semester Examination Practical (ESEP).

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
CSEL403	Skill Lab Course (Web Technology)	--	2*+2	--	--	02	-	02

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE			
		ISE	MSE				
CSEL403	Skill Lab Course (Web Technology)	--	--	--	25	25	50

Pre-requisite:

1. Basic knowledge of programming and data structure Lab

Program Outcomes addressed:

1. PO1: Engineering knowledge
2. PO2: Problem analysis
3. PO4: Conduct investigations of complex problems
4. PO8: Individual and Collaborative Team Work
5. PO10: Communication
6. PO11: Life-long learning

Lab Objectives:

1. To introduce the methods of designing and analyzing algorithms.
2. Design and implement efficient algorithms for a specified application.
3. Strengthen the ability to identify and apply a suitable algorithm for the given real-world problem.
4. Analyze worst-case running time of algorithms and understand fundamental algorithmic problems.

Lab Outcomes:

After successful completion of the course, students will be able to:

1. Implement the algorithms using different approaches.
2. Analyze the complexities of various algorithms.
3. Compare the complexity of the algorithms for specific problems.
4. Use appropriate algorithms to solve computational problems
5. Implement advanced problem-solving techniques like backtracking and branch & bound
6. Understanding complexity classes through implementation and case studies.

Module No.	Unit No.		Hrs.	LO
1.0		**Foundations of Web Development with Git**	**6**	
	1.1	WWW, Basic Internet Protocols, HTTP request and HTTP response message, HTML – Introduction, history and versions.		**LO1 LO2**
	1.2	HTML elements: headings, paragraphs, line break, colors and fonts, links,frames,lists,tables,images and forms, Logical and physical tags in HTML5		
	1.3	Concept of **CSS**, Creating Style Sheet, CSS Properties, CSS Styling 4 (Background, Text Format, Controlling Fonts), Working with block elements and objects, Lists and Tables, CSS Id and Class, Box Model(Introduction, Border properties, Padding Properties, Margin properties) CSS Advanced: (Grouping, Dimension, Display, Positioning, Floating, Align, Pseudo class, Navigation Bar, Image Sprites, Attribute sector). **Basics of Bootstrap**:The Grid System,CSS Foundations,Navigation Systems,JavaScript Effects		
	1.4	Introduction to Git and Github, Benefits of using Github,Pushing the source code into github,Collaborating with others by creating Pull Requests ,Working on parallel branches		
		Self-Learning topic: Create a game using HTML, CSS and Javascript where random shapes (circle, squares, rectangles) of random sizes and random color will appear and disappear on the screen for random time durations (0.5 sec to 3 sec). Clicking on the shape before it disappears will increment your score.		
2.0		**Javascript with AJAX**	**4**	
	2.1	Introduction to JavaScript, DOM Manipulation, Data types, Values, Variables, Expressions and Operators, Statements, Objects, Arrays, Functions, Pattern matching with regular expressions, JavaScript in Web Browsers, The Window object, Scripting Documents, Scripting CSS, Handling Events		**LO3**
	2.2	Introduction to AJAX,AJAX Components,AJAX with Javascript,AJAX with JQuery,AJAX and JSON,AJAX with Forms and API Integration		
		Self-Learning topic:Implement a search bar with live suggestions (like Google Search).		
3.0		**Back End Development**	**5**	
	3.1	**Introduction** to PHP- Data types, control structures, built in functions,		**LO4**

		building web applications using PHP- Session handling Mechanisms, PHP and MySQL database connectivity .		
		Self-Learning topic:Build a webpage for Image or document file upload .		
4.0		**ReactJS (Frontend Layer for Full Stack Development)**	**5**	
	4.1	**ReactJS**:Introduction, JSX, Components, Props, State, Hooks (useState, useEffect), React Router, Axios,Virtual DOM,API integration and Form Handling		**LO5**
		Self-Learning topic: Simple React App like Random Joke Generator		
5.0		**MONGODB(Data Storage) and EXPRESS JS(Backend Layer for Full stack Developemt)**	**4**	
	5.1	MongoDB: NoSQL basics, Collections/Documents, CRUD operations, Mongoose setup (ODM ie Object Data Modeling library), schema design. **Express.js(Node.js framework) : Building** REST API , Routing, Middleware, MongoDB integration, JWT authentication, and backend for the React app.		**LO5**
		Self-Learning topic: Web Application CRUD To-Do app.		
6.0		**Mini project**	**2**	
	6.1	Selection of problem statements and implementing end to end solutions.		**LO6**
		Total	**26**	

Textbooks:

1. Web Technology Black Book, Kogent Learning Sol., First Edition, Dreamtech Press, 2009
2. Ralph Moseley, M.T. Savliya , “Developing Web Applications”, Willy India, Second Edition.
3. Robin Nixon, "Learning PHP, MySQL, JavaScript, CSS & HTML5" Third Edition,O'REILLY,2014
4. Professional Rich Internet Applications: AJAX and Beyond, Dana Moore, Raymond Budd,
   Edward Benson, Wiley publications First Edition.
5. Schwarz, D. (Year). *The Designer's Guide to Figma*. Perlego,First edition.
6. Alex Banks and Eve Porcello, Learning React Functional Web Development with React and Redux, O’Reilly, First Edition.
7. Krishna Chodorow, MongoDB The Definite Guide, O’Reilly, 2nd Edition.
8. Shelly Powers, Learning Node,O’Reilly, 2nd Edition.

Reference Books:

1. Harvey & Paul Deitel & Associates, Harvey Deitel and Abbey Deitel, "Internet and World Wide Web - How To Program", Fifth Edition, Pearson Education, 2011
2. Achyut S Godbole and Atul Kahate, "Web Technologies", Second Edition, Tata McGraw Hill, 2012.
3. Thomas A Powell, Fritz Schneider, "JavaScript: The Complete Reference", Third Edition, TataMcGraw Hill, 2013.
4. Mike Mcgrath, "PHP & MySQL in easy Steps", Tata McGraw Hill, 2012, Second Edition.
5. Masse, M. (2011). REST API Design Rulebook. Germany: O'Reilly Media,First Edition.
6. Steven Holzner ―The Complete Reference - PHP, Tata McGraw Hill, 2008,First Edition.

Software Tools:

Figma Downloads | Web Design App for Desktops & Mobile

Online Resources:

1. Home | spoken-tutorial.org
2. Course: React JS for Web Development: React with Node JS, MongoDB | Udemy
3. W3Schools Online Web Tutorials

Suggested List of Programming Assignments/laboratory Work:		LO
Sr. No.	**Name of the Experiment**	
1	Installation of Git,Creating new GIT repository and understanding functionality like Add,Commit,Modify,View.	LO1
2	Develop a straightforward blog page using HTML, CSS, and Bootstrap. The blog page should incorporate images, embedded videos, and a contact form.	LO2
3	Create a portfolio landing page using Html, CSS and JavaScript. Enhance it with features like dark mode and light mode, and incorporate animations to elevate the website's aesthetic appeal.	LO3
4	Design a static HTML page that contains a selection box with a list of 5 countries. When the user selects a country, its capital should be printed next to the list. Add CSS to customize the properties of the font of the capital (color, bold and font size).	LO3
5	Validate the fields of registration page created in the first experiment using regular expressions in JavaScript and also Validate login credentials without refreshing the page.(AJAX and JSON).	LO3
6	Build a web page enabling users to retrieve and display real-time weather information for a specific city using AJAX. Students should explore free API providers offering weather data.	LO3
7	Create interactive web pages that fetch, display, and update data from MySQL databases dynamically based on user interactions using PhP.	LO4
8	Create a react application and make use of at least 4 hooks available in react. (Eg: Simple	LO5

	counter application in react which uses StateHooks).	
9	Design and implement a basic CRUD (Create, Read, Update, Delete) operations system using MongoDB.	LO5
10	A **blog platform** where users can create, edit, and delete posts, and view others' posts using ExpressJs.	LO5
11	Mini Project based on the content of the syllabus (Group of 2-3 students).	LO6

Term Work (CIAP):

1 Term work should consist of 10 experiments and Journal submission.
2 Mini Project based on the content of the syllabus (Group of 2-3 students).
3 The final certification and acceptance of term work ensures that satisfactory performance of laboratory work and minimum passing marks in term work.
4 Total 25-Marks (Experiments: 10-marks, Attendance: 05-marks, Mini Project:-5-marks, Participation or wining in Web based competition:05-marks).

Oral & Practical exam(ESEP):

Based on the entire syllabus of CEL404 Skill based Lab Web Technology will be conducted as End Semester Examination Practical (ESEP).

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
CSEL404	Value Education (UHV)	--	04	--	--	02	-	02

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE			
		ISE	MSE				
CSEL404	Value Education (UHV)	--	--	--	50	--	50

Program Outcomes addressed:

1. PO1: Engineering knowledge
2. PO2: Problem Analysis
3. PO3: Design/Development of Solutions
4. PO4: Conduct investigations of complex problems
5. PO5: Engineering Tool Usage
6. PO6: The Engineer and The World
7. PO7: Ethics
8. PO8: Individual and Collaborative Team work
9. PO9: Communication
10. PO10: Project Management & Finance
11. PO11: Life-long learning

Course Objectives:

1. **To introduce the fundamental concepts of human values**, including intrinsic and extrinsic values, and their relevance to personal and professional development in the context of IT engineering.
2. **To explore the principles of Universal Human Values (UHV)**, emphasizing self-awareness, self-exploration, and the application of tools like the JOHARI window and SWOT analysis in the IT profession.
3. **To study the different levels of harmony**—within oneself, in the family, society, and nature—and apply these concepts to achieve a balanced and fulfilling life, especially in the fast-paced IT industry.
4. **To comprehend the key aspects of professional ethics in IT**, including ethical standards, work ethics, and moral issues such as data privacy, cybersecurity, and AI ethics.
5. **To develop foundational values** such as integrity, impartiality, nonpartisanship, and objectivity, and cultivate empathy, tolerance, and compassion in both personal and professional contexts, particularly in IT-related decision-making.
6. **To integrate human values into IT practices**, focusing on ethical decision-making, sustainable technology development, and responsible innovation.

Course Outcomes:
After successful completion of the course, students will be able to:

1. **Understand and Explain** (*Understand*) the basic concepts of human values and their significance in personal and professional contexts, particularly in the IT industry.
2. **Explore and Internalize** (*Apply*) human values to guide personal behavior and professional conduct in IT roles such as software development, data analysis, and cybersecurity.
3. **Analyze and Apply** (*Analyze & Apply*) the concept of harmony at various levels of existence to achieve a balanced life, even in high-pressure IT environments.
4. **Identify and Evaluate** (*Analyze & Evaluate*) ethical issues in the IT profession, including data privacy, cybersecurity, AI ethics, and intellectual property rights, using appropriate ethical theories and standards.
5. **Demonstrate and Uphold** (*Apply & Evaluate*) integrity and ethical principles in professional and public service contexts, fostering empathy and compassion in IT projects that impact society.
6. **Integrate and Implement** (*Create & Apply*) human values into IT practices, ensuring that technology development aligns with ethical, social, and environmental considerations.

Module No.	Unit No.		LO
1.0		**Introduction to Human Values and Their Relevance in IT**	LO1
	1.1	Definition, Intrinsic & Extrinsic values, Shalom Schwartz's Theory of Basic Human Values, Value education: Need, Basic Guidelines and Scope, Self-exploration, Happiness and Prosperity, Harmony, Self-awareness: JOHARI window and SWOT analysis	LO1
	1.2	Ethical Challenges in IT: Data privacy, cybersecurity, AI ethics, and intellectual property rights	LO4
2.0		**Understanding Human Beings and Harmony at Various Levels of Existence**	LO3
	2.1	Human beings as a combination of the conscious 'I' and material body, Abraham Maslow's Hierarchy of Needs, Classification between I & Body, Co-existence, Harmony in Self: Swasthya and Sanyama	LO3
	2.2	Harmony in the Family -- Understanding Values in Human Relationships, Differentiation in relationships, Values in relationships	LO3
	2.3	Harmony in the Society -- From Family order to World Family Order, Comprehensive Human Goal, Harmony in Nature -- Understanding the Interconnectedness and Mutual Fulfilment, Understanding the Four Orders of Nature	LO3, LO6

Module No.	Unit No.		LO
3.0		**Professional Ethics in IT**	LO4
	3.1	Definition, Characteristics, Profession, Professionalism, Morality, Moral issues in the IT profession, Understanding Ethics, Ethical Standards, Work Ethics, Engineering Ethics	LO4
	3.2	Types of Inquiries, Kohlberg's Theory, Heinz Dilemma, Gilligan's Theory, and Ethical Theories	LO4
	3.3	Ethical Challenges in IT: Data privacy, cybersecurity, AI ethics, and intellectual property rights	LO4
4.0		**Ethics, Integrity, and Aptitude in IT**	LO5
	4.1	Essence, determinants, and consequences of ethics in human actions, Dimensions of ethics, Ethics in private and public relationships	LO5
	4.2	Key contributions from Indian and global moral thinkers and philosophers, emphasizing integrity, impartiality, and non-partisanship in professional settings	LO5
	4.3	Upholding objectivity and dedication to public service, Cultivating empathy, tolerance, and compassion, with a focus on their application in IT and public welfare	LO5
5.0		**Understanding Harmony in Nature and Sustainable IT Practices**	LO6
	5.1	Concept of harmony in Nature: Meaning of harmony in nature, Disharmony with Nature -- causes, Implications of disharmony with nature	LO6
	5.2	Maintaining harmony with nature: Harmony through mutual fulfilment of the four orders in nature, Harmony through symbiotic relationship with nature, Achieving competence in maintaining harmony with nature in professional life	LO6
	5.3	Sustainable IT Practices: Green computing, energy-efficient algorithms, and eco-friendly technology development	LO6
6.0		**Practicum Project -- Community Engagement and IT for Social Good**	LO2, LO5, LO6
	6.1	Students carry out a community engagement project to benefit the local community through IT-based initiatives (e.g., developing apps for social causes, organizing digital literacy camps, or creating awareness about cybersecurity).	LO2, LO5, LO6
	6.2	Students write a reflective report on how the understanding of universal human values has been integrated into their IT project.	LO5, LO6

Textbooks:

1. **Naagarazan, R. S.** *A Textbook on Professional Ethics and Human Values*. 4th Edition. New Age International Publishers, 2021.
2. **Gaur, R.R., Sangal, R., & Bagaria, G.P.** *A Foundation Course in Human Values and Professional Ethics*. 3rd Edition. Excel Books, 2019.
3. **Khosla, Vaishali R., & Bhagat, Kavita.** *Human Values and Professional Ethics*. 2nd Edition. Macmillan Education, 2020.
4. **Harris, C.E., Pritchard, M.S., & Rabins, M.J.** *Engineering Ethics: Concepts and Cases*. 6th Edition. CENGAGE Learning, 2019.
5. **Murthy, PSR.** *Indian Culture, Values and Professional Ethics*. 4th Edition. BS Publications, 2022.

Reference Books:

1. **Kumar, Niraj.** *Lexicon for Ethics, Integrity & Aptitude for IAS General Studies Paper IV*. 2nd Edition. McGraw Hill Education, 2023.
2. **Subba Rao, G., & Roy Chowdhury, P. N.** *Ethics, Integrity & Aptitude*. 3rd Edition. McGraw Hill Education, 2020.

Online References:

1. https://fdp-si.aicte-india.org/index.php
2. https://example.com/

Course Assessment:

Internal Assessment Method (With Rubrics)

The internal assessment will consist of **Continuous Internal Assessment (CIAP) = 50 marks** based on **Assignments, Case Studies, Presentations, and Practicum Projects**.

Assessment Component	Weightage (%)	Evaluation Criteria (Rubrics)
Assignment on Human Values	20%	- Excellent (5): Demonstrates deep understanding with real-life examples - Good (4): Good understanding with relevant examples - Satisfactory (3): Basic understanding with minimal examples - Needs Improvement (2): Partial understanding with errors - Poor (1): Little to no understanding
Case Study on Ethical Issues in IT	20%	- Excellent (5): In-depth analysis with ethical theories and solutions - Good (4): Covers major ethical aspects with examples - Satisfactory (3): Identifies ethical concerns with some analysis

		- Needs Improvement (2): Limited understanding with minor errors - Poor (1): Lacks analysis and ethical reasoning
Presentation on Sustainability in IT	20%	- Excellent (5): Well-structured, engaging, innovative ideas - Good (4): Clear and logical presentation with good insights - Satisfactory (3): Covers major points but lacks depth - Needs Improvement (2): Some points missing, lacks clarity - Poor (1): Unstructured, lacks coherence
Reflection Report on Practicum Project	20%	- Excellent (5): Thoughtful reflection, well-articulated impact - Good (4): Covers personal learning and impact clearly - Satisfactory (3): General reflection with limited depth - Needs Improvement (2): Superficial understanding - Poor (1): Minimal effort, lacks insight
Participation in Discussion & Engagement	20%	- Excellent (5): Actively participates, provides insightful contributions - Good (4): Engaged, contributes relevant thoughts - Satisfactory (3): Participates but with limited contribution - Needs Improvement (2): Rarely participates, minimal effort - Poor (1): No participation

Examples of Practicum Projects for Community Engagement and IT for Social Good

The practicum project aims to encourage students to apply **Universal Human Values (UHV)** and **Ethics in IT** to solve real-world societal challenges. Below are some project ideas along with explanations of how they integrate **human values and ethics**:

Digital Literacy Program for Underprivileged Communities

Objective: Create and conduct workshops to educate marginalized communities about basic computer skills, cybersecurity awareness, and digital payments.

Implementation:

- Design an easy-to-understand curriculum on digital literacy.
- Conduct workshops/webinars in rural schools or community centers.
- Develop a simple mobile/web application for learning digital skills.
- Educate participants about data privacy, cyber threats, and ethical internet use.

Human Values & Ethics Integration:

- **Empathy & Compassion** – Address digital divide and empower underprivileged individuals.
- **Integrity & Responsibility** – Teach ethical use of technology and responsible online behavior.

- **Public Welfare** – Ensure safe digital access for vulnerable communities.

AI-Based Cyberbullying Detection for Schools & Colleges

Objective: Develop an AI model to identify cyberbullying in chat messages and social media posts, ensuring a safer digital environment.

Implementation:

- Collect and train data on cyberbullying-related words & phrases.
- Implement a Natural Language Processing (NLP)-based chatbot to detect abusive content.
- Educate students on ethical social media behavior and reporting mechanisms.
- Partner with schools/colleges to deploy the model in their IT systems.

Human Values & Ethics Integration:

- **Respect & Non-Partisanship** – Encourage online respectful interactions.
- **Fairness & Objectivity** – Ensure non-biased AI in content moderation.
- **Safety & Privacy** – Protect users' personal data and identity.

Green Computing Awareness & E-Waste Management App

Objective: Develop an app to educate users on sustainable IT practices and provide an e-waste collection service.

Implementation:

- Create an app that guides users on green computing practices.
- Provide nearby e-waste collection centers and reward users for recycling.
- Conduct IT industry awareness campaigns on energy-efficient computing.
- Promote the use of renewable energy in data centers.

Human Values & Ethics Integration:

- **Environmental Sustainability** – Encourage eco-friendly IT solutions.
- **Social Responsibility** – Spread awareness about ethical e-waste disposal.
- **Harmony in Nature** – Minimize IT sector's negative impact on nature.

Cybersecurity Awareness Chatbot for Senior Citizens

Objective: Build a WhatsApp or Telegram chatbot that assists senior citizens in identifying and avoiding online scams, phishing, and frauds.

Implementation:

- Develop an AI chatbot that explains common online scams.
- Create step-by-step tutorials on safe internet banking and social media usage.
- Partner with local community centers and NGOs to spread awareness.
- Ensure chatbot provides real-time support and automated alerts.

Human Values & Ethics Integration:

- **Compassion & Empathy** – Assist vulnerable groups in safe internet use.
- **Integrity & Awareness** – Promote honest and secure online transactions.
- **Public Welfare** – Reduce cyber frauds targeting elderly people.

AI Ethics Awareness in IT Companies & Colleges

Objective: Develop an interactive website or mobile app to educate IT professionals and students on ethical AI usage and biases in AI systems.

Implementation:

- Provide interactive case studies on AI bias, privacy, and ethical dilemmas.
- Conduct quiz-based learning to test AI ethical understanding.
- Collaborate with IT professionals and faculty to design real-world scenarios.
- Ensure alignment with global AI ethics standards (e.g., IEEE, EU AI Act).

Human Values & Ethics Integration:

- **Integrity & Fairness** – Ensure unbiased AI algorithms.
- **Public Interest** – Educate developers on responsible AI implementation.
- **Transparency** – Promote explainable and fair AI decision-making.

Mobile App for Volunteer & Donation Matching

Objective: Develop a volunteer-matching platform that connects IT professionals and students with social organizations in need of technical assistance.

Implementation:

- Allow users to register their skills (app development, cybersecurity, etc.).
- Connect them with NGOs or community projects that require IT support.
- Enable secure crowdfunding and donation tracking for transparency.
- Promote projects focused on digital inclusion and education.

Human Values & Ethics Integration:

- **Social Responsibility** – Encourage IT professionals to give back to society.
- **Transparency & Trust** – Maintain fair donation tracking.
- **Empathy & Compassion** – Align IT skills with community development.

Ethical Hacking & Cybersecurity Training for Students

Objective: Conduct a hands-on ethical hacking workshop to educate students on ethical penetration testing and cybersecurity best practices.

Implementation:

- Develop training modules on ethical hacking, cryptography, and network security.
- Conduct capture-the-flag (CTF) cybersecurity challenges for hands-on learning.
- Educate students on responsible disclosure of vulnerabilities.
- Partner with cybersecurity firms for internships and projects.

Human Values & Ethics Integration:

- **Ethical Responsibility** – Train IT students to prevent cyber crimes.
- **Accountability** – Promote responsible ethical hacking practices.
- **Public Safety** – Improve cybersecurity awareness in college networks.

AI-Powered Sign Language Recognition System

Objective: Develop an AI-based sign language recognition system to help hearing-impaired

individuals communicate using real-time gesture recognition.

Implementation:

- Train a machine learning model on Indian Sign Language (ISL).
- Develop a mobile/web app that converts sign language gestures into text/speech.
- Partner with special education institutes and NGOs for deployment.
- Ensure open-source availability for future development.

Human Values & Ethics Integration:

- **Inclusion & Accessibility** – Bridge communication gaps for disabled individuals.
- **Fairness & Transparency** – Ensure AI is unbiased across different sign languages.
- **Social Welfare** – Enhance digital accessibility for differently-abled people.

- **Project Submission & Reflection Report**

After completing the practicum project, students will submit a reflective report covering:

1. **Project Objective & Problem Statement**
2. **Implementation Details & Challenges Faced**
3. **Human Values & Ethics Integrated**
4. **Impact Assessment & Learning Outcomes**
5. **Future Improvements & Scalability**

Evaluation Rubric:

- **Excellent (5):** Clear objectives, strong ethical integration, significant social impact.
- **Good (4):** Good ethical integration, minor improvement areas.
- **Satisfactory (3):** Basic implementation lacks depth in ethical application.
- **Needs Improvement (2):** Minimal social impact, weak ethical connection.
- **Poor (1):** Unclear project execution, little relevance to human values.

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
CSEM401	Mini Project 1B	--	02	--	--	01	-	01

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE			
		ISE	MSE				
CSEM401	Mini Project 1B	--	--	--	25	25	50

Program Outcomes addressed:

1. PO1: Engineering knowledge .
2. PO2: Problem Analysis.
3. PO3: Design/Development of Solutions .
4. PO4: Conduct investigations of complex problems.
5. PO5: Modern Tool Usage.
6. PO6: The Engineer and The World.
7. PO7: Ethics.
8. PO8: Individual and Collaborative Team Work
9. PO9: Communication..
10. PO10: Project Management & Finance.
11. PO11: Life-long learning.

Objectives

1. To acquaint with the process of identifying the needs and converting it into the problem.
2. To familiarize the process of solving the problem in a group.
3. To acquaint with the process of applying basic engineering fundamentals to attempt solutions to the problems.
4. To inculcate the process of Self-Learning and research.

Outcome: Upon completion of this course, learners will be able to

1. Identify problems based on societal /research needs.
2. Apply Knowledge and skill to solve societal problems in a group.
3. Develop interpersonal skills to work as a member of a group or leader.
4. Deduce the proper inferences from available results through theoretical/ experimental /simulations.
5. Analyze the impact of solutions in societal and environmental context for sustainable development.
6. Apply standard norms of engineering practices.
7. Develop skills in written and oral communication.
8. Illustrate capabilities of Self-Learning in a group, which leads to life-long learning.
9. Explain project management principles during project work.

Guidelines for Mini Project

1. Students shall form a group of 3 to 4 students, while forming a group shall not be allowed for less than three or more than four students, as it is a group activity.
2. Students should do survey and identify needs, which shall be converted into problem statement for mini project in consultation with faculty supervisor/head of department/internal committee of faculties.
3. Students shall submit implementation plan in the form of Gantt/PERT/CPM chart, which will cover weekly activity of mini project.
4. A logbook to be prepared by each group, wherein group can record weekly work progress, guide/supervisor can verify and record notes/comments.
5. Faculty supervisors may give input to students during mini project activity; however, focus shall be on Self-Learning.
6. Students in a group should understand problems effectively, propose multiple solution and select best possible solution in consultation with guide/ supervisor.
7. Students shall convert the best solution into working model using various components of their domain areas and demonstrate.
8. The solution to be validated with proper justification and report to be compiled in standard format of University of Mumbai.
9. With the focus on Self-Learning, innovation, addressing societal problems and entrepreneurship quality development within the students through the Mini Projects, it is preferable that a single project of appropriate level and quality to be carried out in two semesters by all the groups of the students. i.e. Mini Project 1 in semester III and IV. Similarly, Mini Project 2 in semesters V and VI.
10. However, based on the individual students or group capability, with the mentor's recommendations, if the proposed Mini Project adhering to the qualitative aspects mentioned above gets completed in odd semester, then that group can be allowed to work on the extension of the Mini Project with suitable improvements/modifications or a completely new project idea in even semester. This policy can be adopted on case-by-case basis.

Guidelines for Assessment of Mini Project: Term Work

- Term work will be assessed as Continuous Internal Assessment Practical (CIAP).
- The review/ progress monitoring committee shall be constituted by head of departments of each institute. The progress of mini project to be evaluated on continuous basis, minimum two reviews in each semester.
- In continuous assessment focus shall also be on each individual student, assessment based on individual's contribution in group activity, their understanding and response to questions.
- Distribution of Term work marks for both semesters shall be as below.
    1. Marks awarded by guide/supervisor based on logbook: 10
    2. Marks awarded by review committee 10
    3. Quality of Project report 05

The review/progress monitoring committee may consider the following points for assessment based on either one year or half year project as mentioned in general guidelines.

One-year project:

- In the first semester the entire theoretical solution shall be ready, including components/system selection and cost analysis. Two reviews will be conducted based on the presentation given by the students' group.
  - First shall be for finalization of problem
  - Second shall be on finalization of proposed solution of problem.
- In the second semester the expected work shall be procurement of component's/systems, building of working prototype, testing and validation of results based on work completed in an earlier semester.
  - The first review is based on the readiness of building a working prototype to be conducted.
  - Second review shall be based on poster presentation cum demonstration of working model in last month of the said semester.

Half-year project:

- In this case in one semester students' group shall complete project in all aspects including,
  - Identification of need/problem
  - Proposed final solution
  - Procurement of components/systems
  - Building prototype and testing
- Two reviews will be conducted for continuous assessment,
  - First shall be for finalization of problem and proposed solution
  - Second shall be for implementation and testing of solution.

Assessment criteria of Mini Project

Mini Project shall be assessed based on the following criteria;

1. Quality of survey/ need identification.
2. Clarity of Problem definition based on need.
3. Innovativeness in solutions.
4. Feasibility of proposed problem solutions and selection of best solution
5. Cost effectiveness.
6. Societal impact.
7. Innovativeness.
8. Cost effectiveness and Societal impact.
9. Full functioning of working model as per stated requirements.
10. Effective use of skill sets.
11. Effective use of standard engineering norms.
12. Contribution of an individual's as member or leader.
13. Clarity in written and oral communication.

- In **one year, project**, first semester evaluation may be based on the first six criteria's and the remaining may be used for second semester evaluation of performance of students in mini project.

- In the case of **half year project** all criteria's in generic may be considered for evaluation of performance of students in mini project.

Guidelines for Assessment of Mini Project Practical/Oral Examination:

- The report should be prepared as per the guidelines issued by the University of Mumbai.
- Mini Project shall be assessed through a presentation and demonstration of working model by the student project group to a panel of Internal and External Examiners preferably from industry or research organization's having experience of more than five years approved by head of Institution.
- Students shall be motivated to publish a paper based on the work in Conferences/students competitions.

Mini Project shall be assessed based on the following points.

1. Quality of problem and Clarity
2. Innovativeness in solutions
3. Cost effectiveness and Societal impact
4. Full functioning of working model as per stated requirements
5. Effective use of skill sets
6. Effective use of standard engineering norms
7. Contribution of an individual's as member or leader
8. Clarity in written and oral communication
9.

Oral & Practical exam (ESEP)

Based on the entire syllabus of CEM401 Mini Project End Semester Examination Practical (ESEP) will be conducted.

Internal Assessment:

For 03 credit - 80 marks subject

Assessment consists of one Mid Semester Examination (MSE) of 20 marks and In Semester Examination (ISE) of 20 marks. The MSE to be conducted based on 50 % syllabus with duration of one hour.

For 02 credit - 60 marks subject

Assessment consists of one Mid Semester Examination (MSE) of 15 marks and In Semester Examination (ISE) of 15 marks. The MSE to be conducted based on 50 % syllabus with duration of one hour.

In Semester Examination (ISE)

SE 20 marks = 05 marks attendance +15 marks for Activities.

ISE 15 marks = 05 marks attendance +10 marks for Activities.

The Rubrics for activities are as follows. The activities will be decided by course in charge and approved by HoD.

Sr. No	Rubrics	Marks
1	Multiple Choice Questions (Quiz)	05 Marks
2	Literature review of papers/journals	05 Marks
3	Participation in event/ workshop/ talk / competition followed by small report and certificate of participation relevant to the subject	05 Marks
4	Extra Experiments/ Virtual Lab	05 marks
5	Content beyond syllabus presentation	05 marks
6	Wins in the event/competition/hackathon pertaining to the course	10 Marks
7	Case study, Presentation, group discussion, technical debate on recent trends in the said course	10 Marks
8	NPTEL/ Coursera/ Udemy/any MOOC Certificate course for 4 weeks or more	10 Marks
9	Creating Proof of Concept	10 Marks
10	Mini Project /	10 Marks
11	GATE Based Assignment test/Tutorials etc	10 Marks

*For sr.no.8, the date of certification exam should be within the term and in case a student is unable complete the certification, the grading has to be done accordingly.