

**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 Artificial Intelligence and Machine Learning
Curriculum Structure for Undergraduate Academic Program in
Artificial Intelligence and Machine Learning**

First and Second Year Syllabi

**Board of Studies
Department of Artificial Intelligence and Machine Learning**

**Academic Council
SIES Graduate School of Technology**

Effective from: AY 2025-26

PREAMBLE

Dear Students and Stakeholders,

We are thrilled to unveil the newly developed autonomous curriculum at the SIES Graduate School of Technology's Department of Artificial Intelligence and Machine Learning (AIML). This cutting-edge program is designed to foster creativity, cultivate excellence, and adapt to the ever-evolving demands of society, all of which will enhance the nation's technological capabilities and global competitiveness.

The Department has meticulously crafted its curriculum using a top-down approach. This process involves setting clear, measurable learning objectives, aligning course content with these objectives, incorporating experiential learning through projects, skill labs, internships, and industry partnerships, mapping program outcomes (as outlined in the Self-Assessment Report by the NBA in January 2016) to individual courses, and establishing a framework for continuous evaluation and improvement. The process begins with stakeholder consultations to identify industry needs, leading to the introduction of four honors/minor tracks—Cyber Security, AIML, Data Science, and Blockchain.

The curriculum for program electives, laboratory courses, core courses, and honors/minor tracks has been carefully designed to reflect current industry trends. We've included courses that will equip our graduates with the skills needed to thrive in various industries across India.

Our program aligns with the trans-formative vision of the National Education Policy (NEP) 2020, providing students with a comprehensive understanding of key subjects such as artificial intelligence, machine learning, data science, and computational algorithms. Through interdisciplinary courses, skill labs, and specially tailored laboratory courses, students gain the skills to tackle complex challenges. Independent lab courses introduce students to practical engineering concepts like Machine Learning, Data Visualization Techniques, Deep Learning, and Natural Language Processing. The curriculum also offers electives in diverse fields such as Cloud Computing, Blockchain Technology, Security with AI, Pattern Recognition, and Reinforcement Learning, catering to a wide array of student interests.

Within this autonomous curriculum, teachers have numerous opportunities to innovate and enhance the learning experience for students. Faculty members can engage in research and development projects, actively participate in curriculum development, and offer internships that provide students with unique experiences. Instructors can also collaborate with industry associations to enrich the curriculum through relevant projects, internships, and guest lectures. Overall, curriculum autonomy empowers instructors to play a significant role in shaping the educational journey in Artificial Intelligence Machine Learning.

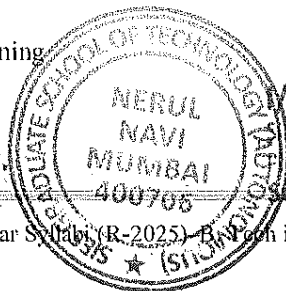
By nurturing creativity, resilience, and a curious mindset, we aim to prepare our graduates to become leaders, innovators, and global ambassadors of excellence in the field of Artificial Intelligence Machine Learning. We invite all interested parties to join us on this transformative journey to redefine engineering education. Together, let's strive for excellence, innovation, and a positive impact on society.


Chairperson
Board of Studies
Artificial Intelligence and Machine Learning
SIES Graduate School of Technology


Chairperson
Academic Council
SIES Graduate School of Technology

HEAD of the Department
Artificial Intelligence & Machine Learning
SIES Graduate School of Technology

Sri Chandrasekarendra Saraswathi Vidyapeeth
Autonomous Curriculum Structure, First Year and Second Year Syllabi (R-2025) - Bachelor in Artificial Intelligence and Machine Learning
Not-1-CF



PRINCIPAL
SIES GRADUATE SCHOOL OF TECHNOLOGY (AUTONOMOUS)
1C/D/E Sri Chandrasekarendra Saraswathi Vidyapeeth
Sector-V Nerul-Navi Mumbai-400706

Semester wise Credit Distribution Structure for Four Year UG Engineering
Program - Artificial Intelligence and Machine Learning

Semester		I	II	III	IV	V	VI	VII	VIII	Total Credits
Basic Science Course (BSC)	BSC/ESC	07	06	--	--	--	--	--	--	13
Engineering Science Course (ESC)		09	10	--	--	--	--	--	--	19
Programme Core Course (PCC)	Program Courses	--	--	17	11	12	11	04	--	55
Programme Elective Course (PEC)		--	--	--	--	03	03	07	--	13
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	02	02	01	06
Internship/On Job Training (OJT)		--	--	--	--	--	--	--	12	12
Co-curricular Courses(CC)	Liberal Learning Courses	04	--	--	--	--	--	--	-	04
Total Credits (Major)		21	21	22	21	22	22	20	19	168

CURRICULUM STRUCTURE

R-2025

First Year B.Tech.
(Common to All Branches)
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
VSEC	Vocational and Skill Enhancement Course
AEC	Ability Enhancement Course
CC	Cocurricular Courses
LLC	Liberal Learning Courses
HSSM	Humanities, Social Science and Management
ISE	In Semester Examination
MSE	Mid Semester Examination
ESE	End Semester Examination
CIAP	Continuous Internal Assessment Practical
ESEP	End Semester Examination Practical

Program Structure for First Year Engineering

W.E.F. A.Y. 2025-26

Semester I

Course Code	Course Name	Category	Teaching Scheme (Contact Hours)			Credits Assigned			
			Theory	Pract	Tut.	Theory	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 ^s	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).

Program Structure for First Year Engineering
W.E.F. A.Y. 2025-26

Semester II

Course Code	Course Name	Category	Teaching Scheme (Contact Hours)			Credits Assigned			
			Theory	Pract.	Tut.	Theory	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 ^s	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.

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).

Program Structure for Second Year
W.E.F. A.Y. 2026-27
Semester III

Course Code	Course Name	Category	Teaching Scheme (Contact Hours)			Credits Assigned			
			Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
AIMLC301	Applied Mathematics III	PCC	3	--	--	3	--	--	3
AIMLC302	Data Structure	PCC	3	--	--	3	--	--	3
AIMLC303	Discrete Structure and Graph Theory	PCC	3	--	--	3	--	--	3
AIMLC304	Database Management Systems	PCC	3	--	--	3	--	--	3
AIMLC305	Computer Organization and Architecture	PCC	2	--	--	2	--	--	2
AIMLC306	Engineering Economics	HSSM	2	--	--	2	--	--	2
AIMLL301	Data Structure Lab	PCC	--	2	--	--	1	--	1
AIMLL302	Database Management Systems Lab	PCC	--	2	--	--	1	--	1
AIMLL303	Computer Organization and Architecture Lab	PCC	--	2	--	--	1	--	1
AIMLL304	Skill Lab -Python Programming	VSEC	--	2*+2	--	--	2	--	2
AIMLM301	Mini Project 1A	CEP	--	2 [#]	--	--	1	--	1
Total			16	12	--	16	6	--	22

Examination Scheme - AIML Semester-III

Course Code	Course Name	Examination Scheme						
		Theory				CIAP	ESEP	Total
		Internal Assessment		ESE ^s	Exam Duration (Hrs.)			
		ISE	MSE					
AIMLC301	Applied Mathematics III	20	20	60	3	--	--	100
AIMLC302	Data Structure	20	20	60	3	--	--	100
AIMLC303	Discrete Structure and Graph Theory	20	20	60	3	--	--	100
AIMLC304	Database Management Systems	20	20	60	3	--	--	100
AIMLC305	Computer Organization and Architecture	15	15	45	2	--	--	75
AIMLC306	Engineering Economics	50				--	--	50
AIMLL301	Data Structure Lab	--	--	--	--	25	25	50
AIMLL302	Database Management Systems Lab	--	--	--	--	25	25	50
AIMLL303	Computer Organization and Architecture Lab	--	--	--	--	25	--	25
AIMLL304	Skill Lab-Python Programming	--	--	--	--	25	25	50
AIMLM301	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.

Program Structure for Second Year

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

Semester IV

Course Code	Course Name	Category	Teaching Scheme (Contact Hours)			Credits Assigned			
			Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
AIMLC401	Applied Mathematics-IV	PCC	3	--	--	3	--	--	3
AIMLC402	Operating System	PCC	3	--	--	3	--	--	3
AIMLC403	Analysis of Algorithm	PCC	3	--	--	3	--	--	3
AIMLC404	Critical Thinking and Design	HSSM	2	--	--	2	--	--	2
MDMC40X1	Multidisciplinary Minor (MDM –I)	MDM	3	--	--	3	--	--	3
AIMLL401	Operating System Lab	PCC	--	2	--	--	1	--	1
AIMLL402	Analysis of Algorithm Lab	PCC	--	2	--	--	1	--	1
AIMLL403	Skill Lab -Linux System and Networking Lab	VSEC	--	2*+2	--	--	2	--	2
AIMLL404	Value Education (UHV)	HSSM (VEC)	--	4	--	--	2	--	2
AIMLM401	Mini Project 1B	CEP	--	2 [#]	--	--	1	--	1
Total			14	16	--	14	7	--	21

Examination Scheme - AIML Semester-IV

Course Code	Course Name	Examination Scheme						
		Theory				CIAP	ESEP	Total
		Internal Assessment		ESE ^s	Exam Duration (Hrs.)			
		ISE	MSE					
AIMLC401	Applied Mathematics-IV	20	20	60	3	--	--	100
AIMLC402	Operating System	20	20	60	3	--	--	100
AIMLC403	Analysis of Algorithm	20	20	60	3	--	--	100
AIMLC404	Critical Thinking and Design	15	15	45	2	--	--	75
MDMC40X1	Multidisciplinary Minor (MDM –I)	20	20	60	3	--	--	100
AIMLL401	Operating System Lab	--	--	--	--	25	25	50
AIMLL402	Analysis of Algorithm Lab	--	--	--	--	25	25	50
AIMLL403	Skill Lab -Linux System Administration and Security	--	--	--	--	25	25	50
AIMLL404	Value Education (UHV)	--	--	--	--	50	--	50
AIMLM401	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.

Program Structure for Third Year
W.E.F.A.Y.2027-28
Semester V

Course Code	Course Name	Category	Teaching Scheme (Contact Hours)			Credits Assigned			
			Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
AIMLC501	Artificial Intelligence	PCC	3	--	--	3	--	--	3
AIMLC502	Data Engineering and Data Mining	PCC	3	--	--	3	--	--	3
AIMLC503	Web Technology and Data Visualization	PCC	3	--	--	3	--	--	3
MDMC50X2	Multidisciplinary Minor (MDM -II)	MDM	3	--	--	3	--	--	3
AIMLPEC501X	Program Elective-I	PEC	3	--	--	3	--	--	3
AIMLL501	Artificial Intelligence Lab	PCC	--	2	--	--	1	--	1
AIMLL502	Data Engineering and Data Mining Lab	PCC	--	2	--	--	1	--	1
AIMLL503	Web Technology and Data Visualization Lab	PCC	--	2	--	--	1	--	1
AIMLL504	Interpersonal and Career Skills Lab	AEC	--	2*+2	--	--	2	--	2
MDML50X1	Multidisciplinary Minor (MDM -I) Lab/ Tut.&	MDM	--	2	&	--	1	--	1
AIMLM501	Mini Project 2	Project	--	2#	--	--	1	--	1
Total			15	14	--	15	7	--	22

Examination Scheme - AIML Semester-V

Course Code	Course Name	Examination Scheme						
		Theory				CIAP	ESEP	Total
		Internal Assessment		ESE ^s	Exam Duration (Hrs.)			
		ISE	MSE					
AIMLC501	Artificial Intelligence	20	20	60	3	--	--	100
AIMLC502	Data Engineering and Data Mining	20	20	60	3	--	--	100
AIMLC503	Web Technology and Data Visualization	20	20	60	3	--	--	100
MDMC50X2	Multidisciplinary Minor (MDM -II)	20	20	60	3	--	--	100
AIMLPEC501X	Program Elective-I	20	20	60	3	--	--	100
AIMLL501	Artificial Intelligence Lab	--	--	--	--	25	25	50
AIMLL502	Data Engineering and Data Mining Lab	--	--	--	--	25	25	50
AIMLL503	Web Technology and Data Visualization Lab	--	--	--	--	25	--	25
AIMLL504	Interpersonal and Career Skills	--	--	--	--	50	--	50
MDML50X1	Multidisciplinary Minor (MDM -I) Lab/ Tut. &	--	--	--	--	25		25
AIMLM501	Mini Project 2	--	--	--	--	25	25	50
Total		100	100	300		175	75	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 2. 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.

& Indicates Tutorial only for the management track (MDMC5062)

Program Elective – I

Technology Bucket			
Computational Intelligence	Intelligent Systems	Industry Automation & Robotics	Extended Reality
AIMLPEC5011: Statistics for Data Science	AIMLPEC5012: Image and Video Processing	AIMLPEC5013: Fundamentals of Industrial Automation	AIMLPEC5014: Game and Mobile App Development

Program Structure for Third Year
W.E.F.A.Y.2027-28
Semester VI

Course Code	Course Name	Category	Teaching Scheme (Contact Hours)			Credits Assigned			
			Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
AIMLC601	Machine Learning	PCC	3	--	--	3	--	--	3
AIMLC602	Natural Language Processing	PCC	3	--	--	3	--	--	3
AIMLC603	Software Engineering and Project Management	PCC	3	--	--	3	--	--	3
MDMC60X3	Multidisciplinary Minor (MDM -III)	MDM	3	--	--	3	--	--	3
AIMLPEC601X	Program Elective-II	PEC	3	--	--	3	--	--	3
AIMLL601	Machine Learning Lab	PCC	--	2	--	--	1	--	1
AIMLL602	Natural Language Processing Lab	PCC	--	2	--	--	1	--	1
AIMLL603	Skill Lab -Software Project Engineering and DevOps Lab	VSEC	--	2	--	--	1	--	1
MDML60X2	Multidisciplinary Minor (MDM-III) Lab/ Tut ^{&}	MDM	--	2*+2	&	--	2	--	2
AIMLP601	Major Project I	Project	--	4 [#]	--	--	1	--	1
Total			15	14	--	15	7	--	22

Examination Scheme - AIML Semester-VI

Course Code	Course Name	Examination Scheme						
		Theory				CIAP	ESEP	Total
		Internal Assessment		ESE ^s	Exam Duration (Hrs.)			
		ISE	MSE					
AIMLC601	Machine Learning	20	20	60	3	--	--	100
AIMLC602	Natural Language Processing	20	20	60	3	--	--	100
AIMLC603	Software Engineering and Project Management	20	20	60	2	--	--	100
MDMC60X3	Multidisciplinary Minor (MDM -III)	20	20	60	3	--	--	100
AIMLPEC601X	Program Elective-II	20	20	60	3	--	--	100
AIMLL601	Machine Learning Lab	--	--	--	--	25	25	50
AIMLL602	Natural Language Processing Lab	--	--	--	--	25	25	50
AIMLL603	Skill Lab - Software Project Engineering and DevOps Lab	--	--	--	--	25	--	25
MDML60X2	Multidisciplinary Minor (MDM-III) Lab/ Tut ^{&}	--	--	--	--	25	--	25
AIMLP601	Major Project I	--	--	--	--	25	25	50
Total		100	100	300	--	125	75	700

* 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.

& Indicates Tutorial only for the management track (MDMC6063)

Program Elective – II

Technology Bucket			
Computational Intelligence	Intelligent Systems	Industry Automation & Robotics	Extended Reality
AIMLPEC6011: Soft Computing	AIMLPEC6012: Geospatial Data Analytics	AIMLPEC6013: Intelligent Wireless Sensor Networks	AIMLPEC6014: UI/UX Design

**Program Structure for Fourth Year
W.E.F.A.Y.2028-29
Semester VII**

Course Code	Course Name	Category	Teaching Scheme (Contact Hours)			Credits Assigned		
			Theory	Pract.	Tut	Theory	Pract.	Total
AIMLC701	Deep Learning	PCC	3	--	--	3	--	3
MDMC70X4	Multidisciplinary Minor (MDM -IV)	MDM	3	--	--	3	--	3
AIMLPEC701X	Program Elective-III	PEC	3	--	--	3	--	3
AIMLPEC702X	Program Elective-IV	PEC	3	--	--	3	--	3
OEC701X	Open Elective-I	OE	3	--	--	3	--	3
AIMLL701	Deep Learning Lab	PCC	--	2	--	--	1	1
MDML70X3	Multidisciplinary Minor (MDM -III) Lab/ Tut. &	MDM	--	2	&	--	1	1
AIMLPEL702X	Program Elective-III Lab	PEC	--	2	--	--	1	1
AIMLP701	Major Project II	Project	--	4 [#]	--	--	2	2
Total			15	10		15	5	20

Examination Scheme - AIML Semester-VII

Course Code	Course Name	Examination Scheme						
		Theory				CIAP	ESEP	Total
		Internal Assessment		ESE ^s	Exam Duration (Hrs.)			
		ISE	MSE					
AIMLC701	Deep Learning	20	20	60	3	--	--	100
MDMC70X4	Multidisciplinary Minor (MDM -IV)	20	20	60	3	--	--	100
AIMLPEC701X	Program Elective-III	20	20	60	3	--	--	100
AIMLPEC702X	Program Elective-IV	20	20	60	3	--	--	100
OEC701X	Open Elective-I	20	20	60	3	--	--	100
AIMLL701	Deep Learning Lab	--	--	--	--	25	25	50
MDML70X3	Multidisciplinary Minor (MDM -III) Lab/ Tut ^{&}	--	--	--	--	25	25	50
AIMLPEL702X	Program Elective-III Lab	--	--	--	--	25		25
AIMLP701	Major Project II	--	--	--	--	25	25	50
Total		100	100	300	--	100	75	675

#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.

& Indicates Tutorial only for the management track (MDMC7064)

Program Elective-III

Technology Bucket			
Computational Intelligence	Intelligent Systems	Industry Automation & Robotics	Extended Reality
AIMLPEC7011: Advanced AI	AIMLPEC7012: Pattern Recognition & Computer Vision	AIMLPEC7013: Machine Learning for Robotics	AIMLPEC7014: AR/VR

Program Elective-IV

Technology Bucket			
Computational Intelligence	Intelligent Systems	Industry Automation & Robotics	Extended Reality
AIMLPEC7021: Big Data Analytics	AIMLPEC7022: Game Theory for Data Science	AIMLPEC7023: AI in Manufacturing and Industry 4.0	AIMLPEC7024: Quantum Computing

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



Program Structure for Fourth Year
W.E.F.A.Y.2028-29
Semester VIII

Course Code	Course Name	Category	Teaching Scheme (Contact Hours)			Credits Assigned		
			Theory	Pract.	Tut.	Theory	Pract.	Total
AIMLC801	Research Methodology	RM	3	--	--	3	-	3
OEC801X	Open Elective-II	OE	3	--	--	3	--	3
AIMLP801	Major Project Stage-II	Project	--	2 [#]	--	--	1	1
AIMLINT801	Internship/Project/Research	Internship	--	--	--	--	12	12
Total			6	2		6	13	19

Examination Scheme - AIML Semester-VIII

Course Code	Course Name	Examination Scheme						
		Theory				CIAP	ESEP	Total
		Internal Assessment		ESE ^s	Exam Duration (Hrs.)			
		ISE	MSE					
AIMLC801	Research Methodology	20	20	60	3	--	--	100
OEC801X	Open Elective	20	20	60	3	--	--	100
AIMLP801	Major Project Stage-II	--	--	--	--	100	50	150
AIMLINT801	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.



Graduate School of
Technology (Autonomous)

RISE WITH EDUCATION

SIES Graduate School of Technology
Department of Artificial Intelligence and Machine Learning
Bachelor of Technology

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



**Graduate School of
Technology (Autonomous)**
RISE WITH EDUCATION

SIES Graduate School of Technology
Department of Artificial Intelligence and Machine Learning
Bachelor of Technology

Multidisciplinary Minor (MDM)

Track	Minor Track	Partner Institute if any	Year/ Sem	Module	Code	Eligible
1	Machine Learning	SIES GST	SE/IV	Artificial Intelligence	MDMC4011	IT/EXTC/ CSE IOT
			TE/V	Machine Learning	MDMC5012	
				Machine Learning Lab	MDML5011	
			TE/VI	Natural Language Processing	MDMC6013	
				Natural Language Processing Lab	MDML6012	
			BE/VII	Deep Learning	MDMC7014	
				Deep Learning Lab	MDML7013	
2	Data Science	SIES GST	SE/IV	Statistical Foundation for Data Science	MDMC4021	ECS/CE/EXTC
			TE/V	Data Analytics and Visualization	MDMC5022	
				Data Analytics and Visualization Lab	MDML5021	
			TE/VI	Decision Making and Business Intelligence	MDMC6023	
				Decision Making and Business Intelligence Lab	MDML6022	
			BE/VII	Big Data Analytics	MDMC7024	
				Big Data Analytics Lab	MDML7023	
3	Embedded Systems	SIES GST	SE/IV	Microprocessor and Microcontrollers	MDMC4031	CE/AIDS/ AIML
			TE/V	Embedded Systems and RTOS	MDMC5032	
				Embedded Systems and RTOS Lab	MDML5031	
			TE/VI	Sensor Technology	MDMC6033	
				Sensor Technology Lab	MDML6032	
			BE/VII	Industrial Internet of Things	MDMC7034	
				Industrial Internet of Things Lab	MDML7033	
4	Cyber Security	SIES GST	SE/IV	Computer Network	MDMC4041	AIDS/AIML
			TE/V	Cryptography and Network Security	MDMC5042	
				Cryptography and Network Security Lab	MDML5041	
			TE/VI	Cloud Computing and Security	MDMC6043	
				Cloud Computing and Security Lab	MDML6042	
			BE/VII	Digital Forensics	MDMC7044	
				Digital Forensics Lab	MDML7043	
5	System Programming	SIES GST	SE/IV	Advance Data Structure	MDMC4051	CSEIOT/ECS/ IT
			TE/V	Advance Algorithm	MDMC5052	
				Advance Algorithm Lab	MDML5051	
			TE/VI	System Programming and Compiler Construction	MDMC6053	
				System Programming and Compiler Construction Lab	MDML6052	
			BE/VII	Distributed Systems	MDMC7054	
				Distributed Systems Lab	MDML7053	
6	Management	SIES SBS	SE/IV	Cost Management	MDMC4061	EXTC/CE/IT/ ECS/AIDS/ AIML/CSE IOT
			TE/V	Supply Chain Management	MDMC5062	
			TE/VI	Organizational Behaviour and Human Resource Management	MDMC6063	
			BE/VII	Marketing Management	MDMC7064	

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
AIMLC301	Applied Mathematics -III	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE ^s			
		ISE	MSE				
AIMLC301	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 plane.
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.

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
FEC101	Applied Mathematics-I	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE ^s			
		ISE	MSE				
FEC101	Applied Mathematics-I	20	20	60	--	--	100

Course Objectives:

1. To develop representation and computation with large datasets using matrices in handling and processing data in machine learning and data analysis.
2. To develop the fundamentals of complex numbers required in various fields like communication, signals analysis and control systems, etc.
3. To develop fundamentals of Taylor and Laurent series which are crucial tools for approximating, analyzing, and solving a variety of engineering problems.
4. To learn about maxima and minima which helps engineers to solve practical problems that involve optimization, efficiency, stability, and resource management.
5. To study higher-order derivatives to gain tools to ensure systems are efficient, stable, and perform as required.
6. To study numerical methods which provide practical approaches to find approximate solutions where exact solutions are infeasible.

Course Outcomes:

After successful completion of the course student will be able to

1. Apply principles of basic operations of matrices to find rank and echelon form of matrices to solve system of simultaneous equations.
2. Apply the knowledge of complex numbers to solve problems in hyperbolic functions and logarithmic functions.
3. Apply Taylor's series and Maclaurin's expansion to expand the function.
4. Find maxima and minima using the basic principles of partial differentiation.
5. Evaluate the higher order derivative using successive differentiation.
6. Solve the system linear and simultaneous algebraic equations using numerical methods.

Module No.	Unit No.	Topics	Hrs.
1.0		Matrices	07
	1.1	Types of Matrices: Symmetric, Skew- Symmetric, Hermitian, Skew-Hermitian, Unitary, Orthogonal Matrices. Rank of a matrix using Echelon form. Normal form (No PAQ form).	
	1.2	System of homogeneous and non-homogeneous equations, their consistency and solutions. Linear dependent and independent vectors.	
2.0		Complex Numbers, Hyperbolic function and Logarithm of Complex Numbers:	11
	2.1	De' Moivre's Theorem and its application.	

	2.2	Find expansion of $\sin^n \theta$, $\cos^n \theta$ in terms of sines and cosines of multiples of θ , expansion of $\sin n\theta$, $\cos n\theta$ in powers of $\sin \theta$, $\cos \theta$ and to find sum of the trigonometric series.	
	2.3	Powers and Roots of complex number.	
	24	Hyperbolic functions. Inverse Hyperbolic functions. Separation of real and imaginary parts of all types of functions.	
	2.5	Logarithmic functions, Separation of real and Imaginary parts of Logarithmic functions.	
3.0		Expansion of Function	04
	3.1	Maclaurin's series (Statement only). Expansion of standard functions.	
	3.2	Taylor's Theorem (Statement only), example using Taylor's series.	
4.0		Partial Differentiation and its Application	09
	4.1	Partial Differentiation: Partial derivatives of first and higher order, Differentiation of composite function.	
	4.2	Euler's Theorem on Homogeneous functions with two and three independent variables (with proof). Deductions from Euler's theorem.	
	4.3	Maxima and Minima of a function of two independent variables	
5.0		Successive Differentiation	04
	5.1	The standard functions and their nth derivative.	
	5.2	Leibnitz theorem (without proof) and problem.	
6.0		Numerical Solutions of Transcendental Equations, System of Linear Algebraic Equations, Curve fitting	04
	6.1	Solution of Algebraic and Transcendental Equations by: Newton Raphson Method.	
	6.2	Solution of system of linear algebraic equations by Gauss Seidel Iteration Method.	
	6.3	Curve fitting: Fitting a straight line, quadratic curve.	
		Total	39

Textbooks:

1. Higher Engineering Mathematics, Dr. B. S. Grewal, Khanna Publication.
2. Advanced Engineering Mathematics, Dennis G. Zill, Warren S. Wright.

Reference books:

1. Foundations of Complex Analysis, S. Ponnusamy, Narosa Publications.
2. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley Eastern Limited, 9th Ed.
3. Advanced Engineering Mathematics by H. K. Dass, 28th edition, S. Chand 2010.
4. Introductory Methods of Numerical Analysis, S.S. Sastry, Eastern Economy Edition.
5. Numerical Methods, M. K. Jain, R. K. Jain, S. R. K. Iyengar, New Age International Publishers.
6. Matrices, Shanti Narayan, S. Chand publication.
7. Applied Numerical Methods with MATLAB for Engineers and Scientists by Steven Chapra, MGH

Course Assessment:

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

MSE: To be conducted as written examination for 20 marks of duration 1 Hr. (on 40% - 50% syllabus)

End Semester Examination:

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

1. All questions are compulsory.
2. Question paper will comprise 3 questions, question 1 & 3 carrying 20 marks, and question No. 2 carrying 40 marks.
3. Each question will be based on the entire syllabus.

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
FEC1021	Applied Physics	03	--	--	03	--		03

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE ^s			
		ISE	MSE				
FEC1021	Applied Physics	20	20	60	--	--	100

Course Objectives:

1. To demonstrate the phenomena of thin film interference
2. To provide students with basic understanding of lasers and signal communication in optical fibers
3. To give exposure to the concepts of semiconductors
4. To build a foundation of quantum mechanics needed for modern technology
5. To impart basic concepts needed for sensor technology
6. To discuss the applications of nanotechnology for nano computing

Course Outcomes:

After successful completion of the course students will be able to

1. Determine the wavelength of light and refractive index of medium using interference phenomenon
2. Illustrate the use of lasers for various applications including optical fibers
3. Apply the knowledge gained in semiconductors in various applications
4. Relate the foundations of quantum mechanics with the development of modern technology
5. Implement the knowledge of sensing mechanisms towards various sensors
6. Interpret the concept of nano technology to emerging areas of technology

Mod ule No.	Unit No.	Topics	Hr s.
1.0		Interference	06
	1.1	Interference: Interference in thin film of uniform thickness (reflected system), maxima and minima conditions for variable thickness (wedge-shaped) film (qualitative), fringe width	
	1.2	Applications: (i) Newton's rings- determination of wavelength and refractive Index of transparent liquid (ii) Antireflecting and highly reflecting coatings.	
2.0		Lasers and Optical Fibres	07
	2.1	Lasers: absorption, spontaneous and stimulated emissions, light amplification population inversion, pumping, components of laser, characteristics of lasers, He-Ne laser, semiconductor laser. Applications:(i) holography (ii) LiDAR (iii) barcode reader	
	2.2	Optical fibres: critical angle, total internal reflection, acceptance angle, acceptance cone, numerical aperture, types of optical fibers: single mode & multimode, step index & graded index, V- number, attenuation, fibre optic communication system.	
3.0		Semiconductor Physics	07
	3.1	Direct and indirect band gap semiconductors, concept of drift velocity, mobility, conductivity in intrinsic semiconductors, Fermi- Dirac distribution function,	

		position of Fermi level in intrinsic and extrinsic semiconductors, variation of Fermi level in N and P type semiconductors with temperature and concentration, Hall effect and applications.	
	3.2	Applications: photo diode, LED, solar cell, Zener diode	
4.0		Quantum Physics	08
	4.1	Quantum Physics: de Broglie hypothesis of matter waves, de Broglie wavelength for electron, Properties of matter waves, Heisenberg's uncertainty principle, Wave function and probability density, mathematical conditions for wave function, Need and significance of Schrödinger's equations, Schrödinger's time dependent and time independent equations, energy of a particle enclosed in a rigid	
	4.2	Applications: Quantum mechanical tunneling, Principles of quantum computing: concept of Qubit	
5.0		Physics of sensors	05
	5.1	Transducers: active and passive transducers, sensing mechanism,	
	5.2	Sensors: Resistive sensors- PT100, Humidity measurement, proximity sensors, pressure sensors- piezoelectric effect, ultrasonic sensors for distance and velocity measurement in liquid and air, optical sensors- light dependent resistors, wavelength and color sensors	
6.0		Nanotechnology and Nanocomputing	06
	6.1	Nanotechnology: nanoscale, nanomaterial classification, properties, significance of quantum confinement and surface to volume ratio, top down and bottom-up approach ball milling, sputtering, sol-gel, and CVD methods of synthesis, Techniques-SEM, AFM	
	6.2	Nanocomputing: Introduction to nano computer, Nano computer Building block, Chemically Assembled Electronic Nanotechnology (CAEN), Single Electron Transfer (SET)	
		Total	39

Textbooks:

1. A Textbook of Engineering Physics -Dr. M. N. Avadhanulu, Dr. P. G. Kshirsagar, S. Chand, Revised Edition 2014
2. Modern Engineering Physics - A. S. Vasudeva, S. Chand, Revised Edition 2013
Engineering Physics D. K Bhattacharya, Poonam Tandon, Oxford Higher Education, 1st Edition 2015
3. Engineering Physics -R. K. Gaur, S. L. Gupta, Dhanpat Rai Publications, 2012
4. Engineering Physics -V. Rajendran, McGraw Hill Educations, 2017
5. A Textbook of Nanoscience and Nanotechnology, T. Pradeep Tata McGraw Hill Education Pvt. Ltd., 2012

Reference books:

1. Semiconductor Physics and Devices – Basic Principles – Donald Neamen – McGraw Hill
2. Fundamentals of optics - Francis A. Jenkins, Harvey E. White, McGraw Hill Publication, India, 4th Edition
3. Fundamentals of Physics, Halliday and Resnick, Wiley publication
4. Concepts of Modern Physics – Arther Beiser, Shobhit Mahajan, S. Choudhury, McGraw Hill, 7th Edition 2017

Online References:

1. https://onlinecourses.nptel.ac.in/noc23_ee95/preview
2. <https://archive.nptel.ac.in/courses/115/102/115102124>
3. <https://archive.nptel.ac.in/courses/115/102/115102025>

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 of duration 1 Hr. (on 40% - 50% syllabus)

End Semester Examination:

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

1. All questions are compulsory.
2. Question paper will comprise 3 questions, question 1 & 3 carrying 20 marks, and question No. 2 carrying 40 marks.
3. Each question will be based on the entire syllabus.

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
FEC1022	Applied Chemistry	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE ^s			
		ISE	MSE				
FEC1022	Applied Chemistry	20	20	60	--	--	100

Course Objectives:

1. To acquire knowledge about superconductors and nanomaterials.
2. To gain knowledge of polymers, conducting and bio-polymers.
3. To understand the concept of phase rule in preparing alloys.
4. To understand the mechanism of corrosion and preventive methods.
5. To acquire knowledge of fuels, green fuels and batteries.
6. To learn the significance of composites and bio-composites.

Course Outcomes

1. Understand the fundamentals of Superconductors and Nanomaterials for device applications.
2. Use of polymers for specific engineering applications based on their properties.
3. Interpret various phase transformations of alloy using thermodynamics.
4. Apply different methods to minimize corrosion in industries.
5. Comparing various energy sources, such as batteries, fuel cells, alternative fuels, and conventional fossil fuels, about their availability, operation, composition, performance efficiency, and environmental impact.
6. Identify different types of composite materials for engineering applications.

Module No.	Unit No.	Topics	Hrs.
1.0		Engineering Materials and Applications	08
	1.1	Superconductors: Types of superconductors, Properties of Superconductors.	
	1.2	Applications of superconductors. Preparation and Structure of 1:2:3 superconductor	
	1.3	Optical Fibers, Fullerenes, Organic Electronic Materials	
	1.4	Nanomaterials: A) Definition, Types of Nanostructured materials, Applications of Nanomaterials. B) Graphene	
	1.5	C) Types of Carbon Nanotubes (SWCNTs and MWCNTs) – Properties and Uses.	
2.0		Introduction to Polymers and Advanced Polymers	06
	2.1	A) Macro-molecular science, basic concept of polymers, Chemical bonding in polymers, Classification of Polymers.	
	2.2	B) Properties of Polymers: - i) Molecular weight -Number average molecular weight, Weight Average Molecular Weight, Numerical	

	2.3	ii) Crystallinity - Crystalline and amorphous polymers – Glass transition temperature. iii) Mechanical Properties: Hardness, tensile strength, creep, fatigue, impact resistance (introduction)	
	2.4	iv) Electrical properties: dielectric strength, insulation resistance, surface resistivity (Introduction), v) Optical properties: refractive index, transmittance, photoelectric property, color	
	2.5	Conducting polymers, Bio- polymers, Liquid crystal polymers, Intelligent (smart) polymers	
3.0		Alloys	06
	3.1	Introduction, Purpose of making alloys. i) Gibbs Phase rule – Statement, Terms involved with examples.	
	3.2	ii) Reduced phase rule, Two-component system (Pb Ag) & Numerical.	
	3.3	iii) Merits and Limitations of Phase rule.	
	3.4	Ferrous alloys – Plain-carbon steels, Heat and Shock resisting steels, Stainless steels. Effect of the alloying element- Ni, Cr, Co, Mn, Mo, W and V	
	3.5	Aluminium Alloys – Composition, properties and uses of i) Duralumin, ii) Magnalium.	
	3.6	Alloys of Pb – Composition, properties and Uses of i) Wood's metal ii) Tinman's solder.	
	3.7	Numerical based on Composition, density and weight of an alloy	
4.0		Corrosion	06
	4.1	Introduction: - Definition, Types of Corrosion –(i)Dry or Atmospheric Corrosion, ii) Wet or Electrochemical corrosion (In Acidic medium, In Neutral medium)	
	4.2	Factors affecting rate of corrosion: - i) Position of metal in galvanic series, ii) Purity of Metal, iii) Nature of Corrosion product, iv) Temperature, v) pH of medium, vi) concentration of medium, vii) moisture, viii) Relative Cathodic and Anodic area, ix) overvoltage	
	4.3	Methods to control corrosion: - i) Selection of metal, ii) Proper Designing, iii) Cathodic protection, iv) Use of Corrosion Inhibitors, v) Metallic Coating	
	4.4	Corrosion in Electronic devices	
5.0		Energy Sciences	08
	5.1	Definition and classification of fuels, Calorific value: Definition, Gross or Higher calorific value & Net or lower calorific value, Dulong's formula & numerical for calculations of Gross and Net calorific values.	
	5.2	Disadvantages of fossil fuels, Alternative (Green) Fuels: Biomass, Biogas, Natural Gas and CNG (Description, Utility, advantages and disadvantages)	
	5.3	Green Fuels- Synthesis and advantages of i] Biodiesel ii] Power Alcohol	
	5.4	Combustion- Calculations for requirement of only oxygen and air (by weight and by volume only) for given solid & gaseous fuels.	
	5.5	Batteries: Fuel Cell (H ₂ -O ₂ Fuel Cell), Solar Battery, Electrochemical Sensors.	
6.0		Composites	05
	6.1	Definition, Characteristics of Composites, Constituents of Composites – Matrix Phase and Dispersed Phase (Definition and Functions)	
	6.2	Classification of Composites	
	6.3	Types of Composites, sub-types and Applications: - i) Fiber- reinforced composites, ii) Layered composites (Laminates), iii) Particulate composites.	
	6.4	Bio-composites – Definition, Classification and Applications.	
		Total	39

Recommended Books:

1. Engineering Chemistry, Jain and Jain, Dhanpat Rai Publication
2. A textbook of Engineering Chemistry, S. S. Dara, S. Chand and Company
3. A Textbook of Engineering Chemistry, Shashi Chawla, Dhanpat Rai and Co.
4. Polymer science: Vasant Gowariker, Wiley Eastern Ltd, new Delhi

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 of duration 1 Hr. (on 40% - 50% syllabus)

End Semester Examination:

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

1. All questions are compulsory.
2. Question paper will comprise **3** questions, question 1 & 3 carrying 20 marks, and question No. 2 carrying 40 marks.
3. Each question will be based on the entire syllabus.

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
FEC103	Basic Electrical and Electronics Engineering	02	--	--	02	--	--	02

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE ^s			
		ISE	MSE				
FEC103	Basic Electrical and Electronics Engineering	15	15	45	--	--	75

Course Objectives:

1. To provide knowledge on fundamentals of DC circuits
2. To provide knowledge of single phase and three phase AC circuits.
3. To inculcate fundamental knowledge of 1- Φ transformer.
4. To provide basic knowledge on fundamentals of DC and AC machines.
5. To provide knowledge of special purpose Diodes.
6. To provide knowledge of Transistor.

Course Outcomes:

After successful completion of the course student will be able to

1. Apply various network theorems to determine the circuit response / behavior.
2. Evaluate and analyze 1- Φ and 3- Φ AC circuits.
3. Describe the construction, operation and applications of 1- Φ transformers.
4. Illustrate the working principle of 3- Φ , 1- Φ Induction motors and DC Motors.
5. Explain the construction, operation and applications of some special purpose Diodes.
6. Explain the construction, operation and applications of some Transistors.

Module No.	Unit No.	Topics	Hrs.
1.0		D. C. Circuits	08
	1.1	DC Circuits: (Only independent sources) Kirchhoff's Laws, Source Transformation, Mesh and Nodal Analysis (no super node and super mesh) Star-Delta / Delta-Star Transformations	
	1.2	Superposition Theorem, Thevenin's Theorem, Norton's Theorem and Maximum Power Transfer Theorem.	
2.0		A.C. Circuits	07
	2.1	AC Circuits: Generation of alternating voltage, basic definitions, average and RMS values, phasor and phase difference, sums on phasors, Single-phase ac series and parallel circuits consisting of R, L, C, RL, RC, RLC combinations, definitions - real, reactive and apparent power, Series resonance (only theory).	
	2.2	Generation of Three-Phase Voltages, voltage & current relationships in Star and Delta Connections	
3.0		Single phase transformer	03
	3.1	Single Phase Transformer: (Numerical are not expected) Working principle of single-phase transformer, types of single-phase transformer, transformation ratio, actual (practical) and ideal transformer,	
	3.2	Transformer losses, efficiency and applications of transformer.	

4.0		Electrical Machines	02
	4.1	Electrical Machines: (Numerical are not expected) principle of operation, constructional details, classification and applications of DC Motor.	
	4.2	Three phase induction motor, Single-Phase induction motors and BLDC motors	
5.0		Semiconductor Diodes	03
	5.1	Diodes: (Numerical are not expected), Construction, working principle, characteristics and applications of P-N junction diode and Zener diode	
	5.2	Basic structure of LED. Application of LED.	
6.0		Transistors	03
	6.1	Introduction to Transistors: (Numerical are not expected) structure and operation of BJT. BJT configurations (only common emitter).	
	6.2	FET structure and operation. Application of BJT and FET in amplification and switching.	
		Total	26

Textbooks:

1. V. N. Mittal and Arvind Mittal “Basic Electrical Engineering” Tata McGraw Hill, (Revised Edition)
2. Vincent Del Toro “Electrical Engineering Fundamentals”, PHI Second edition, 2011.
3. Edward Hughes “Hughes Electrical and Electronic Technology”, Pearson Education (Tenth edition)
4. Edward Hughes “Hughes Electrical and Electronic Technology”, Pearson Education (Tenth edition).
5. D P Kothari and I J Nagrath “Theory and Problems of Basic Electrical Engineering”, PHI 13th edition 2011.
6. M. Naidu, S. Kamakshiah “Introduction to Electrical Engineering” McGraw-Hill Education, 2004.
7. B.R Patil “Basic Electrical Engineering” Oxford Higher Education,
8. Electronic Devices and Circuit Theory” by Robert L. Boylestad and Louis Nashelsky

Reference books:

1. B.L. Theraja “Electrical Engineering “Vol-I and II
2. S.N. Singh, “Basic Electrical Engineering” PHI, 2011.

Course Assessment:

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

MSE: To be conducted as written examination for 15 marks of duration 1 Hr. (on 40% - 50% syllabus)

End Semester Examination:

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

1. All questions are compulsory.
2. Question paper will comprise 3 questions, question 1 & 3 carrying 15 marks, and question No. 2 carrying 30 marks.
3. Each question will be based on the entire syllabus.

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
FEC104	C - Programming	02	--	--	02	--	--	02

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE ^s			
		ISE	MSE				
FEC104	C - Programming	15	15	45	--	--	75

Course Objectives:

1. To develop problem solving skills using algorithms.
2. To provide exposure to different programming constructs.
3. To provide exposure to writing functions.
4. To understand fundamentals of arrays, strings and structures in C language.
5. To develop the knowledge of pointers, Dynamic memory allocation.
6. To acquaint with the concept of file handling.

Course Outcomes:

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

1. Formulate simple algorithms for arithmetic, and logical problems and translate them to programs in C - language
2. Implement, test and execute programs comprising of control structures.
3. Decompose a problem into functions and synthesize a complete program.
4. Demonstrate the use of arrays, strings and structures in C language.
5. Understand the concept of pointers, Dynamic memory allocation
6. Understand the concept of File Handling

Module No.	Unit No.	Topics	Hrs.
Pre-requisite		Introduction to Problem Solving	1
	0.1	Steps for Problem Solving. Algorithm and Flowchart. Flow of Control.	
	0.2	Imperative and Declarative Programming Paradigm.	
1.0		C Programming Fundamentals	9
	1.1	Variables, keywords, Data types, Operators: Arithmetic, Relational and Logical, Assignment, Unary, Conditional, Bitwise, Expression, Statements. Operator Precedence and Expression evaluation.	
	1.2	Branching Structures: if statement, if-else statement, multi-way decision, switch statement, continue statement, break statement	
	1.3	Control/Iterative Structures: while, do-while, for, nested loops, Jump control statements.	
2.0		Arrays and Strings	4
	2.1	Declaration, Definition, accessing array elements, one-dimensional array, two-dimensional array, array of characters, standard String handling functions.	
3.0		Functions and Pointer	4
	3.1	Defining a Function, accessing a Function, Function Prototype, Passing Arguments to a Function, call by value, call by reference, Recursion	
	3.2	Declaration and Access of Pointer variables, Pointer arithmetic, Pointer and Arrays.	

4.0		Structures and Union	4
	4.1	Concept of Structure and Union, Declaration and Initialization of structure and union, Nested structures, Array of Structures, Passing structure to functions	
5.0		Dynamic Memory Allocation	2
	5.1	Static memory allocation and Dynamic memory allocation, Dynamic allocation of Arrays, Freeing memory, Reallocating memory blocks	
6.0		File handling	2
	6.1	Concept of streams used in the C file system, Using Files in C, File modes, Working with Text and Binary files	
Total			26

Text books:

1. Pradeep Day and Manas Gosh ,—Programming in C++, Oxford University Press.
2. E. Balaguruswamy, Programming in ANSI C, McGraw-Hill
3. Sumitabha Das, Computer Fundamentals and C Programming, McGraw-Hill

Reference books:

1. Yashavant Kanetkar, “Let Us C”, BPB publication, Sixteenth Edition
2. Venugopal K.R, Prasad Sudeep, —Mastering C, McGraw-Hill
3. Byron Gottfried, —Programing with C, McGraw Hill (Schaum”s outline series)

Course Assessment:

ISE: To be conducted in any of these forms - Assignment/ Quiz/ Presentation/ Class Test of 15 marks.

MSE: To be conducted as written examination for 15 marks of duration 1 Hr. (on 40% - 50% syllabus)

End Semester Examination:

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

1. All questions are compulsory.
2. Question paper will comprise 3 questions, question 1 & 3 carrying 15 marks, and question No. 2 carrying 30 marks.
3. Each question will be based on the entire syllabus.

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
FEC105	Applied Mechanics and Robot Dynamics	02	--	--	02	--	--	02

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE ^s			
		ISE	MSE				
FEC105	Applied Mechanics and Robot Dynamics	15	15	45	--	--	75

Course Objectives:

1. To acquaint with the concept of force & basic principle of centroid and its application
2. To familiarize with the moment, Resultant and Equilibrium of system of coplanar force.
3. To acquaint with the basic concept of friction and its application in real-life problems.
4. To understand the parameters required to quantify the Kinematics of Particle and Rigid body.
5. To understand forward and inverse kinematics of robotic arm
6. To understand relation between robot joints and parameters

Course Outcomes:

After successful completion of the course student will be able to

1. Determine the equivalent force-couple system for a given system of forces.
2. Calculate reactions forces for various type of beam structure
3. Apply fundamental concept of friction to real world scenario involving inclined plane and connected bodies.
4. Calculate position, velocity and acceleration etc. of particle/rigid body using principles of kinematics
5. Analyze Forward and Inverse Kinematics of robotic arm
6. Establish the relation between robot joints and its parameters.

Module No.	Unit No.	Topics	Hrs
1.0		System of Coplanar Forces	06
	1.1	Concept of force, Principle of transmissibility, Composition and resolution of forces. Moment of force about a point, Varignon's Theorem. Various systems of forces. Couples. Force couple system, Resultant of coplanar force system.	
	1.2	Centroid of plain laminas: Plain lamina consisting of primitive geometrical shapes	
2.0		Equilibrium	06
	2.1	Conditions of static equilibrium. Free body diagram. Various types of supports and support reactions. Equilibrium of Connected Bodies.	
	2.2	Types of Beams and various types of loads. Determination of reactions at supports for beams	
3.0		Friction	05
		Concept of Static Friction and Dynamic/ Kinetic Friction, Laws of dry friction, Coefficient of Friction, Angle of Friction, Concept of Cone of friction. Angle of Repose, Equilibrium of bodies on horizontal and inclined plane	
4.0		Kinematics of Particle and Rigid Bodies	04

	4.1	Motion of particle with variable acceleration, Motion Curve.	
	4.2	General Plane motion of Rigid body. The concept of instantaneous center of rotation (ICR) for velocity. Velocity analysis of rigid body using ICR.	
5.0		Robot Kinematics-I	03
		Fundamental of Robot Mechanics, Degree of Freedom, Classification of Robots, Introduction to Forward Kinematics and Inverse Kinematics, Homogeneous transformation (Limited to 2 DOF Serial Robot)	
6.0		Robot Kinematics- II	02
		Concept of D-H Parameters, robot kinematics (Forward and Inverse), Control system for Robot joint, Adaptive control, Drives and transmission systems, End effectors, Grippers etc.,	
		Total	26

Textbooks:

1. Engineering Mechanics by A K Tayal, Umesh Publication.
2. Engineering Mechanics by Kumar, Tata McGraw Hill
3. Engineering Mechanics by Beer & Johnston, Tata McGraw Hill

Reference books:

1. Engineering Mechanics by R. C. Hibbeler.
2. Engineering Mechanics by F. L. Singer, Harper & Row Publication
3. Engineering Mechanics by Macklin & Nelson, Tata McGraw Hill
4. Engineering Mechanics by Shaum Series
5. Engineering Mechanics (Statics) by Meriam and Kraige, Wiley Books
6. Engineering Mechanics (Dynamics) by Meriam and Kraige, Wiley Books
7. Introduction to Industrial Robotics by Ramchandran Nagarajan, Pearson publication

Online References:

1. <https://archive.nptel.ac.in/courses/112/106/112106286/>
2. https://onlinecourses.nptel.ac.in/noc21_me70/preview
3. <https://archive.nptel.ac.in/courses/112/106/112106180>

Course Assessment:

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

MSE: To be conducted as written examination for 15 marks of duration 1 Hr. (on 40% - 50% syllabus)

End Semester Examination:

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

- 1 All questions are compulsory.
2. Question paper will comprise 3 questions, question 1 & 3 carrying 15 marks, and question No. 2 carrying 30 marks.
3. Each question will be based on the entire syllabus.

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
FEL1011	Applied Physics Lab	--	01	--	--	0.5	--	0.5

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE			
		ISE	MSE				
FEL1011	Applied Physics Lab	--	--	--	25	--	25

Lab Objectives:

1. To develop scientific understanding of physics concepts
2. To develop the ability to explain the processes and applications related to science subjects
3. To apply skills and knowledge in real life situations
4. To improve the knowledge about the theory concepts of Physics learned in the class
5. To improve ability to analyze experimental result and write laboratory report
6. To develop understanding about inferring and predicting

Lab Outcomes: Learners will be able to

1. Determine parameters such as numerical aperture / power attenuation of an optical fibre
2. Determine wavelength / divergence of laser beam
3. Perform experiments based on interference in thin film and determine radius of curvature of lens / diameter of wire / thickness of paper
4. Calculate basic parameters / constants using semiconductors
5. Use various sensors such as optical, resistive and piezoelectric
6. Demonstrate the concept for virtual lab and simulation Experiments

List of Experiments (Minimum five experiment required)

Sr. No.	Title of the Experiment
1	Determination of numerical aperture of an optical fibre
2	Determine the divergence of laser beam
3	Determination of radius of curvature of a lens using Newton's ring set up.
4	Determination of diameter of wire/hair or thickness of paper using wedge shape film method
5	Determination of Hall Coefficient using Hall Effect phenomenon
6	Determination of wavelength using Diffraction grating. (Laser source)
7	Determination of Planck's constant using photocell
8	Determine UDM parameters
9	Study of colour sensor
10	Simulation experiments based on nanotechnology using open-source Simulation
11	Measuring optical power attenuation in plastic optical fiber
12	I-V characteristics of PN junction diode/Zener diode/photo diode
13	Study of the characteristics of Resistance Temperature Detector (RTD)/optical sensors

Term Work:

Term work shall consist of at least 5-6 practical based on the above list. Further, term work journal must include at least 2 assignments. Term work will be assessed as Continuous Internal Assessment Practical (CIAP).

Term work marks: 25 marks (Total)= 15 marks (Experiment)+ 5 marks (Assignments)+ 5 marks (Attendance)

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
FEL1012	Applied Chemistry Lab	--	01	--	--	0.5	--	0.5

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE			
		ISE	MSE				
FEL1012	Applied Chemistry Lab	--	--	--	25	--	25

Lab Objective:

1. To apply knowledge of quantitative analysis to determine the quality of coal.
2. To analyze experimental results and write laboratory report.
3. To learn about properties of oil to prevent corrosion.
4. To know the significance of viscosity.
5. To understand the significance of pH.
6. To learn to synthesize man-made polymers.

Lab Outcomes: After completion of experiment, the learners will be able to:

1. Understand the significance of proximate analysis of coal and determine quality of coal sample.
2. Learn various quantitative analytical techniques to determine % of elements from alloy samples.
3. Understand the significance of various properties of oil to prevent corrosion.
4. Understand the properties of lubricants and their variation with temperature using Redwood/ Abel's apparatus.
5. Apply knowledge of various quantitative analytical techniques to determine metal ion concentration/ pH
6. Synthesize UF/PF resin at laboratory level/Virtual lab.

Exp. No.	List of Experiments
1.	Determination of Moisture Content in Coal
2.	Determination of Ash Content in Coal
3.	Determination of Zn in Brass
4.	Estimation of Cu in Brass
5.	Determination of Acid Value of Oil
6.	Determination of Saponification Value of oil
7.	Determination of Viscosity of oil by Redwood Viscometer
8.	Determination of Flash point of lubricating oil using Abel's apparatus.
9.	Determination of metal ion concentration using Calorimeter.
10.	Determination of free acid (pH) of acid solution.
11.	Synthesis of Phenol- formaldehyde
12.	Synthesis of Urea- formaldehyde

Term Work: Term Work shall consist of at least 5 to 6 Practical based on the above list. Also, Term work Journal must include at least 2 assignments. Term work will be assessed as Continuous Internal Assessment Practical (CIAP).

Term work marks: 25 marks (Total)= 15 marks (Experiment)+ 5 marks (Assignments)+ 5 marks (Attendance)

Course Name	Course Code	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical/ Oral	Tutorial	Total
FEL102	Basic Electrical and Electronics Engineering Lab	--	02	--	--	01	--	01

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE			
		ISE	MSE				
FEL102	Basic Electrical and Electronics Engineering Lab	--	--	--	25	25	50

Lab Objective:

1. To impart the basic concept of network analysis and its application.
2. To provide the basic concept of AC circuit analysis and its application.
3. To illustrate the operation of the transformer
4. To illustrate the operation of machines.
5. To explain the Zener diode voltage regulation characteristic.
6. To explain the BJT and FET as switches and amplifiers.

Lab Outcomes: After successful completion of the course student will be able to

1. Interpret and analyze the behavior of DC circuits using network theorems.
2. Perform and infer experiments on single-phase and three-phase AC circuits
3. Illustrate the performance of a single-phase transformer
4. Illustrate the performance of A.C. machine and DC Motor
5. Perform an experiment on voltage regulation characteristics of Special diode
6. Perform an experiment on the VI characteristics of Transistor.

Sr. No.	List of Experiments
1	To understand the basic safety precautions in electrical lab and use of electronic components and measuring instruments.
2	Perform and verify Superposition theorem.
3	Perform and verify Thevenin theorem.
4	Perform and verify Norton's & Maximum power transfer theorem.
5	Perform and verify resonance in series RLC circuit.
6	Perform and verify Relationship between IL and I _{ph} and VL and VPL in three phase Star and delta connected load.
7	Perform SC and OC test on single phase transformer using virtual lab
8	To study and understand the concepts of DC motor and generator.
9	To verify results of given electrical circuit using simulation software
10	To demonstrate cut-out sections of the DC machine
11	To plot Zener diode voltage regulation characteristics
12	To demonstrate the application of BJT as a switch
13	To demonstrate BJT/ FET as an amplifier

Online Resources:

1. All About Circuits (<https://www.allaboutcircuits.com>)
2. Circuit Lab (<https://www.circuitlab.com>)
3. Tinker cad (<https://www.tinkercad.com>)

Assessment:

Term Work:

Term Work shall consist of at least 08 to 10 Practical based on the above list. Also, Term work Journal must include at least 6 assignments. 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)

Practical or Oral Exam:

An Oral /Practical exam will be held based on the above syllabus and will be conducted as End Semester Examination Practical (ESEP).

Course code	Course code	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
FEL103	C - Programming Lab	--	02	--	--	01	--	01

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE			
		ISE	MSE				
FEL103	C - Programming Lab	--	--	--	25	25	50

Course Objectives:

Learner will be able to

1. Translate given algorithms to a program.
2. Correct syntax and logical errors.
3. Write iterative as well as recursive programs.
4. Represent data in arrays, strings and structures and manipulate them through a program.
5. Declare pointers and demonstrate call by reference concept.
6. Use File-handling functions

Course Outcomes:

At the end of the course the student should be able to:

1. Understand and implement basic problem statement using algorithms / flowcharts.
2. Recall and debug syntax and logical errors.
3. Write iterative as well as recursive programs.
4. Understand data in arrays, strings and structures and manipulate them through a program.
5. Understand the concept of pointers and demonstrate call by reference concept program
6. Understand various File handling techniques and methods using C programming language

Unit No.	List of Experiments
1	Write a program to swap two variables' values with and without using third variables. Write algorithm and draw flowchart for the same.
2	Write a program to check odd or even number: (a) using modulus operator (b) using conditional operator.
3	Design and develop a C program to read a year as an input and find whether it is leap year or not. Also consider the end of the centuries. Write algorithm and draw flowchart for the same.
4	Write a C program to find the whether the number is an AMSTRONG number or not
5	Design and develop a flowchart or an algorithm that takes three coefficients (a, b, and c) of a Quadratic equation ($ax^2 + bx + c = 0$) as input and compute all possible roots. Implement a C program for the developed flowchart/algorithm and execute the same to output the possible roots for a given set of coefficients with appropriate messages. .
6	Write a program to calculate $1/1! + 2/2! + 3/3! + \dots + n/n!$.
7	Write a menu driven program to perform simple arithmetic operations based on the user's choice. The user will indicate the operation to be performed using the signs e.g. + for addition, etc.

	Write an algorithm and draw flowchart for same.
8	Write a program to read a number of more than one digit, reverse the number and display the sum of digits of numbers. Write algorithm and draw flowchart for the same.
9	Write a program to print given number pattern using for loop
10	Write a C program to find maximum and minimum between two numbers using functions. Write algorithm and draw flowchart for the same.
11	Write C program to find GCD of two integers by using recursive function
12	Write a C program to find both the largest and smallest number in a list of integers. Write algorithm and draw flowchart for the same.
13	Develop, implement and execute a C program that reads two matrices A (m x n) and B (p x q) and Compute product of matrices A and B. Read matrix A and matrix B in row major order and in column major order respectively. Print both the input matrices and resultant matrix with suitable headings and output should be in matrix format only.
14	Write a Program for deletion of an element from the specified location from Array.
15	Write a C program using user defined functions to determine whether the given string is palindrome or not.
16	Write program C to count the number of lines, words and characters in a given text.
17	Write a program to swap two numbers using a function. Pass the values to be swapped to this function using the call-by-value method and call-by-reference method.
18	Demonstrate structure and Union to specify data on students like Roll-number, Name, Department, Course, Year of Joining and Print the data of a student according to roll number.
19	Write a program to copy one array to another using pointer.
20	Write a program to read a file and display its contents along with line numbers before each line

Term Work:

Experiments (20 Programs) and Assignments (2 Assignments) should be completed by students on the given time duration. 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 TW ensure the satisfactory performance of laboratory work and minimum passing in the TW.

Practical and Oral:

Practical and oral Exam should be conducted for the Lab, on Computer Programming in C subject for given list of experiments and will be conducted as End Semester Examination Practical (ESEP).

Course code	Course code	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
FEL104	Applied Mechanics And Robot Dynamics Lab	--	02	--	--	01	--	01

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE			
		ISE	MSE				
FEL104	Applied Mechanics And Robot Dynamics Lab	--	--	--	25	25	50

Lab Objectives

1. To acquaint with basic principles of centroid and its application
2. To familiarize with the concepts of force, moment, Resultant and Equilibrium of system of coplanar force.
3. To acquaint with the basic concept of friction and its application in real-life problems.
4. To understand the parameters required to quantify the Kinematics of Particle and Rigid body.
5. To understand the parameters required to quantify the Kinetics of rigid body.
6. To acquaint with the basics of Robot kinematics

Lab Outcomes: Learners will be able to

1. Determine the equivalent force-couple system for a given system of forces
2. Demonstrate the understanding of Centroid and its significance and locate the same.
3. Illustrate the concept of force, moment and apply the same along with the concept of equilibrium in two- and three-dimensional systems with the help of FBD.
4. Calculate position, velocity and acceleration etc. of particle and rigid body using principles of kinematics.
5. Analyze particles in motion using force and acceleration, work-energy and impulse momentum principles
6. Establish the relation between robot joints and parameters

List of Experiment:

1. Verification of Polygon law of coplanar forces.
2. Verification of law of Moment using Bell crank lever.
3. Determination of Support reaction for beam.
4. Determination of coefficient of friction using Inclined plane.
5. Verification of Lami's theorem using Jib crane.
6. Resultant of non-concurrent non-parallel coplanar force system.
7. Determination of coefficient of restitution for Collision of elastic bodies (Law of conservation of momentum).
8. Forward and Inverse kinematics Visualization of DH (Denavit–Hartenberg) parameters in Rob analyzer Software.
9. Programming exercises on determination of Resultant of Coplanar Force System.
10. Programming exercise covering the determination of Support Reactions, including Fixed Support, Hinged Support, Roller Support, and other types of structural supports.

Assessment:

Term Work:

Term Work shall consist of at least Six Practical's and Six Assignments. 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)

Practical or Oral Exam:

An Oral /Practical exam will be held based on the above syllabus and will be conducted as End Semester Examination Practical (ESEP) of 2 hours duration for 25 Marks.

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
FEL105	Engineering Workshop-I	--	02	--	--	01	--	01

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE			
		ISE	MSE				
FEL105	Engineering Workshop-I	--	--	--	25	--	25

Course Objectives:

1. To impart training to help the students develop engineering skill sets.
2. To inculcate respect for physical work and Shop Floor.
3. To get exposure to the interdisciplinary engineering domain.
4. To get exposure to handle different tools.
5. To inculcate respect for hard labor.
6. To inculcate the habit working in team for common job/goal.

Course Outcomes:

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

1. Develop the necessary skills required to handle/use different fitting tools.
2. Develop skill required for hardware operation maintenance.
3. Able to install an operating system and system drives.
4. Able to identify the network components and perform basic networking and crimping.
5. Able to perform simple arc welding operations.
6. Develop the necessary skills to perform plumbing and machining activities.

NOTE:

1. Trade 1 and 2 are compulsory.
2. Select any one trade topics out of trade 3 to trade 5.

Practical demonstrations and hands-on activities will be conducted during the designated periods. A detailed report of the demonstrations, accompanied by appropriate sketches, must also be submitted as part of the term work.

CO evaluation is to be conducted based on the chosen trades as well as compulsory trades.

Trade	Topics	Hrs.
1.0	Fitting [Compulsory]	12
	Use and setting of fitting tools for chipping, cutting, filing, marking, center punching, drilling, tapping. Term work to include One Job involving following operations: filing to size, drilling and tapping, male- female joint in group of two	
2.0	Hardware and Networking [Compulsory]	06
	Dismantling of a Personal Computer (PC), Identification of Components of a PC such as power supply, motherboard, processor, hard disk, memory (RAM, ROM), CMOS battery, CD drive, monitor, keyboard, mouse, printer, scanner, pen drives, disk drives etc. Assembling of PC, Installation of Operating System (Anyone) and Device drivers, Boot-up sequence. Installation of application software (at least one) Basic troubleshooting and maintenance Identification of network components: LAN card, wireless card, switch, hub, router, different types of network cables (straight cables, crossover cables, Rollover cables) Basic networking and crimping. NOTE: Hands on experience to be given in a group of not more than Four Students	
3.0	Welding	06
	Edge preparation for welding jobs. Arc welding for different job like, Lap Welding of two plates, butt-welding of plates with simple cover, arc welding to join plates at right angles.	
4.0	Plumbing	06
	Use of plumbing tools, spanners, wrenches threading dies, demonstration Of preparation of a domestic line involving fixing of a water tap and use of Coupling, elbow, tee, and union etc..	
5.0	Machine Shop	06
	At least One Turning Job on Lathe/ Milling Machine is to be demonstrated and simple job to be made for Term Work in a group of 4 students	

Textbook:

1. Workshop technology volume I, P. N. Rao McGraw Hill publication.
2. Elements of workshop technology volume I, S. K. Hazra Chaudhuri, A K Hazra Chaudhuri, Nirjar
3. Roy media promoters and publishers private limited

Reference books:

1. Workshop Technology Part 2 WAJ Chapman Viva books Pvt ltd.
2. A course in Workshop Technology, B S Raghuvanshi, Dhanpat Rai and CO Ltd

Assessment

Term Work Description:

Term Work will encompass practical exercises covering at least three trades based on the mentioned list. Term work will be assessed as Continuous Internal Assessment Practical (CIAP).

Term Work Assessment:

25 Marks (Total marks) = 20 Marks (Workshop Experiment) + 5 Marks (Attendance)

Course Code	Course Name	Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
FEL106	Health, Wellness and Mindfulness	--	2*+2	--	--	02	--	02

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE			
		ISE	MSE				
FEL106	Health, Wellness and Mindfulness	--	--	--	25	--	25

* Two hours of practical class to be conducted for full class as demo/discussion.

Rationale:

The Health, Wellness and Mindfulness syllabus equips first-year engineering students with essential knowledge to manage their physical, mental and social well-being amidst academic pressures. It emphasizes practical skills in areas such as diet, stress management and hygiene, promoting a balanced lifestyle. The course integrates active learning to ensure students can apply these concepts effectively in their daily lives.

Course Objectives:

1. To recall key concepts of health and wellness, including definitions, importance, and types (physical, mental, social, and spiritual)
2. To explain the role of essential nutrients in maintaining health and the impact of balanced and unhealthy diets.
3. To demonstrate the ability to create a personalized health plan, incorporating proper diet, exercise, and stress management techniques.
4. To analyze the causes and effects of various lifestyle-related diseases and evaluate the effectiveness of prevention and management strategies.
5. To evaluate different stress management techniques and hygiene practices to determine their effectiveness in maintaining mental and physical health.
6. To design mindfulness activities and health improvement strategies, applying their knowledge to real-world scenarios and promoting well-being.

Course Outcomes:

1. Identify and define key concepts related to health and wellness, such as different types of health, common diseases, and essential nutrients.
2. Describe the importance of a balanced diet, healthy lifestyle choices, and the impact of poor nutrition and substance abuse on overall well-being.
3. Implement personalized health plans and practice healthy eating habits, regular exercise, and stress management techniques.
4. Examine and compare different causes of lifestyle diseases and assess the role of physical activity, yoga, and proper diet in disease prevention.
5. Judge the effectiveness of various hygiene practices and different stress management methods.
6. Formulate and propose innovative mindfulness exercises and wellness strategies, tailored to their needs, promoting a holistic approach to health.

Module No.	Unit No.	Topics	Hrs.
1.0		The foundations of healthful living and Wellness:	06
	1.1	Describe and distinguish between Health and Wellness, Importance of health and wellness Education. Physical, social, mental, spiritual health and its relevance to everyday life Body systems and common diseases. Substance abuse (Drugs, Cigarette, Alcohol), de-addiction, counselling and rehabilitation. Information about Health organizations: World Health Organization (WHO), United Nation Educational Scientific & Cultural Organization (UNESCO), Integrated Child Development Services (ICDS), Ministry of Health & Family Welfare (MHFW)	
	1.2	Activities: Divide the students into small groups and assign each group a specific lifestyle choice (Healthy or Unhealthy) to explore. Request that they talk to the class about the possible impacts on health and share their insight.	
2.0		Diet and Nutrition for Health and Wellness	04
	2.1	Essentials of nutrients and their function in maintaining good health. Components of balanced diet for healthy living. Malnutrition, under nutrition and over nutrition. Processed foods and unhealthy eating habits. Importance of organic foods.	
	2.2	Activities: Establish a Customized Health Plan for each student. Pick an Important Subject: Select a certain health-related subject, such as Healthy Diets, Eating Habits, Traditional ways of eating, Impact of unhealthy eating on Health and wellness Script Development: Write a script that blends artistic aspects with educational material.	
3.0		Management of Health and Wellness	04
	3.1	Healthy foods for prevention and progression of Cancer, Hypertension, Cardiovascular, and metabolic diseases (Obesity, Diabetes, Polycystic Ovarian Syndrome). Importance of Physical Fitness, Spirituality and its Health benefits. Prevention and management of sedentary lifestyle diseases through exercise. Role of Yoga, in maintaining physical and mental health.	
	3.2	Activities: Discussion forums for diseases which they came across in the surroundings. Case studies related to health issues	
4.0		Stress Awareness and Management	04
	4.1	Understanding Stress, Sources and Causes of Stress, Physiological and Psychological Effects, Coping Mechanisms and Strategies, Stress Management Programs, Resilience and Stress Recovery	
	4.2	Activities: Discussions about stress-reduction strategies. Role plays on Stress Management and Awareness	
5.0		Hygiene, Personal Hygiene, Mental Hygiene & Community Hygiene	04
	5.1	Meaning, Concept and types of Hygiene. Importance of Hygiene for healthy life. Personal Hygiene, Mental Hygiene	
	5.2	Activities: Students will present their understanding of hygiene and will share ways to improve it.	

6.0		Mindfulness	04
	6.1	Foundation of Mindfulness, Mindfulness in action, Meditation techniques Brainstorming sessions for improving logical reasoning, thinking ability Activities to recognize and manage thoughts, emotions, and actions	
	6.2	Activities: Groupwise Activities can be conducted	
		Total	26

Reference books:

1. Physical Activity and Health by Claude Bouchard, Steven N. Blair, William L. Haskell.
2. Mental Health Workbook by Emily Attached & Marzia Fernandez, 2021.
3. Mental Health Workbook for Women: Exercises to Transform Negative Thoughts and Improve Well-Being by Nashay Lorick, 2022
4. Lifestyle Diseases: Lifestyle Disease Management, by C. Nyambichu & Jeff Lumiri, 2018.
5. Physical Activity and Mental Health by Angela Clow & Sarah Edmunds, 2013
6. Yoga for Beginners: A Practical Guide" by Iyengar B.K.S, Dorling Kindersley, 2006
7. Emotional Intelligence: Why It Can Matter More Than IQ By Daniel Goleman, Bantam, 2006
8. Atomic Habits: An Easy & Proven Way to Build Good Habits & Break Bad Ones by James Clear, Penguin, 2018

Online References:

1. <https://www.psychologytoday.com/us/basics/resilience/building-resilience>
2. <https://mindfulness.org/relaxation-techniques/>
3. <https://www.health.harvard.edu/staying-healthy/how-stress-affects-your-health>
4. https://www.mindtools.com/pages/article/newLDR_78.htm
5. <https://www.mayoclinic.org/symptoms/stress/basics/definition/sym-20050973>
6. <https://www.nimh.nih.gov/health/topics/stress/index.shtml>
7. <https://www.stress.org.uk/cognitive-behavioural-therapy-cbt/>

Assessment:

Suggested Pedagogy and assessment criteria for Teachers:

1. Project-based activities.
2. Presentation, Group Discussions, and Case studies.
3. Flip class mode/ Roleplay
4. Quiz MCQ
5. Assignment as per the modules: 06
6. Internal Assessment through flipped class and PowerPoint presentation along with documentation

Sample Case Studies:

1. Academic Stress:
2. Workplace Stress
3. Stress and Physical Health
4. Stress Reduction Techniques
5. Stress and Resilience
6. Stress and Academic Performance

Term Work: Total Marks: 25, includes 05 marks for attendance, 10 marks for minimum 6 assignments and 10 marks for mini project. Term work will be assessed as Continuous Internal Assessment Practical (CIAP).

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
FEL107	Induction cum Universal Human Values	--	05*	--	--	2.5	--	2.5

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE			
		ISE	MSE				
FEL107	Induction cum Universal Human Values	--	--	--	25	--	25

Course evaluation is activity-based which may be an individual or group of four students.

Rationale:

“The purpose of the education system is to develop good human beings capable of rational thought and action, possessing compassion and empathy..., with sound ethical moorings and values. It aims at producing engaged, productive, and contributing citizens for building an equitable, inclusive, and plural society as envisaged by our Constitution. Education must develop not only cognitive capacities... but also social, ethical, and emotional capacities and dispositions.... Education is fundamental for achieving full human potential, developing an equitable and just society, and promoting national development... A holistic and multidisciplinary education would aim to develop all capacities of human beings – intellectual, aesthetic, social, physical, emotional, and moral in an integrated manner” [NEP 2020, p 4].

UHV courses are intended to help students to develop a holistic, humane world vision. A self-reflective, explorational methodology is adopted. All content discussed is universal, rational, and verifiable, and leads to harmony.

Holistic education inculcates the following three aspects in the student:

- 1. Holistic, Humane Vision of Life** – harmonious individual to cosmos
- 2. Human Values**– human feelings, participation based on holistic vision
- 3. Skills**– required to live with these values in mutual relationships at all levels of human existence.

Course Objectives:

- To explore a holistic perspective of oneself, family, society, and nature through self-exploration.
- To understand the concept of harmony within the individual, family, society, and nature.
- To reflect on personal values and beliefs to strengthen self-awareness.
- To commit to taking actions that align with universal human values with courage and integrity.
- To prepare oneself to reach full human potential and contribute to an equitable, just society and national development.
- To clarify fundamental universal human values to guide understanding and practice in alignment with national and global aspirations, such as the Constitution, NEP 2020, UN MDGs, and SDGs

Course Outcomes: After completion of the course learner will be able to

- Recognize basic human aspirations and develop a plan to fulfill them.
- Describe the existing reality of a human being.
- Explain human values and relationships and outline a program to ensure mutual happiness.
- Illustrate harmony within one's surroundings, family, and society.
- Discuss harmony in nature and coexistence and demonstrate responsibility in solving problems with sustainable solutions.

6. Apply the learned concepts to daily life and professional practices to contribute to a universal human order, and develop holistic technologies, management models, and production systems.

Module No.	Unit No.	Topics	Hrs.
1.0		Introduction - Need, Basic Guidelines, Content and Process for Value Education	05
	1.1	Purpose and motivation for the course, Self-exploration, Continuous Happiness and Prosperity. The basic Human Aspirations.	
	1.2	Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfil the above human aspirations.	
2.0		Understanding Harmony in the Human Being	04
	2.1	Understanding human being as a co-existence of the sentient 'I' and the material 'Body'. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility.	
	2.2	The Body as an instrument of 'I', characteristics and activities of 'I' and harmony in 'I', harmony of I with the Body: Self-regulation and Health; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Self-regulation and Health.	
3.0		Understanding Harmony in the Family	07
3.0	3.1	Understanding values in human, Human relationship and program for its fulfilment to ensure mutual happiness.	
	3.2	Trust and Respect as the foundational values of relationship, the other salient values in relationship	
4.0		Understanding Harmony in the Society	03
	4.1	Understanding the harmony in society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive.	
	4.2	Human Goals, Visualizing a universal harmonious order in society- Undivided Society, Universal Order from family to world family.	
5.0		Understanding Harmony in the Nature and Existence - Whole existence as Coexistence	04
	5.1	Understanding the harmony in Nature, Interconnectedness and mutual fulfilment among the four orders of nature, cyclability and self-regulation in nature.	
	5.2	Understanding Existence as Co-existence of mutually interacting units in all pervasive space, Holistic perception of harmony at all levels of existence	
6.0		Implications of the Holistic Understanding of Harmony on Professional Ethics	03
	6.1	Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic. Universal Order, Competence in professional ethics: Ability to utilize the professional competence for augmenting universal human order and identify the scope and characteristics of people friendly and eco-friendly production systems	
	6.2	Ability to identify and develop appropriate technologies and management patterns for above production systems. Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order. Sum up.	
		Total	26

(In every module one lecture can be used for students sharing and discussion)

Textbooks:

1. A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 3rd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2. The Teacher's Manual Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2
3. A Foundation Course in Holistic Human Health – Its Philosophy and Practice, Sharmila Asthana, Akhilesh Shukla, T Sundara Raj Perumall, 1st Edition, October 2023, Published by UHV Publications, , Kanpur, UP.7 A

References:

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya
2. Prakashan, Amarkantak, 1999.
3. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
4. The Story of Stuff (Book).
5. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
6. Small is Beautiful - E. F Schumacher.
7. Slow is Beautiful - Cecile Andrews
8. Economy of Permanence - J C Kumarappa
9. Bharat Mein Angreji Raj – Pandit Sunderlal
10. Rediscovering India - by Dharampal
11. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
12. India Wins Freedom - Maulana Abdul Kalam Azad
13. Vivekananda - Romain Rolland (English)
14. Gandhi - Romain Rolland (English)

Online References:

1. <https://uhv.org.in>
2. NPTEL Course: Exploring Human Values: Visions of Happiness and Perfect Society, By Prof. A. K. Sharma, Department of Humanities and Social Sciences, IIT Kanpur: -Web link <https://nptel.ac.in/courses/109104068>
3. NPTEL Course: Moral Thinking: An Introduction to Values and Ethics by Prof. Vineet Sahu, IIT Kanpur: -Web link https://onlinecourses.nptel.ac.in/noc23_hs89/preview

Note:

1. This is an audit course.
2. This course is to be taught by faculty from every teaching department.
3. Lecture hours are to be used for interactive discussion, placing proposals about the topics at hand and motivating students to reflect, explore and verify them.
4. In the discussions, the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self-exploration
5. One or two periods from each module may be used for tutorials. These are important for the course. The Difference is that the laboratory is everyday life, and practical are how you behave and work in real life.
6. Depending on the nature of topics, worksheets, home assignment and/or activity can be included. The practice sessions (tutorials) would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to the development of commitment, namely behaving and working based on basic human values.

* Indicates workload of a learner for UHV. Faculty Load: ½ hour per week per four groups

Term Work: Total Marks: 25, includes 05 marks for attendance, 10 marks for Assignments & Quiz on each module and 10 marks for report writing. Term work will be assessed as Continuous Internal Assessment Practical (CIAP).

Semester II

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
FEC201	Applied Mathematics-II	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE ^s			
		ISE	MSE				
FEC201	Applied Mathematics-II	20	20	60	--	--	100

Course Objectives:

1. To study Differential equations which are fundamental tool in engineering for modeling, analyzing, and designing systems across various disciplines.
2. To learn LDE with constant coefficient simplify the mathematical treatment of linear systems, making it easier to model, analyze, and optimize their behavior
3. To develop the knowledge of improper integral, length of the curve and techniques like differentiation under integral sign.
4. To develop the knowledge of multiple integrals in various coordinate systems.
5. To study applications of multiple integrals.
6. To study numerical methods for ordinary differential equations

Course Outcomes: On completion of the course, the learner will be able to

1. Identify and solve the differential equation of first order and first-degree, exact, and linear differential equations.
2. Solve higher-order homogeneous and non-homogeneous differential equations with constant coefficients
3. Evaluate the integrals using Beta-Gamma functions, DUIS and rectify the curve.
4. Evaluate double integral, change the order of integration.
5. Evaluate the multiple integrals by using the different coordinate systems.
6. Apply the principles of numerical methods for solving ODE and numerical integrations analytically.

Module No.	Unit No.	Topics	Hrs.
1.0		Differential Equations of First Order and First Degree	05
	1.1	Exact differential Equations, Equations reducible to exact form by using four rules of integrating factors.	
	1.2	Linear differential equations (Review), equation reducible to linear form, Bernoulli's equation.	
2.0		Higher Order Linear Differential Equations with Constant Coefficients and Variable Coefficients:	07
	2.1	Linear Differential Equation with constant coefficient: complementary function, particular integrals of differential equation of the type $f(D)y = X$, where X is e^{ax} , $\sin(ax + b)$, $\cos(ax + b)$, x^m , $e^{ax} \cdot V$	
	2.2	Method of variation of parameters.	

3.0		Beta and Gamma Function, Differentiation under Integral sign and Rectification:	10
	3.1	Beta and Gamma functions and its properties. Differentiation under integral sign with constant limits of integration.	
	3.2	Rectification of plane curves in Cartesian form. Rectification of curve in Polar forms.	
4.0		Multiple Integrals:	09
	4.1	Introduction, Evaluation of Double Integrals. (Cartesian & Polar).	
	4.2	Changing the order of integration.	
	4.3	Evaluation of double integrals over the given region. (Cartesian & Polar).	
	4.4	Evaluation of double integrals by changing to polar coordinates.	
	4.5	Triple Integration: Introduction and evaluation of Triple Integrals using Cartesian coordinate system.	
	4.6	Evaluation of triple integrals using cylindrical and spherical coordinate system.	
5.0		Application Multiple Integrals:	04
	5.1	Application of double integrals to compute Area.	
	5.2	Application of triple integrals to compute Volume	
6.0		Numerical solution of ordinary differential equations of first order and first degree, Numerical Integration:	04
	6.1	Numerical solution of ordinary differential equation using: (a) Eulers method (b) Runge-Kutta method of order four.	
	6.2	Numerical integration by (a) Trapezoidal rule (b) Simpson's 1/3rd rule (c) Simpson's 3/8th rule (all without proof).	
		Total	39

Textbooks:

1. Higher Engineering Mathematics, Dr. B. S. Grewal, Khanna Publication.
2. Advanced Engineering Mathematics, Dennis G. Zill, Warren S. Wright.

Reference books:

1. Calculus, Thomas and Finney, Pearson Education.
2. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley Eastern Limited, 9th Ed.
3. Advanced Engineering Mathematics by H. K. Dass, 28th edition, S. Chand 2010.
4. Applied Numerical Methods with MATLAB for Engineers and Scientists by Steven Chapra, McGraw Hill.
5. A First Course in Differential Equations with Modelling Applications, Dennis G. Zill.

Course Assessment:

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

MSE: To be conducted as 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. All questions are compulsory.
2. Question paper will comprise 3 questions, question 1 & 3 carrying 20 marks, and question No. 2 carrying 40 marks.
3. Each question will be based on the entire syllabus.

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
FEC2021	Applied Physics	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE ^s			
		ISE	MSE				
FEC2021	Applied Physics	20	20	60	--	--	100

Course Objectives:

1. To demonstrate the phenomena of thin film interference
2. To provide students with basic understanding of lasers and signal communication in optical fibers
3. To give exposure to the concepts of semiconductors
4. To build a foundation of quantum mechanics needed for modern technology
5. To impart basic concepts needed for sensor technology
6. To discuss the applications of nanotechnology for nano computing

Course Outcomes:

After successful completion of the course students will be able to

1. Determine the wavelength of light and refractive index of medium using interference phenomenon
2. Illustrate the use of lasers for various applications including optical fibres
3. Apply the knowledge gained in semiconductors in various applications
4. Relate the foundations of quantum mechanics with the development of modern technology
5. Implement the knowledge of sensing mechanism towards various sensors
6. Interpret the concept of nano technology to emerging areas of technology

Mod ule No.	Unit No.	Topics	Hrs.
1.0		Interference	06
	1.1	Interference: Interference in thin film of uniform thickness (reflected system), maxima and minima conditions for variable thickness (wedge-shaped) film (qualitative), fringe width	
	1.2	Applications: (i) Newton's rings- determination of wavelength and refractive Index of transparent liquid (ii) Antireflecting and highly reflecting coatings.	
2.0		Lasers and Optical Fibres	07
	2.1	Lasers: absorption, spontaneous and stimulated emissions, light amplification population inversion, pumping, components of laser, characteristics of lasers, He-Ne laser, semiconductor laser. Applications: (i) holography (ii) LiDAR (iii) barcode reader	
	2.2	Optical Fibers: critical angle, total internal reflection, acceptance angle, acceptance cone, numerical aperture, types of optical fibers: single mode & multimode, step index & graded index, V- number, attenuation, fibre optic communication system.	
3.0		Semiconductor Physics	07
	3.1	Direct and indirect band gap semiconductors, concept of drift velocity, mobility, conductivity in intrinsic semiconductors, Fermi- Dirac distribution function, position of Fermi level in intrinsic and extrinsic semiconductors, variation of	

		Fermi level in N and P type semiconductors with temperature and concentration, Hall effect and applications.	
	3.2	Applications: photo diode, LED, solar cell, Zener diode	
4.0		Quantum Physics	08
	4.1	Quantum Physics: de Broglie hypothesis of matter waves, de Broglie wavelength for electron, Properties of matter waves, Heisenberg's uncertainty principle, Wave function and probability density, mathematical conditions for wave function, Need and significance of Schrödinger's equations, Schrödinger's time dependent and time independent equations, energy of a particle enclosed in a rigid	
	4.2	Applications: Quantum mechanical tunneling, Principles of quantum computing: concept of Qubit	
5.0		Physics of sensors	05
	5.1	Transducers: active and passive transducers, sensing mechanism,	
	5.2	Sensors: Resistive sensors- PT100, Humidity measurement, proximity sensors, pressure sensors- piezoelectric effect, ultrasonic sensors for distance and velocity measurement in liquid and air, optical sensors- light dependent resistors, wavelength and color sensors	
6.0		Nanotechnology and Nanocomputing	06
	6.1	Nanotechnology: nanoscale, nanomaterial classification, properties, significance of quantum confinement and surface to volume ratio, top down and bottom-up approach ball milling, sputtering, sol-gel, and CVD methods of synthesis, Techniques-SEM, AFM	
	6.2	Nanocomputing: Introduction to nano computer, Nano computer Building block, Chemically Assembled Electronic Nanotechnology (CAEN), Single Electron Transfer (SET)	
		Total	39

Textbooks:

1. A Textbook of Engineering Physics -Dr. M. N. Avadhanulu, Dr. P. G. Kshirsagar, S. Chand, Revised Edition 2014
2. Modern Engineering Physics - A. S. Vasudeva, S. Chand, Revised Edition 2013
3. Engineering Physics D. K Bhattacharya, Poonam Tandon, Oxford Higher Education, 1st Edition 2015
4. Engineering Physics -R. K. Gaur, S. L. Gupta, Dhanpat Rai Publications, 2012
5. Engineering Physics -V. Rajendran, McGraw Hill Educations, 2017
6. A Textbook of Nanoscience and Nanotechnology, T. Pradeep Tata McGraw Hill Education Pvt. Ltd., 2012.

Reference books:

1. Semiconductor Physics and Devices – Basic Principles – Donald Neamen – McGraw Hill
2. Fundamentals of optics - Francis A. Jenkins, Harvey E. White, McGraw Hill Publication, India, 4th Edition
3. Fundamentals of Physics, Halliday and Resnick, Wiley publication
4. Concepts of Modern Physics – Arther Beiser, Shobhit Mahajan, S. Choudhury, McGraw Hill, 7th Edition 2017

Online References:

1. https://onlinecourses.nptel.ac.in/noc23_ee95/preview
2. <https://archive.nptel.ac.in/courses/115/102/115102124>
3. <https://archive.nptel.ac.in/courses/115/102/115102025>

Course Assessment:

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

MSE: To be conducted as 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. All questions are compulsory.
2. Question paper will comprise **3** questions, question 1 & 3 carrying 20 marks, and question No. 2 carrying 40 marks.
3. Each question will be based on the entire syllabus.

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
FEC2022	Applied Chemistry	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE ^s			
		ISE	MSE				
FEC2022	Applied Chemistry	20	20	60	--	--	100

Course Objectives:

1. To acquire knowledge about superconductors and nanomaterials.
2. To gain knowledge of polymers, conducting and bio-polymers.
3. To understand the concept of phase- rule in preparing alloys.
4. To understand the mechanism of corrosion and preventive methods.
5. To acquire knowledge of fuels, green fuels and batteries.
6. To learn the significance of composites and bio-composites.

Course Outcomes:

1. Understand the fundamentals of Superconductors and Nanomaterials for device applications.
2. Use of polymers for specific engineering applications based on their properties.
3. Interpret various phase transformations of alloy using thermodynamics.
4. Apply different methods to minimize corrosion in industries.
5. Comparing various energy sources, such as batteries, fuel cells, alternative fuels, and conventional fossil fuels, about their availability, operation, composition, performance efficiency, and environmental impact.
6. Identify different types of composite materials for engineering applications.

Module No.	Unit No.	Topics	Hrs.
1.0		Engineering Materials and Applications	08
	1.1	Superconductors: Types of superconductors, Properties of Superconductors.	
	1.2	Applications of superconductors. Preparation and Structure of 1:2:3 superconductor	
	1.3	Optical Fibers, Fullerenes, Organic Electronic Materials	
	1.4	Nanomaterials: A) Definition, Types of Nanostructured materials, Applications of Nanomaterials. B) Graphene	
	1.5	C) Types of Carbon Nanotubes (SWCNTs and MWCNTs) – Properties and Uses.	
2.0		Introduction to Polymers and Advanced Polymers	06
	2.1	A) Macro-molecular science, basic concept of polymers, Chemical bonding in polymers, Classification of Polymers.	
	2.2	B) Properties of Polymers: - i) Molecular weight -Number average molecular weight, Weight Average Molecular Weight, Numerical	

	2.3	ii) Crystallinity - Crystalline and amorphous polymers – Glass transition temperature. iii) Mechanical Properties: Hardness, tensile strength, creep, fatigue, impact resistance (introduction)	
	2.4	iv) Electrical properties: dielectric strength, insulation resistance, surface resistivity (Introduction), v) Optical properties: refractive index, transmittance, photoelectric property, color	
	2.5	Conducting polymers, Bio- polymers, Liquid crystal polymers, Intelligent (smart) polymers	
3.0		Alloys	06
	3.1	Introduction, Purpose of making alloys. i) Gibbs Phase rule – Statement, Terms involved with examples.	
	3.2	ii) Reduced phase rule, Two-component system (Pb Ag) & Numerical.	
	3.3	iii) Merits and Limitations of Phase rule.	
	3.4	Ferrous alloys – Plain-carbon steels, Heat and Shock resisting steels, Stainless steels. Effect of the alloying element- Ni, Cr, Co, Mn, Mo, W and V	
	3.5	Aluminum Alloys – Composition, properties and uses of i) Duralumin, ii) Magnalium.	
	3.6	Alloys of Pb – Composition, properties and Uses of i) Wood's metal ii) Tinman's solder.	
	3.7	Numerical based on Composition, density and weight of an alloy	
4.0		Corrosion	06
	4.1	A) Introduction: - Definition, Types of Corrosion –(i)Dry or Atmospheric Corrosion, ii) Wet or Electrochemical corrosion (In Acidic medium, In Neutral medium)	
	4.2	B) Factors affecting rate of corrosion: - i) Position of metal in galvanic series, ii) Purity of Metal, iii) Nature of Corrosion product, iv) Temperature, v) pH of medium, vi) concentration of medium, vii) moisture, viii) Relative Cathodic and Anodic area, ix) overvoltage	
	4.3	Methods to control corrosion: - i) Selection of metal, ii) Proper Designing, iii) Cathodic protection, iv) Use of Corrosion Inhibitors, v) Metallic Coating	
	4.4	Corrosion in Electronic devices	
5.0		Energy Sciences	08
	5.1	Definition and classification of fuels, Calorific value: Definition, Gross or Higher calorific value & Net or lower calorific value, Dulong's formula & numerical for calculations of Gross and Net calorific values.	
	5.2	Disadvantages of fossil fuels, Alternative (Green) Fuels: Biomass, Biogas, Natural Gas and CNG (Description, Utility, advantages and disadvantages)	
	5.3	Green Fuels- Synthesis and advantages of i] Biodiesel ii] Power Alcohol	
	5.4	Combustion- Calculations for requirement of only oxygen and air (by weight and by volume only) for given solid & gaseous fuels.	
	5.5	Batteries: Fuel Cell (H ₂ -O ₂ Fuel Cell), Solar Battery, Electrochemical Sensors.	
6.0		Composites	05
	6.1	Definition, Characteristics of Composites, Constituents of Composites – Matrix Phase and Dispersed Phase (Definition and Functions)	
	6.2	Classification of Composites	
	6.3	Types of Composites, sub-types and Applications: - i) Fibre- reinforced composites, ii) Layered composites (Laminates), iii) Particulate composites.	
	6.4	Bio-composites – Definition, Classification and Applications.	
		Total	39

Recommended Books:

1. Engineering Chemistry, Jain and Jain, Dhanpat Rai Publication
2. A textbook of Engineering Chemistry, S. S. Dara, S. Chand and Company
3. A Textbook of Engineering Chemistry, Shashi Chawla, Dhanpat Rai and Co.
4. Polymer science: Vasant Gowariker, Wiley Eastern Ltd, new Delhi

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 3 hours are of 80 marks and scaled to 60.

1. All questions are compulsory.
2. Question paper will comprise **3** questions, questions 1 & 3 carrying 20marks, and question No. 2 carrying 40 marks.
3. Each question will be based on the entire syllabus.

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
FEC203	Engineering Graphics	02	--	--	02	--	--	02

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE ^s			
		ISE	MSE				
FEC203	Engineering Graphics	15	15	45	--	--	75

Course Objectives:

1. To impart and inculcate proper understanding of the engineering curves
2. To impart the knowledge to read and interpret a drawing
3. To improve visualization skills.
4. To enable students to represent three-dimensional objects on a two-dimensional surface in a way that accurately conveys their shape, size, and orientation.
5. To acquaint students with representing internal features of a three-dimensional object by way of section that accurately conveys their internal orientation.
6. To improve visualization and draw an isometric object.

Course Outcomes:

After successful completion of the learner will be able to

1. Apply basic concepts of geometrical constructions to create engineering curves.
2. Apply the basic principles of projections in Projection of Lines and Planes
3. Apply the basic principles of projections in Projection of Solids.
4. Apply the basic principles of sectional views in Section of solids.
5. Apply the basic principles of projections in converting pictorial views into orthographic Views.
6. Apply the basic principles of projections in converting pictorial views into Isometric Views.

Module No.	Unit No.	Topics	Hrs.
1.0		Introduction to Engineering Graphics	02
	1.1	Introduction to Engineering Graphics and its significance in Engineering domain. Types of Lines, Dimensioning Systems as per IS convention. Introduction to plain and diagonal scales.	
	1.2	Engineering Curves: Basic construction of Cycloid, Involute.	
2.0		Projection of Points and Lines	03
	2.1	Points Projections of points in any quadrants and resting on planes.	
	2.2	Projections of Lines Projections of lines inclined to both the reference planes (Excluding Traces of lines). Simple application-based problems on projection of lines.	
3.0		Projection of Solids	05
	3.1	Projections of solids with the axis inclined to one and both reference planes. (Prism, pyramid, cylinder and cone only). Triangular to hexagonal prism and pyramids to be considered. Exclude Spheres, Composite, hollow solids and frustum of solids). Use change of position or Auxiliary plane method.	
4.0		Section of Solids	06

	4.1	Sections of Prism, Pyramid, Cylinder, & Cone cut by plane perpendicular to at least one reference plane (Exclude Curved Section Plane). Use change of position or Auxiliary plane method.	
5.0		Orthographic Projection	05
	5.1	Orthographic Projections Fundamentals of orthographic projections like concept of quadrants, observer position, horizontal, vertical and profile plane, symbol etc. Different orthographic views, First and Third angle method of projection. Views of a simple machine part as per the first angle projection method recommended by I.S.	
	5.2	Sectional Orthographic Projections Fundamentals of sectional projections like concept of section plane, its representation, section lines and its features, need of sectional views, rib and web in section. Types of section and its representation. Different views of a simple machine part as per the First angle projection.	
6.0		Isometric Projection	05
	6.1	Basic concept of isometric projection, Difference between isometric projection and isometric views. Conversion of Orthographic views to isometric views (Excluding sphere).	
		Total	26

Textbooks:

1. N.D. Bhatt, "Engineering Drawing (Plane and solid geometry)", Charotar Publishing House Pvt. Ltd.
2. N.D. Bhatt & V.M. Panchal, "Machine Drawing", Charotar Publishing House Pvt. Ltd.

References:

1. Narayana, K.L. & P Kannaiah (2008), Textbook on Engineering Drawing, Scitech Publisher.
2. Prof. Sham Tickoo (Purdue University) & Gaurav Verma, "(CAD Soft Technologies).
3. Auto CAD 2012 (For engineers and Designers)", Dreamtech Press New Delhi.
4. Dhananjay A Jolhe, "Engineering Drawing" Tata McGraw Hill.

Online References:

1. <https://archive.nptel.ac.in/courses/112/105/112105294/>
2. <https://nptel.ac.in/courses/1121030193>
3. <https://archive.nptel.ac.in/courses/112/102/112102304/>

Course Assessment:

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

MSE: To be conducted as written examination for 15 marks (on 40% - 50% syllabus)

End Semester Examination:

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

1. All questions are compulsory.
2. Question paper will comprise 4 questions, question 1, 3 & 4 carrying 10 marks and question No.2 carrying 30 marks.
3. Each question will be based on the entire syllabus.

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
FEC204	Digital System Design	03	-	-	03	-	-	03

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE ^s			
		ISE	MSE				
FEC204	Digital System Design	20	20	60	--	--	100

Course Objectives:

1. To understand number system representations and their inter-conversions utilized in digital electronic circuits.
2. To understand Boolean algebra, its simplification techniques, and the design of logic circuits using basic and universal gates.
3. To evaluate digital logic processes and implement logical operations using combinational logic circuits.
4. To analyze, design and implement logical operations using sequential logic circuits.
5. To apply Moore and Mealy state machine concepts and design practical sequential circuits.
6. To understand memory types and programmable logic devices.

Course Outcomes:

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

1. Explain digital systems, perform number system conversions, and apply binary arithmetic and coding techniques.
2. Simplify Boolean expressions and design logic circuits using various logic gates, including NAND and NOR.
3. Analyze Boolean expressions and design combinational logic circuits.
4. Design and implement various flip-flops, counters, shift registers, and sequential logic circuits.
5. Differentiate between state machine types and design functional sequential circuits.
6. Distinguish memories and programmable logic devices.

Module No.	Unit No.	Topics	Hrs.
1.0		Introduction to Digital Systems	06
	1.1	Introduction: Overview of Digital Systems, Importance in modern technology, Analog vs. Digital Systems, Examples of analog and digital systems.	
	1.2	Fundamental Concepts and Logic: Binary, Octal, Decimal, Hexadecimal Number Systems, their inter-conversion, Binary Arithmetic operations, Codes: Grey, BCD, Excess-3, ASCII.	
2.0		Logic Gates and Boolean Algebra	05
	2.1	Logic Gates: Basic Logic and Universal Gates (AND, OR, NOT, NAND, NOR XOR, XNOR), Realization using NAND and NOR gates.	
	2.2	Boolean Algebra: Boolean Algebra Rules and Simplification Techniques, De Morgan's Theorem.	

3.0		Combinational Logic	10
3.0	3.1	Boolean Expression Minimization: Sum of Products (SOP) and Products of Sum (POS), minimization with Karnaugh Map (up to four variables).	
	3.2	Arithmetic Circuits: Half adder, Full adder, Half Subtractor, Full Subtractor, Multiplexer, Demultiplexer, Decoder, Encoder, Comparator (2 bit).	
4.0		Sequential Logic	10
	4.1	Flip flops: SR, JK, Master-slave flip flops, T & D flip flops, Conversion of flip flops.	
	4.2	Counters and Registers: Asynchronous and Synchronous counters with State transition diagram, Up/Down, BCD Counter, Introduction to Shift Registers.	
5.0		Sequential Logic Design	04
	5.1	Introduction: Introduction to Moore and Mealy circuits, Clocked synchronous state machine analysis, State reduction techniques (inspection, partition and implication chart method) and state assignment.	
	5.2	Application of Sequential circuit: Sequence detector, Clocked synchronous state machine design.	
6.0		Different Types of Memories and Programmable Logic Devices	04
	6.1	Memory Types: Classification and Characteristics of memory, SRAM, DRAM, ROM, PROM, EPROM and Flash memories.	
	6.2	Introduction to PLD: Programmable Logic Devices (PLD), Programmable Logic Array (PLA), Programmable Array Logic (PAL).	
		Total	39

Textbooks:

1. R. P. Jain, "Modern Digital Electronic", McGraw-Hill Publication, 4th Edition.
2. John F. Wakerly, "Digital Design Principles And Practices", Pearson Education.
3. M. Morris Mano, "Digital Logic and Computer Design", PHI.

Reference books:

1. Malvino, "Digital computer Electronics", McGraw-Hill Publication, 3rd Edition.
2. A. Anand Kumar, "Fundamentals of Digital Circuits", PHI, Fourth Edition (2016).
3. Digital Logic Applications and Design – John M. Yarbrough, Thomson Publications, 2006

Online References:

1. [Course: Digital Circuits By Prof. Santanu Chattopadhyay \(IIT Kharagpur\);
https://swayam.gov.in/nd1_noc20_ee70/preview](https://swayam.gov.in/nd1_noc20_ee70/preview)
2. <https://www.coursera.org/learn/digital-systems>
3. <https://www.udemy.com/share/104ruW/>

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 3 hours are of 80 marks and scaled to 60.

- 1 All questions are compulsory.
2. Question paper will comprise 3 questions, questions 1 & 3 carrying 20 marks, and question No. 2 carrying 40 marks.
3. Each question will be based on the entire syllabus.

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
FEC205	Professional Communication Techniques	02	--	--	02	--	--	02

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE ^s			
		ISE	MSE				
FEC205	Professional Communication Techniques	15	15	45	--	--	75

Course Objectives:

1. To develop effective communication skills by introducing the basic communication process and its applications.
2. To inculcate effective listening, speaking, reading and writing skills for professional competency.
3. To improve students' linguistic abilities by strengthening vocabulary and grammar proficiency
4. To inculcate reading and writing ability through comprehension of given passage, summarization of technical text and paragraph composition.
5. To train the students in drafting effective business letters and emails for professional correspondence.
6. To create proficiency in technical writing to successfully execute professional responsibilities.

Course Outcomes:

At the end of the course the students will be able to:

1. Exhibit proficiency in identifying and applying core communication principles and overcoming communication barriers.
2. Display improved language skills across listening, speaking, reading, and writing for professional competency
3. Demonstrate enriched vocabulary and proficient grammar usage.
4. Proficiently summarize texts, paraphrase content accurately, and apply appropriate referencing styles while avoiding plagiarism.
5. Draft clear and effective business letters and emails using established correspondence principles.
6. Create accurate technical descriptions and user instructions.

Module No.	Unit No.	Topics	Hrs.
1.0		Fundamentals of Communication	08
	1.1	Introduction - Definition, Objectives – Primary & Secondary Objectives	
	1.2	The Process of Communication	
	1.3	Organizational Communication, Formal (Upward, Downward and Horizontal),	
	1.4	Informal Communication (Grapevine)	
	1.5	Methods of Communication, Verbal (Oral & Written)	

	1.6	Non-verbal, Non-verbal cues perceived through the five senses: (Visual, Auditory, Tactile, Olfactory and Gustatory cues), Non-verbal cues transmitted through the use of: (The Body, Voice, Space, Time and Silence)	
	1.7	Barriers to Communication - Psychological, Semantic/Linguistic barriers	
	1.8	Barriers to Communication – Socio-Cultural, Physical, Mechanical barriers	
2.0		LSRW – Developing Listening, Speaking, Reading, Writing	04
	2.1	Introduction to Active Listening Skills – Hearing vs Listening, Types of Listening, barriers to listening, strategies to improve listening	
	2.2	Effective Speaking Skills – Advantages of Speaking, Characteristics of effective speaking, Different types of speaking – Monologues, conversational, public speaking, extempore.	
	2.3	Techniques to improve Reading skills – Introduction, advantages of reading, Types of reading techniques: intensive, extensive, Skimming, Scanning, Methods – SQ3R (Survey, question, Read, Recite, and Review)	
	2.4	Effective Writing techniques – Introduction, Advantages, features of effective writing skills, strategies to improve writing	
3.0		Language Skills – Grammar & Vocabulary, Verbal Aptitude	03
	3.1	Vocabulary Building, Root words (Etymology), Meaning of Words in Context, Synonyms & Antonyms, Collocations, Word Form Charts, Prefixes & Suffixes, Standard Abbreviations	
	3.2	Grammar - To enhance students' linguistic abilities by focusing on listening, speaking, reading, and writing skills, as well as vocabulary and grammar proficiency., Tautologies, Pleonasms (Redundancies), Idioms, Clichés	
	3.3	Improving Verbal Ability through Verbal Aptitude test for Competitive Exams	
4.0		Comprehension, Summarization, Paragraph Writing	03
	4.1	Introduction to Reading with good Comprehension -Comprehending Technical/Non-technical Passages, Identifying the Central Idea	
	4.2	Summarization of passages, reports, chapters, books. Graphic Organizers for Summaries - Radial Diagrams like Mind Maps, Flowcharts, Tree Diagrams, Cyclic Diagrams. Linear Diagrams like Timelines, Pyramids, Venn Diagrams, Point-form Summaries, One-sentence Summaries of Central Idea	
	4.3	Paragraph - Structure of a Paragraph, Paragraph Development	
5.0		Business Correspondence	05
	5.1	Principles - Seven Cs of Business Correspondence, Completeness, Conciseness, Consideration, Concreteness, Clarity, Courtesy, Correctness	
	5.2	Parts of a Formal Letter: Letterheads and/or Sender's Address, Dateline, Inside Address, Reference Line (Optional), Attention Line (Optional), Salutation, Subject Line, Body, Complimentary Close, Signature Block, Enclosures/Attachments	
	5.3	Format: Complete/Full Block Format	
	5.4	Emails, Format of Emails, Features of Effective Emails, Language and style of emails.	
	5.5	Types of Correspondence: Claim and Adjustment, Request/Permissions and Sales Correspondence	
6.0		Technical Writing	03
	6.1	Introduction, what is Technical Writing? , Importance and Principles of Technical Writing, Difference between Technical Writing & Literary Writing, Framing Definitions,	

	6.2	Types of Expositions: Object / Process Description	
	6.3	Writing Instructions, Hazard Notations Difference between Technical Description & Instructions	
		Total	
			26

Reference Books:

1. Sanjay Kumar Pushp Lata: Communication Skills: Second Edition: Oxford Publication
2. Rizvi Ashraf: Effective Technical Communication: Tata Mc Graw-Hill
3. Sharma R.C Mohan Krishna: Business Communication and Report Writing: Tata McGraw-Hill
4. Geoffrey Leech: English Grammar for Today: Palgrave, UK
5. Norman Lewis: Word Power Made Easy: Anchor Books, New York
6. Raman Meenakshi and Sharma Sangeeta: Communication Skills: Oxford University Press
7. Mark Innoston: Professional English in Use-Engineering: Technical English for Professionals: Cambridge
8. English Grammar by Raymond Murphy
9. Rizvi Ashraf: Effective Technical Communication: Tata Mc Graw-Hill
10. Chaturvedi and Chaturvedi: Business Communication: Pearson Education

Course Assessment:

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

MSE: To be conducted as written examination for 15 marks (on 40% - 50% syllabus)

End Semester Examination:

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

1. All questions are compulsory.
2. Question paper will comprise 3 questions, questions 1 & 3 carrying 15 marks, and question No. 2 carrying 30 marks.
3. Each question will be based on the entire syllabus.

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
FEL2011	Applied Physics Lab	--	01	--	--	0.5	--	0.5

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE			
		ISE	MSE				
FEL2011	Applied Physics Lab	--	--	--	25	--	25

Lab Objectives:

1. To develop scientific understanding of physics concepts
2. To develop the ability to explain the processes and applications related to science subjects
3. To apply skills and knowledge in real life situation
4. To improve the knowledge about the theory concepts of Physics learned in the class
5. To improve the ability to analyze experimental result and write laboratory report
6. To develop understanding about inferring and predicting

Lab Outcomes: Learners will be able to

1. Determine parameters such as numerical aperture / power attenuation of an optical fibre
2. Determine wavelength / divergence of laser beam
3. Perform experiments based on interference in thin film and determine radius of curvature of lens / diameter of wire / thickness of paper
4. Calculate basic parameters / constants using semiconductors
5. Use various sensors such as optical, resistive and piezoelectric
6. Demonstrate the concept for virtual lab and simulation Experiments

List of Experiments (Minimum five experiment required)

Sr. No.	Title of the Experiment
1	Determination of numerical aperture of an optical fiber
2	Determine the divergence of laser beam
3	Determination of radius of curvature of a lens using Newton's ring set up.
4	Determination of diameter of wire/hair or thickness of paper using wedge shape film method
5	Determination of Hall Coefficient using Hall Effect phenomenon
6	Determination of wavelength using Diffraction grating. (Laser source)
7	Determination of Planck's constant using photocell
8	Determine UDM parameters
9	Study of colour sensor
10	Simulation experiments based on nanotechnology using open-source Simulation
11	Measuring optical power attenuation in plastic optical fiber
12	I-V characteristics of PN junction diode/Zener diode/photo diode
13	Study of the characteristics of Resistance Temperature Detector (RTD)/optical sensors

Term Work:

Term work shall consist of at least 5-6 practical based on the above list. Further, term work journal must include at least 2 assignments. 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)

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
FEL2012	Applied Chemistry Lab	--	01	--	--	0.5	--	0.5

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE			
		ISE	MSE				
FEL2012	Applied Chemistry Lab	--	--	--	25	--	25

Lab Objective:

1. To apply knowledge of quantitative analysis to determine the quality of coal.
2. To analyze experimental results and write laboratory report.
3. To learn about properties of oil to prevent corrosion.
4. To know the significance of viscosity.
5. To understand the significance of pH.
6. To learn to synthesize man-made polymers.

Lab Outcomes: After completion of experiment, the learners will be able to:

1. Understand the significance of proximate analysis of coal and determine quality of coal sample.
2. Learn various quantitative analytical techniques to determine % of elements from alloy samples.
3. Understand the significance of various properties of oil to prevent corrosion.
4. Understand the properties of lubricants and their variation with temperature using Redwood/ Abel's apparatus.
5. Apply knowledge of various quantitative analytical techniques to determine metal ion concentration/ pH
6. Synthesize UF/PF resin at laboratory level/Virtual lab.

Exp. No.	List of Experiments
1.	Determination of Moisture Content in Coal
2.	Determination of Ash Content in Coal
3.	Determination of Zn in Brass
4.	Estimation of Cu in Brass
5.	Determination of Acid Value of Oil
6.	Determination of Saponification Value of oil
7.	Determination of Viscosity of oil by Redwood Viscometer
8.	Determination of Flash point of lubricating oil using Abel's apparatus.
9.	Determination of metal ion concentration using Calorimeter.
10.	Determination of free acid (pH) of acid solution.
11.	Synthesis of Phenol- formaldehyde
12.	Synthesis of Urea- formaldehyde

Term Work:

Term Work shall consist of at least 5 to 6 practical based on the above list. Also, Term work Journal must include at least 2 assignments. Term work will be assessed as Continuous Internal Assessment Practical (CIAP). 25 Marks: 15 Marks for Experiment + 5 Marks for Assignments and 5 Marks for Attendance

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
FEL202	Engineering Graphics Lab	--	02	--	--	01	--	01

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE			
		ISE	MSE				
FEL202	Engineering Graphics Lab	--	--	--	25	25	50

Lab Objective:

1. To impart and inculcate proper understanding of the theory of projection.
2. To impart the knowledge to read and interpret a drawing
3. To improve visualization skills.
4. To enable students to represent three-dimensional objects on a two-dimensional surface in a way that accurately conveys their shape, size, and orientation.
5. To acquaint students with representing internal features of a three-dimensional object by way of a section that accurately conveys their internal orientation.
6. To impart basic AutoCAD skills.

Lab Outcomes: Learners will be able to

1. Apply basic AutoCAD Commands to draw two-dimensional object
2. Apply the basic principles of projections in projection of basic geometric objects.
3. Apply the basic principles of projections in projection of regular solid objects.
4. Apply the basic principles of projections in converting orthographic views.
5. Apply the basic principles of projections in converting sectional orthographic views
6. Apply the basic principles of projections in converting Isometric views

Online Resource:

1. <https://archive.nptel.ac.in/courses/112/105/112105294/>
2. <https://nptel.ac.in/courses/112103019>
3. <https://archive.nptel.ac.in/courses/112/102/112102304/>

List of Experiment:

1. Drawing basic geometrical objects using Auto CAD such as Square, Hexagon, Rectangle etc.
2. Orthographic Projections model 1 Using Auto CAD.
3. Orthographic Projections model 2 Using Auto CAD.
4. Sectional Orthographic Projections model 1 Using Auto CAD.
5. Sectional Orthographic Projections model 2 Using Auto CAD.
6. Sectional Orthographic Projections model 3 Using Auto CAD.
7. Isometric Views model 1 Using Auto CAD.
8. Isometric Views model 2 Using Auto CAD.
9. Isometric Views model 3 Using Auto CAD.
10. Projection of solids (Prism and Pyramid only) model 1 Using Auto CAD.
11. Projection of solids (Prism and Pyramid only) model 2 Using Auto CAD.

(Laboratory work should contain any 6 experiments out of 11 experiments and all printouts to be taken in the CAD Laboratory. Preferably, use A4 size sheets for print out.)

Assessment

Term Work: Term Work shall consist of all the above-mentioned practical. Term work will also include the **A3 size sketch book**. Problems taught in theory class in A3 size sketch book may be considered for term work. Alternatively, subject teachers may give problems on each topic to be solved by students as home assignments in the same **A3 size sketch book**. Term work will be assessed as Continuous Internal Assessment Practical (CIAP).

A) Term Work Marks: 25 Marks

1. Assignments [A3 Size Sketchbook] = 10 Marks
2. CAD printout = 10 Marks
3. Attendance = 5 Marks

B) Practical Exam: (2 hours/ 25 Marks)

End semester Practical exam will be held using CAD software only and will be conducted as End Semester Examination Practical (ESEP). **This exam will be based on the following syllabus.**

1. Isometric projections. (One Problem, Compulsory)
2. Orthographic Projection (One Problem) OR
3. Sectional Orthographic Projection (One problem)

Note:

1. The examiners may decide the weightage of the questions asked in the practical exam.
2. Printout of the answers must be taken preferably in A4 size sheets and should be assessed by external examiner only.
3. Knowledge of AutoCAD software, concepts of Engineering Graphics related to specified problem and accuracy of drawing should be considered during evaluation.

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
FEL203	Digital System Design Lab	--	02	--	--	01	-	01

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE			
		ISE	MSE				
FEL203	Digital System Design Lab	--	--	--	25	25	50

Pre-requisite:

1. Knowledge of Basic Electrical & Electronics Engineering (FEC103).

Lab Objectives:

1. To verify the truth table of various logic gates using ICs.
2. To simplify Boolean algebraic expressions using Boolean laws.
3. To realize logic gates using universal gates.
4. To implement digital circuits for various arithmetic operations, logical functions, and code conversions.
5. To design and simulate combinational logic circuits.
6. To design and simulate sequential logic circuits.

Lab Outcomes:

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

1. Verify truth tables for various logic gates using ICs.
2. Realize logic expressions using basic and universal logic gates.
3. Construct and validate logic gates using universal gates.
4. Design and implement digital circuits for performing various arithmetic operations, logical functions, and code conversions.
5. Design and simulate combinational logic circuits using appropriate tools and techniques.
Design and simulate sequential logic circuits effectively.

Suggested List of Experiments:	
Sr. No.	Title of Experiments
1	To verify the truth table of various logic gates using ICs.
2	To implement Boolean function in SOP and POS form.
3	To realize the gates using universal gates.
4	Implement digital circuits to perform Binary to Gray and Gray to Binary operations.
5	To realize half adder and full adder.
6	Design and implement BCD adder using 4-bit Binary Adder IC-7483.
7	To implement logic operation using MUX/Demux.
8	Design and implement 2-bit Comparator.
9	Study of flip flop IC.
10	Flip-flop conversions JK to D, JK to T and D to TFF.
11	Design and implement Up/Down counter.
12	Design and implement shift register using flip flop.

13	Verify encoder and decoder operations.
14	Design of synchronous/asynchronous counter.
15	To implement universal shift register using IC 74194

Online Resources:

1. <http://vlabs.iitkgp.ernet.in/coa/#>
2. <https://circuitverse.org/simulator>
3. <http://www.cburch.com/logisim/>

Term Work:

The term work should include 10 experiments: 6 hardware experiments, and 4 using simulators or virtual labs. At least 02 assignments covering the entire syllabus must be given on the content of theory and practicals of “Digital System Design”. 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
FEL204	Professional Communication Techniques Lab	--	01	--	--	0.5	--	0.5

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE			
		ISE	MSE				
FEL204	Professional Communication Techniques Lab	--	--	--	25	--	25

Lab Objective:

The learners should be able to

1. Skilfully assess communication dynamics and manoeuvre in professional environments
2. Gain proficiency in active listening by understanding a variety of Speech Acts
3. Evaluate the audience's goal, and communication obstacles critically to speak effectively.
4. Thoroughly understand complex documents, both technical and non-technical, for effective comprehension and summarisation.
5. Use technical writing skills for professional transactions to efficiently arrange and produce relevant content.
6. Compose a paragraph with techniques of unity coherence and development.

Lab Outcomes:

Learner will be able to

1. Utilise the knowledge of communication dynamics to successfully navigate work environments.
2. Use active listening techniques to understand others' perspectives.
3. Examine various obstacles to communication, the target audience, and the purpose to communicate, as a professional speaker.
4. Comprehend and summarise complex technical and non-technical writings to carry out professional responsibilities.
5. Compose technically proficient content for business correspondence.
6. Identify the key parts and develop a paragraph efficiently with supporting details and conclusion.

Sr. No.	Details of Activities
1.	Grammar, Vocabulary & Verbal Aptitude Grammar & Vocabulary Practice Worksheet. Online MCQ testing basic grammar skills, vocabulary - based on competitive exams format.
2.	Reading Comprehension and summarization Comprehension passages followed by questions for reading practice. To be assigned from competitive exam formats
3.	Reading Short stories and writing a review of the story Reading and critical analysis of stories from the short story collection of Indian authors like R.K. Narayan, Ruskin Bond, Sudha Murthy, Aesop Fables, Panchatantra, etc.
4.	Public Speaking Students to prepare a speech of 2 minutes on a topic of their choice. To be delivered during tutorial hour.
5.	Extempore Speech Simple topics based on day-to-day life experiences or current events will be given - 05 minutes preparation time before the speech. To be delivered during tutorial hour.

6.	Listening Exercise Listening tests to be conducted during tutorial - from IELTS/TOEFL, other language proficiency exams.
7.	Summarization Summarising the given passage - text to text, text to graphic and graphic to text
8.	Creative Writing Paragraph Writing - Identify the central idea, understanding author's point of view, structure of a paragraph and paragraph development
9.	Business Correspondence Exercises based on Language and style, Principles of Correspondence. Writing different types of letters and emails
10.	Basic Technical Writing Vocabulary exercises. Writing Technical Definition, Description of objects/processes and Instruction

List of Assignments:

1. Draft of Public Speech
2. Theory of Communication
3. Summarization and Comprehension
4. Listening Exercise
5. Business Correspondence
6. Basic Technical Writing

Term Work:

At least 06 assignments covering the entire syllabus must be given during the "Batch Wise Practical". The assignments should be students' centric, and an attempt should be made to make assignments more meaningful, interesting and innovative.

Term work assessment must be based on the student's overall performance with every assignment graded sometimes. The grades will be converted to marks as per "Credit and Grading System" manual and should be added and averaged. Based on the above scheme grading and term work assessment should be done.

Assessment:

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

The distribution of marks for term work shall be as follows:

- | | | |
|----------------|---|----------|
| 1. Assignments | : | 20 marks |
| 2. Attendance | : | 05 marks |

Online Resources:

1. <https://ielts.org>
2. <https://www.ets.org/toefl.html>
3. <https://www.britishcouncil.in/>
4. <https://www.cambridgeenglish.org/test-your-english/>
5. https://onlinecourses.swayam2.ac.in/cec22_cm03/preview

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
FEL205	Object Oriented Programming Methodology Lab	--	2*+2	--	--	02	--	02
* Theory class to be conducted for full class								

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE			
		ISE	MSE				
FEL205	Object Oriented Programming Methodology Lab	--	--	--	25	25	50

Lab Objectives:

The learners should be able to

1. To learn the basic concepts of object-oriented programming
2. To study JAVA programming language
3. To study various concepts of Object Oriented programming like Inheritance , polymorphism and packages, etc.
4. To study concepts of Runtime Error using Exception Handling
5. To Study the concepts of Multithreading
6. To explain components of GUI based programming

Lab Outcomes: At the end of the course, the students should be able to

1. Apply fundamental object oriented programming constructs
2. Illustrate the concept of packages, classes and objects.
3. Elaborate the concept of strings, arrays and vectors
4. Implement the concept of inheritance and interfaces
5. Implement the concept of exception handling and multithreading
6. Develop GUI based application using AWT

Module		Detailed Content	Hours
1		Introduction to Object Oriented Programming	02
	1.1	OOP concepts: Objects, class, Encapsulation, Abstraction, Inheritance, Polymorphism, message passing	
	1.2	Java Virtual Machine, JIT, Bytecode	
	1.3	Basic programming constructs: variables, data types, operators, unsigned right shift operator, expressions, branching and looping	
2		Class, Object, Packages and Input/output Classes	05
	2.1	Class, object, data members, member functions, this keyword, Access modifiers, Constructors and its types, static members and static functions, Method overloading Packages in java, user defined packages, Input and output classes and functions in Java like Buffered Reader class, Scanner class	
3		Array, String and Vector	03
	3.1	Array, 1D-array, 2D-array, String class, String Buffer class and functions, Vector class and its functions	
4		Inheritance, Polymorphism and Abstraction	04
	4.1	Types of inheritance, Method overriding, super keyword, abstract class and abstract method, final keyword, final class and method, Multiple inheritance using interface, extended interfaces	
5		Exception handling and Multithreading	05
	5.1	Exception handling using try, catch, finally, throw and throws, Multiple try and catch blocks, user defined exception, Thread lifecycle, thread class methods, creating threads using Thread class and Runnable interface	
6		GUI programming in JAVA	07
	6.1	AWT: working with windows, using AWT controls for GUI design., Swing class introduction, Graphics class functions, Font and color class, Event handling classes and Listener interfaces, Adapter Classes as Helper Classes in Event Handling. Introducing Swing: AWT vs Swings, Components and Containers, Swing Packages, A Simple SwingApplication, Painting in Swing, Designing Swing GUI Application using Buttons, JLabels, Checkboxes, Radio Buttons, JScrollPane, JList, JComboBox, Trees, TablesScroll pane Menus and Toolbar	

Textbooks:

1. Bjarne Stroustrup, "The C++ Programming language", Third edition, Pearson Education, 2000.
1. Deitel, "C++ How to Program", 4th Edition, Pearson Education, 2005.
3. D. T. Editorial Services, "Java 8 Programming Black Book", Dreamtech Press, Edition, 2015.
4. Yashwant Kanitkar, "Let Us Java", BPB Publications, 4nd Edition, 2019.

Reference Books:

1. Herbert Schidt, "The Complete Reference", Tata McGraw-Hill Publishing Company Limited, 10th Edition, 2017.
2. Harvey M. Deitel, Paul J. Deitel, Java: How to Program, 8th Edition, PHI, 2009.
3. Grady Booch, James Rumbaugh, Ivar Jacobson, "The Unified ModelingLanguageser Guide", Pearson Education.
4. Sachin Malhotra, Saurabh Chaudhary "Programming in Java", Oxford University Press, 2010

Software Tools:

1. Raptor-Flowchart Simulation: <http://raptor.martincarlisle.com/>
2. Eclipse: <https://eclipse.org/>
3. Netbeans: <https://netbeans.org/downloads/>
4. Code Block: <http://www.codeblocks.org/>
5. J-Edit/J-Editor/Blue J

Online Repository:

1. Google Drive 2. GitHub 3. Code Guru

Textbooks:

1. Herbert Schildt, 'JAVA: The Complete Reference', Ninth Edition, Oracle Press
2. E. Balagurusamy, 'Programming with Java', McGraw Hill Education.

Reference books:

1. Ivor Horton, "Beginning JAVA", Wiley India.
2. Dietal and Dietal, "Java: How to Program", 8th Edition, PHI .
3. "JAVA Programming", Black Book, Dreamtech Press.
4. "Learn to Master Java programming", Staredu solutions

Online Resources:

1. www.nptelvideos.in
2. www.w3schools.com
3. www.tutorialspoint.com
4. <https://starcertification.org/Certifications/Certificate/securejava>

Suggested List of Programming Assignments/laboratory Work:	
Sr. No.	Name of the Experiment
1	Programs on Basic programming constructs like branching and looping
2	Program on accepting input using Input-Output classes
3	Programs on class and objects
4	Program on method and constructor overloading.
5	Program on Packages
6	Program on 2D array, strings functions
7	Program on String Buffer and Vectors
8	Program on types of inheritance
9	Program on Multiple Inheritance
10	Program on abstract class and abstract methods.
11	Program using super and final keyword
12	Program on Exception handling
13	Program on user defined exception
14	Program on Multithreading
15	Program on Graphics class
16	Program to create GUI application
17	Mini Project based on the content of the syllabus (Group of 2-3 students)

Term Work:

- 1 Term work should consist of 15 experiments and Journal must include at least 2 assignments
- 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: 15-marks, Attendance: 05-marks, Mini Project:-5-marks)

Oral & Practical exam

Based on the entire syllabus of FEL 205: **Object Oriented Programming with JAVA** 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
FEL206	Engineering Workshop-II	--	02	--	--	01	--	01

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE			
		ISE	MSE				
FEL206	Engineering Workshop-II	--	--	--	25	--	25

Lab Objective:

1. To impart training to help the students develop engineering skill sets.
2. To inculcate respect for physical work and hard labor.
3. To get exposure to interdisciplinary engineering domain.
4. To get exposure to handle different tools.
5. To inculcate respect for hard labour.
6. To inculcate the habit working in team for common job/goal.

Lab Outcomes: Learners will be able to...

1. Develop the necessary skill required to handle/use different carpentry tools.
2. Identify and understand the safe practices to adopt in electrical environment.
3. Demonstrate the wiring practices for the connection of simple electrical load/ equipment.
4. Design, fabricate and assemble PCB.
5. Develop the necessary skill required to handle/use different masons' tools.
6. Develop the necessary skill required to use different sheet metal and brazing tools.
7. Able to demonstrate the operation, forging with the help of a simple job.

NOTE:

Trade 1 and 2 are compulsory.

Select any one - trade topics out of the topic trade 3 to 5.

Demonstrations and hands-on experience to be provided during the periods allotted for the same.

Report on the demonstration including suitable sketches is also to be included in the term work

CO-1 is related to Trade-1

CO-2 to CO-4 is related to Trade-2 CO-5 is related to Trade-3

CO-6 is related to Trade-4 CO-7 is related to Trade-5

CO evaluation is to be conducted based on the chosen trades as well as compulsory trades.

Trade	Topics	Hrs.
1.0	Carpentry [Compulsory]	12
	Use and setting of hand tools like hacksaws, jackplanes, chisels and gauges for construction of various joints, wood tuning and modern wood turning methods. Term work to include One carpentry job involving a joint and report on demonstration of a job involving wood turning	
2.0	Basic Electrical Workshop[Compulsory]	06

	Single phase and three-phase wiring. Familiarization. of protection switchgears and their ratings (fuse, MCB, ELCB). Wiring standards, Electrical safety in the work place safe work practices. Protective equipment, measures and tools. Layout drawing, layout transfer to PCB, etching and drilling and soldering technique.	
3.0	Mansory	06
	Use of mason's tools like trowels, hammer, spirit level, square, plumbline and pins etc. demonstration of mortar making, single and one and half brick masonry, English and Flemish bonds, block masonry, pointing and plastering.	
4.0	Sheet Metal Working and Brazing:	06
	Use of sheet metal, working hand tools, cutting, bending, spot welding	
5.0	Forging (Smithy):	06
	At least One Forging Job to be demonstrated and a simple job to be made for Term Work in a group of 4 students	

Textbooks:

1. Workshop Technology, Volume-I, P. N. Rao, McGraw Hill Publication
2. Elements of Workshop Technology, Vol-I, S. K. Hajra Choudhury, A K Hajra Choudhury, Nirjar Roy, Media Promoters & Publishers Pvt Ltd

Reference books

1. Workshop Technology, Part-II, WAJ Chapman, VIVA Books Pvt Ltd
2. A Course in Workshop Technology, B.S. Raghuvanshi, Dhanpat Rai and Co Ltd

Assessment:

Term Work: Term Work will encompass practical exercises covering at least three trades based on the list. Term work will be assessed as Continuous Internal Assessment Practical (CIAP).

Term Work Assessment: 25 Marks (Total marks) = 20 Marks (Workshop Experiment) + 5 Marks (Attendance)

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
FEL207	Indian Knowledge System (IKS)	--	2*+2	--	--	2	--	2

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE			
		ISE	MSE				
FEL207	Indian Knowledge System (IKS)	--	--	--	25	--	25

Course evaluation is activity based which may be an individual or group of students.

*Two hours of theory for whole class.

Rationale:

The Indian Knowledge System (IKS) is vital for preserving India's rich cultural heritage, fostering holistic and sustainable practices, and integrating ancient wisdom with modern science to address contemporary challenges and enrich global knowledge.

Course Objectives:

1. To explore and understand the evolution of Indian scientific thought
2. To evaluate the historical and modern educational systems in our country
3. To analyze sustainable practices in ancient India
4. To know the richness of Indian Arts and Culture
5. To understand the contributions of Indian Scientists and Nobel Laureates
6. To understand the principles of good governance

Course Outcomes:

1. Recognize the sources and concepts of the Indian knowledge system
2. Learn about our history of Indian ancient knowledge and its significance in the current scenario.
3. Demonstrate sustainable development in various fields like Science, Technology, agriculture, industry, architecture performing arts, etc.
4. Understand and appreciate the rich heritage that resides in literature
5. Learn about the ancient Bhartiya education system in comparison with the modern era
6. Showcase the multi-dimensional nature of IKS and its importance in modern society

Prerequisite:

3. Students should have the foundational knowledge and skills necessary for a comprehensive understanding of IKS
4. Students should be familiar with the Indian Culture, Language, and History of Science and Technology in India.

Module No.	Unit No.	Topics	Hrs.
1.0		Introduction to the Indian Knowledge System (I.K.S.)	03
	1.1	Introduction: Basic knowledge and scope of IKS, IKS in ancient India and modern India, Bhartiya education system – ancient to modern era, Sources of Education, Aim of Education, Curriculum, methods of learning	
	1.2	Educational Institutes, Higher Educational Institutions, Advantages and Disadvantages of the Gurukul System, Distinguish between the Gurukul system And the Modern Education System.	
2.0		Development of Scientific Thoughts in Ancient India	04
	2.1	Development in Science, Technology, Astronomy, Mathematics.	
	2.2	Development in Life Sciences – Life Science, Physiology, Ayurveda	
3.0		Development of Arts & Culture in India	05
	3.1	Introduction to Ancient Architecture (Arts, Forts, Paintings, Sculpture, Temple architecture, etc)	
	3.2	Development in performing arts & culture: Music, Art of singing, Art of dancing, Natyakala Cultural traditions and Folk arts.	
4.0		Good Governance in Ancient India	05
	4.1	Introduction to Indian religions, Moral and Ethical Governance, Vishva Kalyan through Vasudhaiva Kutumbkam	
	4.2	Principles of Good Governance about Ramayana, Mahabharat, Artha Sastra, Kautilyan State	
5.0		Contribution of Indian Scientist & Nobel Laureates	05
	5.1	Boudhayan, Aryabhatta, Brahmgupta, Bhaskaracharya, Varahamihira, Nagarjuna, Susruta, Kanada & Charak	
	5.2	Rabindranath Tagore, C.V. Raman, Har Gobind Khorana, Mother Teresa, Subrahmanyam Chandrasekhar, Amartya Sen, V.S. Naipaul, Venkatraman Ramakrishnan, Kailash Satyarthi and Abhijit Banerjee.	
6.0		Sustainable Practices in Ancient India	04
	6.1	Agriculture, waste management, water conservation, forest conservation, architecture, urban planning, biodiversity preservation, etc.	
	6.2	Yoga, pranayama, and meditation for health and well-being	
		Total	26

Textbooks:

1. A.K Bag, History of technology in India (Set 3 vol), Indian Nation Science Academy, 1997.
2. An Introduction to Indian Knowledge Systems: Concepts and Applications, B Mahadevan, V R Bhat, and Nagendra Pavana R N; 2022 (Prentice Hall of India).
3. Ancient Indian Knowledge: Implications To Education System, Boski Singh; 2019
4. India's Glorious Scientific Tradition by Suresh Soni; 2010 (Ocean Books Pvt. Ltd.)

5. Indian Art: Forms, Concerns, and Development in Historical Perspective (History of Science, Philosophy and Culture in Indian Civilization), General Editor: D.P. Chattopadhyaya, Ed. By. B.N. Goswamy; 1999 Munshiram Manoharlal Publishers Pvt. Ltd.
6. Indian Knowledge Systems: Vol I and II, Kapil Kapoor and A K Singh; 2005 (D.K. Print World Ltd).
7. Pandey, K.K. Kriya Sarira Comprehensive Human Physiology, Chaukhambha Sanskrit series, Varanasi, 2018
8. Shukla Vidyadhar & Tripathi Ravidatt, Aayurved ka Itihasevam Parichay, Chaukhambha Sanskrit Sansthaan, New Delhi, 2017
9. Textbook on The Knowledge System of Bharata by Bhag Chand Chauhan; 2023 (Garuda Prakashan) 6. Pride of India- A Glimpse of India's Scientific Heritage edited by Pradeep Kohle et al. Samskrit Bharati; 2006
10. Traditional Knowledge System in India, Amit Jha

Online References:

1. <https://swayam.gov.in/explorer?searchText=iks>
2. <https://iksindia.org/book-list.php>
3. <https://iksindia.org/index.php>

Assessment: Suggested Pedagogy and assessment criteria for Teachers:

1. Project-based activities.
2. Presentation, Group Discussions, and Case studies.
3. Visit historical places.
4. Flip class mode/ Roleplay
5. Quiz MCQ
6. Assignment as per the modules: 06
7. Internal Assessment through flipped class and PowerPoint presentation along with documentation

Sample Case Studies:

1. Mathematics of Madhava, Nilakantha Somayaji
2. Astronomical models of Aryabhata
3. Wootz steel, Aranumula Mirrors, and lost wax process for bronze castings
4. Foundational aspects of Ayurveda
5. Foundational aspects of Ashtanga yoga
6. Foundational aspects of Sangeeta and Natya-shastra

Term Work:

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

Term Work Assessment: 25 Marks (Total marks) = 10 Marks (Assignments) + 10 marks (Presentation/Group Discussion) + 05 Marks (Attendance)

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
AIMLC301	Applied Mathematics -III	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE ^s			
		ISE	MSE				
AIMLC301	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 plane.
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.	Topics	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 $\sin$, $\cos$, $\sin h$, $\cos h$, ≥ 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 Topics: 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 Topics: 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 2 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 Topics: 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 of $f(z)$ 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 Topics: 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 Topics: 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 Topics: 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 Education.
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
AIMLC302	Data Structure	03	-	-	03	-	-	03

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE ^s			
		ISE	MSE				
AIMLC302	Data Structure	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. PO4: Conduct investigation of complex problems
5. PO11: Life-long learning

Course Objectives:

1. To identify the need and significance of Data structures as a computer Professional.
2. To describe linear and nonlinear data structures.
3. To apply various operations on data structures and select the appropriate one to solve a specific real-world problem.
4. To analyze various techniques for representation of the data in the real world.
5. To understand various graph concepts.
6. To discuss arching and Hashing techniques

Course Outcomes: Learners will be able to

1. Illustrate linear and Non-Linear data structures.
2. Discuss operations on stack and queue.
3. Illustrate linked list data structures.
4. Apply operations like searching, insertion, deletion in the tree.
5. Analyze various operations of graph.
6. Apply various searching and hashing operation

Module No.	Unit No.	Topics	Hrs.	CO
1.0		Introduction to Data Structures	02	
	1.1	Introduction to Data Structures , Concept of ADT, Types of Data Structures-Linear and Nonlinear, Operations on Data Structures, Applications of Data Structures		CO1
2.0		Stack and Queues	08	
	2.1	Introduction, ADT of Stack, Operations on Stack, Array Implementation of Stack, Applications of Stack-Well form-ness of Parenthesis, Infix to Postfix, Conversion and Postfix Evaluation, Recursion.		CO2
	2.2	Introduction, ADT of Queue, Operations on Queue, Array Implementation of Queue, Types of Queue-Circular Queue, Priority Queue, introduction of Double Ended Queue, Applications of Queue.		
		Self-learning Topics: Multiple queues. Variants of recursion. Case study on priority management.		
3.0		Linked List	10	
	3.1	Introduction, Representation of Linked List, Linked List v/s Array, Types of Linked List - Singly Linked List, Circular Linked List, Doubly Linked List, Operations on Singly Linked List and Doubly Linked List, Stack and Queue using Singly Linked List, Singly Linked List Application-Polynomial Representation and Addition, Generalized linked list.		CO3
		Self-learning Topics: Case study on linked lists.		
4.0		Tree	11	
	4.1	Introduction, Tree Terminologies, Binary Tree, Binary Tree Representation, Types of Binary Tree, Binary Tree Traversals, Binary Search Tree, Operations on Binary Search Tree, Applications of Binary Tree-Expression Tree, Huffman Encoding Search Trees-AVL, rotations in AVL Tree, operations on AVL Tree, Introduction of B Tree, B+ Tree.		CO4
		Self-learning Topics: Case study on trees. Threaded binary trees.		
5.0		Graphs	04	
	5.1	Introduction, Graph Terminologies-Representation of Graph, Graph Traversals-Depth First Search (DFS) and Breadth First Search (BFS), Graph Application-Topological Sorting. Applications of graph.		CO5
		Self-learning Topics: Data structures for web graph and google map.		
6.0		Searching Techniques	04	
	6.1	Linear Search, Binary Search, Hashing-Concept, Hash Functions-		CO6

		division method, multiplication, mid-square and folding. Collision resolution Techniques-open addressing and chaining.		
		Self-learning Topics: Case study on hashing and collision		
		Total	39	

Textbooks:

1. Data Structures using C, Reema Thareja, 2nd Edition, 2014, Oxford Press.
2. Data Structures: A Pseudocode Approach with C, Richard F. Gilberg and Behrouz A. Forouzan, 2nd Edition, 2007, CENGAGE Learning.
3. Jean Paul Tremblay, P. G. Sorenson, "Introduction to Data Structure and Its Applications", McGraw-Hill Higher Education 2nd Edition.
4. Data Structures Using C, ISRD Group, 2nd Edition, Tata McGraw-Hill.

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. Data Structures Using C, Aaron M Tenenbaum, Yedidyah Langsam, Moshe J Augenstein, 1st Edition, 2019, Pearson Publication.

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

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
AIMLC303	Discrete Structure and Graph Theory	03	-	-	03	-	-	03

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE ^s			
		ISE	MSE				
AIMLC303	Discrete Structure and Graph Theory	20	20	60	--	--	100

Pre- requisite:

1. Basic Mathematics

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. Cultivate clear thinking and creative problem solving.
2. Thoroughly train in the construction and understanding of mathematical proofs. Exercise common mathematical arguments and proof strategies.
3. To apply graph theory in solving practical problems.
4. Thoroughly prepare for the mathematical aspects of other Computer Engineering courses.

Course Outcomes: Learners will be able to

1. Illustrate the notion of mathematical thinking, mathematical proofs and to apply them in problem solving.
2. Interpret the concept of relations, functions, Diagraph .
3. Identify and analyze chain, antichain and lattice in hasse diagram
4. Analyze a complex computing problem and apply principles of discrete mathematics to identify solutions.
5. Identify the use of groups and codes in Encoding-Decoding.
6. Apply concepts of graph theory in solving real world problems.

Module No.	Unit No.	Topics	Hrs.	CO
1.0		Logic	06	
	1.1	Propositional Logic, Predicate Logic, Laws of Logic, Quantifiers, Normal Forms, Inference Theory of Predicate Calculus, Mathematical Induction.		CO1
		Self-learning Topics: Truth table, Boolean algebra.		
2.0		Relations and Functions	06	
	2.1	Basic concepts of Set Theory, sets, Venn diagram, operation on sets, partition of set.		CO2
	2.2	Relations: Definition, Types of Relations, Representation of Relations, Closures of Relations, Warshall's algorithm, Equivalence relations and Equivalence Classes.		
	2.3	Functions: Definition, Types of functions, Composition of functions, Identity and Inverse function.		
		Self-learning Topics: Operation on relations.		
3.0		Posets and Lattice	05	
	3.1	Partial Order Relations, Poset, Hasse Diagram, Chain and Anti chains, Lattice, Types of Lattice, Sub lattice.		CO3
		Self-learning Topics: Types of Partial order relations.		
4.0		Permutation, Combination and Discrete Probability	08	
	4.1	The rules of Sum and Product, Counting principles.		CO4
	4.2	Recurrence relations, Solving recurrence relations, Random experiment; sample space; events; axioms of probability; conditional probability. Theorem of total probability; Bayes' theorem. Application to information theory and discrete probability, Markov chains and their applications.		
		Self-learning Topics: Permutation and combinations		
5.0		Algebraic Structures	08	
	5.1	Algebraic structures with one binary operation: Semi group, Monoid, Groups, Subgroups, Abelian Group, Cyclic group, Isomorphism.		CO5
	5.2	Algebraic structures with two binary operations: Ring.		
	5.3	Coding Theory: Coding, binary information and error detection, decoding and error correction.		
		Self-learning Topics: Types of Rings, cryptography.		
6.0		Graph Theory	06	
	6.1	Types of graphs, Graph Representation, Sub graphs, Operations on		CO6

		Graphs, Walk, Path, Circuit, Connected Graphs, Disconnected Graph, Components, Homomorphism and Isomorphism of Graphs, Euler and Hamiltonian Graphs, Planar Graph, Cut Set, Cut Vertex, graph coloring, graph travelers algorithm (BFS, DFS, Dijkstra's algorithm).		
		Self-learning Topics: Application of cut vertex and cut set vertex, application of graph theory.		
		Total	39	

Textbooks:

1. Bernad Kolman, Robert Busby, Sharon Cutler Ross, Nadeem-ur-Rehman, "Discrete Mathematical Structures", Edition 6, 2015, Pearson Education.
2. C. L. Liu "Elements of Discrete Mathematics", Fourth edition 2017, McGraw-Hill Book Company.
3. K. H. Rosen, "Discrete Mathematics and applications", Eight edition 2021, Tata McGraw Hill Publishing Company.

Reference books:

1. Y N Singh, "Discrete Mathematical Structures", First Edition 2016 Reprint, 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", Seventeenth Edition 2002, Tata McGraw Hill Publishing Company.
4. Narsing Deo, "Graph Theory with applications to engineering and computer science", First Edition 2004, PHI Publications.

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 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
AIMLC304	Database Management System	03	-	-	03	-	-	03

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE ^s			
		ISE	MSE				
AIMLC304	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.	Topics	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 Topics: 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 Topics: 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 Topics: 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 Topics: 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 Topics: 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: Introduction, Design Steps, Distributed databases: types, storage methods		CO6
		Self-learning Topics: 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
AIMLC305	Computer Organization and Architecture	02	-	-	02	-	-	02

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE ^s			
		ISE	MSE				
AIMLC305	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: Modern Tool Usage
5. PO6: The Engineer and Society
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: Learners will be able to

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.	Topics	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 Topics: 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 Topics: 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 architecture. 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 Topics: 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 Topics: 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 Topics: 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 Topics: 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 is of 60 marks and scaled to 45

1. Question paper will comprise of 3 questions.
2. Question 1 (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. Question 3 (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
AIMLC306	Engineering Economics	02	-	-	02	-	-	02

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE ^s			
		ISE	MSE				
AIMLC306	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

Course Outcomes: Learners will be able to

1. Define the basic concepts of micro and macroeconomics, engineering economics and their application in engineering economics.
2. Define and Explain the Concept of Market in the Modern Economy.
3. Evaluate the effects of changes in demand and supply on price determination of products and services.
4. Analyze the costs and benefits of various engineering solutions.
5. Develop the ability to account for time value of money using engineering economy factors and formulas.
6. Understand market dynamics and pricing strategies in different industrial sectors

Module No.	Unit No.	Topics	Hrs.	CO
1.0		Introduction to Economics	03	CO1
	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.		
		Self-Learning: Basic Economic Concepts: Cost, Benefit, Profit.		
2.0		Market and Government in Modern Economy	03	CO2
	2.1	Modern Economy - Market Definition, How market solve three economics problems, Trade, Money & Capital, The economic role of Government.		
		Self-Learning Market Economy vs. Planned Economy, The Role of Private vs. Public Sectors		
3.0		Supply, Demand and Product market	06	CO3
	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.		
	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	CO4
	4.1	Production - Production function, Laws of returns: Law of variable proportion, Law of returns to scale.		
	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 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 50 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
AIMLL301	Data Structure Lab	--	02	--	--	01	-	01

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE			
		ISE	MSE				
AIMLL301	Data Structure Lab	--	--	--	25	25	50

Pre-requisite:

1. FEL103- Knowledge of C programming

Program Outcomes Mapped:

1. PO1: Engineering Knowledge
2. PO2: Problem Analysis
3. PO3: Design and development of solutions
4. PO7: Ethics
5. PO11: Life-Long 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 develop application using data structure algorithms.
5. To prepare students in analysing different searching and hashing techniques.
6. To prepare students in applying linear and non-linear data structures for real world problems solving.

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. Select appropriate searching techniques for given problems.
5. Analyze different variations in linear data structures.
6. Analyze different variations in non-linear data structures.

Suggested Experiments: Students are required to complete at least 10 experiments.		
Star (*) marked experiments are compulsory.		
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	Applications of Stack ADT.	LO1, LO3
5*	Implement Linear Queue ADT using array.	LO1
6*	Implement Circular Queue ADT using array.	LO5
7	Implement Priority Queue ADT using array.	LO5
8	Implement Singly Linked List ADT.	LO2
9*	Implement Circular Linked List ADT.	LO5
10	Implement Doubly Linked List ADT.	LO5
11*	Implement Stack / Linear Queue ADT using Linked List.	LO1, LO2
12*	Implement Binary Search Tree ADT using Linked List.	LO2, LO6
13*	Implement Graph Traversal techniques a) Depth First Search b) Breadth First Search	LO2, LO6
14*	Applications of Binary Search Technique.	LO4
15	Quiz on lead code based on above experiments.	LO1-6

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

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.

Online Resources:

1. www.leetcode.com
2. www.hackerrank.com
3. www.cs.usfca.edu/~galles/visualization/Algorithms.html
4. www.codechef.com

Term Work:

Term work shall consist of at least 12 experiments (Ensure that all the LOs are covered.)

The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. Term work will be assessed as Continuous Internal Assessment Practical (CIAP).

Term work Marks:

- 25 Marks (Total Marks) = 20 Marks (Experiment) + 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
AIMLL302	Database Management System Lab	--	02	--	--	01	-	01

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE			
		ISE	MSE				
AIMLL302	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: Engineering Tool Usage
4. PO7: Ethics
5. PO8: Individual and Collaborative Team Work
6. PO9: Communication
7. PO11: Life-Long 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 Mapped
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:

Term work shall consist of at least 12 experiments (Ensure that all the LOs are covered.)

The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. Term work will be assessed as Continuous Internal Assessment Practical (CIAP).

Term work Marks:

- 25 Marks (Total Marks) = 20 Marks (Experiment) + 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
AIMLL303	Computer Organization and Architecture Lab	--	02	--	--	01	--	01

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE			
		ISE	MSE				
AIMLL303	Computer Organization and Architecture Lab	--	--	--	25	--	25

Pre-requisite:

1. FEL203 -Digital System Design Lab

Program Outcomes Addressed:

1. PO1: Engineering Knowledge
2. PO2: Problem Analysis
3. PO3: Design/Development of Solutions
4. PO5: Modern Tool Usage
5. 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
2. /non-restoring division algorithms using assembly language. 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
Sr. No.	Title of Experiments	
1	To implement Booth's algorithm.	L01
2	To implement restoring division algorithm.	L01
3	To implement non restoring division algorithm.	L01
4	To implement ALU design using simulator.	L02
5	To implement memory design using simulator.	L02
6	To implement cache memory design using simulator.	L02
7	Use of programming tools (8086kit/ Emulator 8086) to perform basic arithmetic operations on 8-bit data.	L03
8	Use of programming tools (8086kit/ Emulator 8086) to perform basic arithmetic operations on 16-bit data.	L03
9	Code conversion (Hex to BCD and BCD to Hex)/ (ASCII to BCD and BCD to ASCII) using 8086.	L04
10	To transfer a block of data using 8086.	L04
11	Assembly program to find the GCD/ LCM of two numbers.	L04
12	Assembly program to sort numbers in ascending/ descending order.	L05
13	Assembly program to find minimum/ maximum number from a given array.	L05
14	Calculate the factorial of a given number using 8086.	L04
15	Program for interfacing 8355 for Read/Write operation/ Square wave generation.	L06

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:

Term work shall consist of at least 12 experiments (Ensure that all the LOs are covered.)

The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. Term work will be assessed as Continuous Internal Assessment Practical (CIAP).

Term work Marks:

- 25 Marks (Total Marks) = 20 Marks (Experiment) + 05 Marks (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
AIMLL304	Skill Lab (Python Programming)	--	2*+2	--	--	02	-	02

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE			
		ISE	MSE				
AIMLL304	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 investigations of complex problems
5. PO5: Engineering Tool Usage
6. PO6: The Engineer & The World
7. PO7: Ethics
8. PO8: Individual & Collaborative Team work
9. PO9: Communication
10. PO10: Project Management & 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

0		Knowledge of some programming language like C, Java.	01	LO
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-study topics: 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-study topics: 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-study topics: 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-study topics: 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-study topics: 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-study topics: Creating array views copies, Aggregating, Merge Data Frames, Interactive Visualization with Plotly.		
			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 a. Python program to append data to existing file and then display the entire file b. Python program to count number of lines, words and characters in a file. c. 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	a. Creating GUI with python containing widgets such as labels, textbox, radio, checkboxes and custom dialog boxes. b. 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 <code>groupby ()</code> 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:

Term work shall consist of at least 12 experiments (Ensure that all the LOs are covered.)

The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. Term work will be assessed as Continuous Internal Assessment Practical (CIAP).

Term work Marks:

- 25 Marks (Total Marks) = 20 Marks (Experiment) + 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
AIMLM301	Mini Project 1 A	--	02 [#]	--	--	01	-	01

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE			
		ISE	MSE				
AIMLM301	Mini Project 1 A	--	--	--	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 & The World
7. PO7: Ethics
8. PO8: Individual & 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.

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
AIMLC401	Applied Mathematics-IV	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE			
		ISE	MSE				
AIMLC401	Applied Mathematics-IV	20	20	60	--	--	100

Pre-requisite:

1. FEC101- Applied Mathematics-I
2. FEC102- Applied Mathematics-II
3. AIMLC301- Applied Mathematics-III

Program Outcomes addressed:

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

Course Objectives:

1. To evaluate eigenvalues and eigenvectors and apply them to solve systems of linear equations and matrix diagonalization.
2. To evaluate line and contour integrals and construct the power series expansion of a complex-valued function.
3. To understand the concepts of probability distributions and sampling theory for small samples.
4. To apply the sampling theory on small dataset for analysis.
5. To understand the concepts of non-parametric and analysis of variance for testing.
6. To optimize the Linear and Non-linear programming problems.

Course Outcomes: Learners will be able to

1. Evaluate eigenvalues and eigenvectors, analyze their properties, and apply them in engineering problem-solving.
2. Apply the concepts of Complex Integration to evaluate integrals, analyze and compute residues, and solve various contour integrals.
3. Design conclusions on population-based data science problems and interpret the hypotheses.
4. Analyze nonparametric test and perform Analysis of Variance on the population to analyze data.
5. Apply the concept of optimization on Linear Programming Problems.

6. Examine Non-Linear Programming Problems to engineering problems of optimization.

Module No.	Unit No.	Topics	Hrs.	CO
1.0		Linear Algebra (Theory of Matrices)	06	CO1
	1.1	Characteristic Equation, Eigenvalues and Eigenvectors, and properties (without proof). Cayley-Hamilton Theorem (without proof), verification and reduction of higher degree polynomials.		
	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	CO2
	2.1	Line Integral, Cauchy's Integral theorem for simple connected and multiply connected regions (without proof), Cauchy's Integral formula (without proof).		
	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	CO3
	3.1	Probability Distribution: Poisson and Normal distribution.		
	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	CO4
	4.1	Chi-Square Test: Test of goodness of fit.		
	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	CO5
	5.1	Types of solutions, Standard and Canonical of LPP, Basic and Feasible solutions, slack variables, surplus variables, Simplex method.		

	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	CO6
	6.1	NLPP with one equality constraint (two or three variables) using the method of Lagrange's multipliers.		
	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.

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

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

1. The 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 CO's 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
AIMLC402	Operating System	03	-	-	03	-	-	03

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE ^s			
		ISE	MSE				
AIMLC402	Operating System	20	20	60	--	--	100

Pre-requisite:

1. AIMLC305- Computer Organization and Architecture

Program Outcomes addressed:

1. PO1: Engineering knowledge
2. PO2: Problem analysis

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: 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.	Topics	Hrs.	CO
1.0		Operating system Overview	03	CO1
	1.1	Introduction, Objectives, Functions and Evolution of Operating System		
	1.2	Operating system structures: Layered, Monolithic and Microkernel		
	1.3	Linux Kernel, Shell and System Calls		
		Self-Learning Topics: Resource Manager view, process view, Virtual Machine.		
2.0		Process Management and Scheduling	07	CO2
	2.1	Process: Basic Concepts of Process; Process State Model and Transition; Operation on Process; Process Control Block, Context switching		
	2.2	Threads: Introduction to Threads; Types of Threads		
	2.3	Uniprocessor Scheduling: Basic Concepts of Scheduling; Types of Schedulers scheduling algorithms.		
		Self-Learning Topics: Multithreading Models, Thread libraries, Performance comparison of Scheduling Algorithms		
3.0		Process Synchronization and Deadlock	10	CO3
	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		
	3.2	Deadlocks Management: System Model, Deadlock Characterization; Deadlock Detection and Recovery; Deadlock Prevention; Deadlock Avoidance.		
		Self-Learning Topics: Barber's shop problem , real time case study for Deadlock detection and recovery		
4.0		Memory Management	09	CO4
	4.1	Memory Management: Basic Concepts of Memory Management; Swapping; Contiguous Memory Allocation; Paging; Structure of Page Table; Segmentation.		
	4.2	Virtual Memory: Basic Concepts of Virtual Memory; Demand Paging, Copy-on Write; Page Replacement Algorithms; Thrashing		
		Self-Learning Topics: Concept of memory management in Linux & Windows NT/XP		
5.0		File and I/O Management	06	CO5

	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		
	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 Topics: NTFS File system, RAID structure		
6.0		Operating Systems Security	04	CO6
	6.1	Overview of Security and Protection: Goals of Security and Protection, Security and Protection Threats.		
	6.2	Protection Structure: Granularity of Protection, Access control Matrix, Access Control Lists (ACLs), Capability Lists(C-Lists), Protection Domain		
		Self-learning Topics: 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 Dhamdhare, Operating Systems: A Concept Based Approach, Mc-Graw Hill, 2009.

Reference books:

1. Achyut Godbole and Atul Kahate, Operating Systems, McGraw Hill Education, 3rd Edition, 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.
- ISE 20 marks = 05 marks for attendance + 15 marks for activities

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 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 CO's 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
AIMLC403	Analysis of Algorithm	03	-	-	03	-	-	03

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE ^s			
		ISE	MSE				
AIMLC403	Analysis of Algorithm	20	20	60	--	--	100

Pre-requisite:

1. FEC104: C-Programming
2. AIMLC302: Data Structure

Program Outcomes addressed:

1. PO1: Engineering knowledge
2. PO2: Problem analysis
3. PO4: Conduct investigations of complex problems
4. PO9: Individual and Collaborative team work
5. PO10: Communication
6. PO12: Life-Long learning

Course Objectives:

1. To provide mathematical approaches for analysis of algorithms.
2. To understand and solve problems using various algorithmic approaches.
3. To analyze algorithms using various methods.
4. To develop a technique for analyzing and computing the performance of an algorithm.
5. To understand computational complexity classes and their significance in problem-solving.
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. Analyze the running time and space complexity of the algorithms.
2. Describe, apply, and analyze the complexity of the divide and conquer strategy.
3. Solve optimization problems using greedy strategy and analyze the complexity.
4. Illustrate and analyze the complexity of dynamic programming strategy.
5. Explain and apply backtracking, branch, and bound.
6. Apply string matching techniques and understand various complexity classes.

Module No.	Unit No.	Topics	Hrs.	CO
1.0		Introduction	07	CO1
	1.1	Introduction: Performance analysis, space and time complexity, Growth of function, Big-Oh, Omega Theta notation Mathematical background for algorithm analysis. Analysis of selection sort, insertion sort.		
	1.2	Recurrences: The substitution method, Recursion tree method, Master method.		
		Self-Learning: Bubble Sort, Randomized Algorithms		
2.0		Divide and Conquer Approach	06	CO2
	2.1	General method, Merge sort, Quick sort, Finding minimum and maximum algorithms and their Analysis, Analysis of Binary search		
		Self-Learning: Implementation of Linear search, Strassen's Matrix Multiplication		
3.0		Greedy Method Approach	06	CO3
	3.1	General Method, Single source shortest path: Dijkstra Algorithm, Fractional Knapsack problem, Job sequencing with deadlines, Minimum cost spanning trees: Kruskal and Prim's algorithms		
		Self-Learning: Graph representations: adjacency matrix and adjacency list, Optimal storage on tape algorithm.		
4.0		Dynamic Programming Approach	09	CO4
	4.1	General Method, Multistage graphs, Single source shortest path Bellman ford Algorithm, All pair shortest path: Floyd Warshall Algorithm, 0/1 knapsack Problem, Travelling Salesperson problem, longest common subsequence		
		Self-Learning: Matrix operations, Assembly-line scheduling Problem		
5.0		Backtracking and Branch and bound	06	CO5
	5.1	General Method, Backtracking: N-queen problem, Sum of subsets, Graph coloring.		
	5.2	Branch and Bound: Travelling Salesperson Problem, 15 Puzzle problem		
		Self-Learning: Basics of graph theory and set theory, Hamiltonian cycle.		
6.0		String Matching Algorithms	05	CO6
	6.1	The Naïve string-matching algorithm, The Rabin Karp algorithm, The Knuth-Morris-Pratt algorithm		
	6.2	Complexity class: Definition of P, NP, NP-Hard, NP-Complete		
		Self-Learning: Modular arithmetic, Boyer Moore algorithm		
		Total	39	

Textbooks:

1. T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C. Stein, Introduction to Algorithms, PHI Publication, 2005.
2. Ellis Horowitz, Sartaj Sahni, and Sangu thevar Rajasekaran, Fundamentals of Computer Algorithms, 2nd Edition, Orient Black Swan, 2008..

Reference books:

1. Sanjoy Dasgupta, Christos Papadimitriou, and Umesh Vazirani, Algorithms, McGraw Hill Education, 2006.
2. S. K. Basu, Design Methods and Analysis of Algorithms, PHI Learning Pvt. Ltd., 2005.

Online References:

1. <https://nptel.ac.in/courses/106/106/106106131/>
2. https://swayam.gov.in/nd1_noc19_cs47/preview
3. <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.
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 CO's 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
AIMLC404	Critical Thinking and Design	02	-	-	02	-	-	02

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE\$			
		ISE	MSE				
AIMLC404	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.

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.	Topics	Hrs.	CO
1.0		Introduction to Critical Thinking	4	CO1
	1.1	Introduction: Start-up definitions of Critical Thinking how skilled are you as a Thinker? Hard Work, Concept of Critical Thinking, establish new habits of thoughts, Develop confidence		
	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 Topics: Role of Intellectual Humility in Decision-Making		
2.0		Four Stages of Development, Game Plan	3	CO2
	2.1	Four Stages of Development: Stage 1: Unreflective thinker, Stage 2: Challenged thinker, Stage 3: Beginning thinker, Stage 4: Practicing thinker		
	2.2	Game Plan: Purpose & Key Components of Game Plan, Integrating of Game Plan Strategies		
	2.3	Self-Learning Topics: Case Study: Explores how a student progresses through four stages using self-reflection& discipline.		
3.0		Self-Understanding, Parts & Universal Standards	3	CO3
	3.1	Three Distinctive Functions: Recognize the Mind's Three Distinctive Functions; Special Relationship		
	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	CO4
	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		

	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	CO5
	5.1	Generating & Broadening Ideas: Creating Stretch Goals, Power of Metaphors & Widening Perspectives, Importance of Diversity in Ideation		
	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	CO6
	6.1	Ideate: Brainstorming & Hybrid Ideation Techniques, Challenging Assumptions & Breaking Patterns, Cross- Industry Inspiration (Analogous Design), Designing for Extreme Users & Ideation Triggers		
	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 10 marks.
- ISE 15 marks = 05 marks for attendance + 10 marks for activities.

MSE:

- To be conducted as written examination for 15 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 CO's 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 4031	Microprocessor and Microcontroller	03	-	-	03	-	-	03

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE ^s			
		ISE	MSE				
MDMC 4031	Microprocessor and Microcontroller	20	20	60	--	--	100

Pre-requisites

1. FEC204: Digital system design

Program Outcomes addressed:

1. PO1: Engineering knowledge
2. PO2: Problem analysis
3. PO3: Design and Development of Solution

Course Objectives:

1. To equip students with the fundamental knowledge and basic technical competence in the field of Microprocessors.
2. To emphasize instruction set and logic to build assembly language programs.
3. To prepare students for higher processor / Controller architectures.
4. To understand architecture of 8051 and ARM7 core.

Course Outcomes:

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

1. Describe core concepts of 8086 microprocessor.
2. Interpret the instructions of 8086 and write assembly and Mixed language programs.
3. Appraise the architecture of advanced processors
4. Describe core concepts of 8051 micro-controller.
5. Interpret the instructions of 8051 and write assembly language programs.
6. Appraise the architecture of advanced controllers.

Module No.	Unit No.	Topics	Hrs.	CO
1.0		The Intel Microprocessors 8086 Architecture	08	CO1
	1.1	8086CPU Architecture, Functional Pin Diagram		
	1.2	Programmer's Model		
	1.3	Memory Segmentation, Banking in 8086		
	1.4	Demultiplexing of Address/Data bus		
	1.5	Functioning of 8086 in Minimum mode and Maximum mode		
	1.6	Interrupt structure and its servicing		
		Self-Learning: Timing diagram of minimum and maximum mode		
2.0		Instruction Set and Programming of 8086	05	CO2
	2.1	Addressing Modes, Instruction set		
	2.2	Program related -Data Transfer Instructions, String Instructions, Logical Instructions, Arithmetic Instructions, Transfer of Control Instructions, Processor Control Instructions		
		Self-Learning : 8255,8259 ,8257		
3.0		Pentium Processor	06	CO3
	3.1	Comparison of 8086 and Pentium, Pentium Architecture, Superscalar Operation, Integer & Floating-Point Pipeline Stages		
	3.2	Branch Prediction Logic, Cache Organization, MESI Protocol		
		Self-learning: 80386 Processor		
4.0		8051 Microcontroller	08	CO4
	4.1	Comparison between Microprocessor and Microcontroller		
	4.2	Features, architecture and pin configuration of 8051		
	4.3	CPU timing and machine cycle		
	4.4	Memory organization		
	4.5	Counters and timers		
	4.6	Interrupts		
	4.7	Serial data input and output		
		Self-Learning : Input output ports		
5.0		8051 Assembly Language Programming and Interfacing	06	CO5
	5.1	Addressing modes, Instruction set		
	5.2	Programs related to : arithmetic, logical, delay subroutine, input, output, timer, counters, port, serial communication, and interrupts		
		Self-Learning : Need of Assembler & Cross Assemble, Assembler Directives		
6.0		ARM7	06	CO6
	6.1	Introduction & Features of ARM 7, Concept of Cortex-A, Cortex-R and Cortex-M		

		Architectural inheritance, Pipelining Programmer's model		
	6.2	Brief introduction to exceptions and interrupts handling Instruction set: Data processing, Data Transfer, Control flow		
		Self-Learning: Programming of ARM7		
		Total	39	

Textbooks:

1. K. M. Bhurchandani and A. K. Ray, "Advanced Microprocessors and Peripherals", McGraw Hil
2. Douglas V Hall, SSSP Rao "Microprocessors & Interfacing", McGraw Hill
3. M. A. Mazidi, J. G. Mazidi and R. D. Mckinlay, "The 8051 Microcontroller & Embedded systems", Pearson Publications
4. C. Kenneth J. Ayala and D. V. Gadre, "The 8051 Microcontroller & Embedded system using assembly & 'C' ", Cengage Learning
5. Steve Furber, "ARM System on chip Architecture", Pearson

Reference books:

1. John Uffenbeck, "8086/8088 family: Design Programming and Interfacing", PH

Online References:

- 1 https://swayam.gov.in/nd1_noc20_ee11/preview
- 2 <https://nptel.ac.in/courses/108/105/108105102/>
- 3 <https://www.classcentral.com/course/swayam-microprocessors-and-microcontrollers-9894>
- 4 <https://www.mooc-list.com/tags/microprocessors>

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 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
5. All CO's 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
MDMC4041	Computer Network	03	-	-	03	-	-	03

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE ^s			
		ISE	MSE				
MDMC4041	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: Modern 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.	Topics	Hrs.	CO
1.0		Introduction to Networking	04	CO1
	1.1	Introduction to computer network, network application, network software and hardware components (Interconnection networking devices), Network topology, protocol hierarchies, design issues for the layers, connection oriented and connectionless services		
	1.2	Reference models: Layer details of OSI, TCP/IP models. Communication between layers.		
	1.3	Self-Learning: ARPANET, IEEE 802.11 standards, Firewalls, VPNs, Software-Defined Networking		
2.0		Physical Layer	03	CO2
	2.1	Introduction to Communication Electromagnetic Spectrum		
	2.2	Unguided Transmission Media: Radio wave, Microwave, Infrared. Guided Transmission Media: Twisted pair, Coaxial, Fiber optics.		
	2.3	Self-Learning: Properties & Propagation (Line-of-Sight Communication), Satellite Communication & Radar Systems, Cellular Networks (3G, 4G, 5G)		
3.0		Data Link Layer	08	CO3
	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)		
	3.2	Medium Access Control Sublayer Channel Allocation problem, Multiple access Protocol (Aloha, Carrier Sense Multiple Access (CSMA/CD)		
	3.3	Self-Learning: Link Layer Security		
4.0		Network layer	12	CO4
	4.1	Network Layer design issues, Communication Primitives: Unicast, Multicast, Broadcast. IPv4 Addressing (classful and classless), Subnetting, Super netting design problems, IPv4 Protocol, Network Address Translation (NAT), IPv6		
	4.2	Routing algorithms: Shortest Path (Dijkstra's), Link state routing, Distance Vector Routing, BGP		
	4.3	Protocols – ARP, RARP, ICMP, IGMP		
	4.4	Congestion control algorithms: Open loop congestion control, Closed loop congestion control, QoS parameters, Token & Leaky		

		bucket algorithms		
	4.5	Self-Learning: EIGRP (Enhanced Interior Gateway Routing Protocol), Dynamic Source Routing (DSR), Ad-hoc On-Demand Distance Vector (AODV), Zone Routing Protocol (ZRP)		
5.0		Transport Layer	06	CO5
	5.1	The Transport Service: Transport service primitives, Berkeley Sockets, Connection management (Handshake), UDP, TCP, TCP state transition, TCP timers		
	5.2	TCP Flow control (sliding Window), TCP Congestion Control: Slow Start		
	5.3	Self-Learning: Sockets, Packet Loss Handling & Retransmission Mechanisms, Real-World Applications of TCP/UDP, QoS (Quality of Service) in Transport Protocols, Modern Enhancements to TCP (QUIC, BBR Congestion Control)		
6.0		Application Layer	06	
	6.1	DNS: Name Space, Resource Record and Types of Name Server. HTTP, SMTP, Telnet, FTP, DHCP		CO6
	6.2	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

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 CO's 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
MDM C4061	Cost Management	03	-	-	03	-	-	03

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE ^s			
		ISE	MSE				
MDMC4061	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: Lifelong Learning

Course Objectives:

1. 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	1.1	Module 1: Introduction to Cost Accounting	04	CO1
		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.		
		Self-Learning: Basic accounting concepts, Journal entry and ledgers		

2.0	2.1	Classification of Costs and Cost Sheet	05	CO2
		Elements of Cost, Classification of Costs, Cost center and cost unit, Preparation of Cost Sheet & Estimated Cost Sheet.		
		Self-Learning: Purpose and importance of cost sheet.		
3.0	3.1	Material Management and Accounting for materials	06	CO3
		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.		
		Self-Learning: Basic flowchart for material flow in a company.		
4.0	4.1	Accounting for labour and Overheads	08	CO4
		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.		
		Self-Learning: Types of labour, classification of overheads.		
5.0	5.1	Cost Control and Cost Reduction	10	CO5
		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, 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	6.1	Marginal Costing & CVP Analysis	06	CO6
		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.		
		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. 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.
- ISE 20 marks = 05 marks for attendance + 15 marks for activities

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 CO's 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
AIMLL401	Operating System Lab	--	02	--	--	01	-	01

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE			
		ISE	MSE				
AIMLL401	Operating System Lab	--	--	--	25	25	50

Pre-requisite:

1. AIMLC402: Operating system.

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. PO9: Individual & Collaborative Team work
7. PO10: Communication

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 b. Write a program demonstrate the concept of Dining Philosopher's Problem	
8		Memory Management	LO4
	8.1	a. Write a program to demonstrate the concept of MVT and MFT memory management techniques b. 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 b. 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	

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., 9th Edition, 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

Online References:

1. Online Simulator: [Downloads-CPU-OS Simulator](#)

Term Work:

Term work shall consist of at least 12 experiments (Ensure that all the LOs are covered.)

The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. Term work will be assessed as Continuous Internal Assessment Practical (CIAP).

Term work Marks:

- 25 Marks (Total Marks) = 20 Marks (Experiment) + 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
AIMLL402	Analysis of Algorithm Lab	--	02	--	--	01	-	01

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE			
		ISE	MSE				
AIMLL402	Analysis of Algorithm Lab	--	--	--	25	25	50

Pre-requisite:

1. FEC104:C-Programming and
2. AIMLC302: Data Structure

Program Outcomes addressed:

1. PO1: Engineering knowledge
2. PO2: Problem analysis
3. PO4: Conduct investigations of complex problems
4. PO9: Individual and team work
5. PO10: Communication
6. PO12: 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. Apply 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.

Suggested List of Experiments:		
Sr. No.	Title of Experiments	LO
1	A library management system needs to arrange books by their ID numbers in ascending order. Implement sorting techniques to efficiently organize the books.	LO1, LO2
2	Implementation of merge sort and quick sort.	LO1, LO2
3	A student records system allows users to search for a student's record by ID number. Implement an efficient search algorithm to find a student's details quickly.	LO1, LO3
4	A GPS navigation system needs to provide users with the shortest path between their current location and a given destination. Implement Dijkstra's algorithm to compute the optimal route.	LO1, LO3
5	Implementation of Prim's Algorithm for Minimum Spanning Tree (MST).	LO1, LO4
6	Implementation of the 0/1 Knapsack Problem using Dynamic Programming.	LO1, LO3
7	Implementation of the Floyd-Warshall algorithm all-pair shortest path.	LO1, LO3
8	A DNA sequencing research project aims to find the longest common subsequence between two DNA strands. Implement an LCS algorithm to compare genetic sequences efficiently.	LO1, LO4
9	A chess tournament system is testing possible arrangements of N queens on an N×N board such that no two queens attack each other. Implement the N Queens problem using backtracking to generate valid placements	LO1, LO5
10	Implementation of the Rabin- Karp String Matching Algorithm.	LO1, LO4
11	A university needs to schedule exams such that no two exams for the same student are scheduled at the same time. Implement the graph coloring algorithm to minimize the number of time slots required.	LO1, LO5
12	Write a case study on Complexity Classes: P, NP, NP-Hard, NP-Complete.	LO6

Textbooks:

1. T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C. Stein, "Introduction to Algorithms", PHI Publication, 2005.
2. Ellis Horowitz, Sartaj Sahni, and Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", 2nd Edition, Orient BlackSwan, 2008.

Reference books:

1. Sanjoy Dasgupta, Christos Papadimitriou, and Umesh Vazirani, "Algorithms", McGraw Hill Education, 2006.
2. S. K. Basu, "Design Methods and Analysis of Algorithms", PHI Learning Pvt. Ltd., 2005.

Online References:

1. <https://nptel.ac.in/courses/106/106/106106131/>
2. https://swayam.gov.in/nd1_noc19_cs47/preview
3. <https://www.coursera.org/specializations/algorithms>

Term Work:

Term work shall consist of at least 12 experiments (Ensure that all the LOs are covered.)

The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. Term work will be assessed as Continuous Internal Assessment Practical (CIAP).

Term work Marks:

- 25 Marks (Total Marks) = 20 Marks (Experiment) + 05 Marks (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
AIMLL403	Skill Lab: Linux System and Networking Lab	--	2*+2	--	--	02	--	02

* Theory class to be conducted for full class

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE			
		ISE	MSE				
AIMLL403	Skill Lab: Linux System and Networking Lab	--	--	--	25	25	50

Pre-requisite:

1. FEC104 – C-Programming
2. AIMLL304 – Skill Lab (Python Programming)

Program Outcomes Addressed:

PO1: Engineering Knowledge
PO2: Problem Analysis
PO5: Engineering Tool Usage
PO6: The Engineer and The World
PO7: Ethics
PO8: Individual and Collaborative Teamwork
PO11: Life-Long Learning

Lab Objectives:

1. To install and configure Linux operating systems and perform essential system administration tasks.
2. To execute and manage Linux commands for users, permissions, process control, and file systems.
3. To configure Linux-based network services such as SSH, FTP, DNS, and perform remote management.
4. To understand and simulate the functions of networking devices and protocols using real tools and simulators.
5. To analyze packet flow and TCP/IP protocol behavior using Wireshark and related tools.
6. To design and configure networks using static/dynamic IP addressing, implement routing protocols, and develop network-based applications.

Lab Outcomes: Learners will be able to

1. Install and configure Linux OS and manage system-level tasks like file handling, user permissions, and background processes.
3. Apply various Linux commands to manage system operations and networking configurations.
4. Configure and operate key network services like FTP, SSH, DHCP, DNS on Linux platforms.
5. Simulate and analyze the working of networking devices and use network-related commands in practical setups.
6. Examine packet formats and functioning of each layer in the TCP/IP model using packet capture tools like Wireshark.
7. Design IP addressing schemes, configure routers/switches, implement routing algorithms (RIP, OSPF, NAT), and demonstrate application-layer protocols.

Module No.	Unit No.	Topics	Hrs.	LO
1.0		Introduction to Open-Source Software	4	LO1
	1.1	Need of Open Sources, Advantages and applications of Open sources, FOSS – FOSS usage, Free Software Movement, Open-Source Software Development Model, comparison with close source / Proprietary software, widely used open source software license: Apache License 2.0, BSD license, GNU General Public License, MIT License, Mozilla Public License 2.0		
	1.2	Installation of Linux (Redhat-CentOS-Fedora-Ubuntu): Linux Architecture, Kernel and shells, Boot Process, bootloader, understanding FHS of Linux, Understanding the different types of run-levels, understanding different types of shutdown commands,		
		Self-Learning Topics: Contributing to Open-Source Projects, Automation in Linux		
2.0		Open-Source Operating System: System Administration Task	4	LO2
	2.1	Basic Command Line: Working with the Bash Shell, Getting the Best of Bash, Useful Bash Key Sequences, Working with Bash History, Performing Basic File System Management Tasks, Working with Files and Directories, Piping and Redirection, Finding Files, Working with Links		
	2.2	Process management Task: Performing Job management Tasks, System and Process Monitoring and management, Managing Process Niceness, Scheduling Jobs using CRON, Creating Backups		
		Self-Learning Topics: Disk Management and Partitioning, Log Management and Monitoring		

3.0		Storage and Network Management in Open-Source Operating Systems	5	LO3
	3.1	Storage Configuration and Management: Understanding Partitions and Logical Volumes, Creating Partitions, File Systems Overview, Creating File Systems, Mounting and Unmounting File systems, Mounting File Systems Automatically Through fstab, Working with Logical Volumes, Creating Logical Volumes, Resizing Logical Volumes, Creating Swap Space, Working with Encrypted Volumes		
	3.2	Network Management: Understanding Network Manager, Network Manager Configuration Files, Network Service Scripts, Networking from the Command Line, Troubleshooting Networking, Setting Up IPv4 and IPv6, Configuring SSH, Enabling the SSH Server, Using the SSH Client, Using PuTTY on Windows Machines, Configuring Key-Based SSH Authentication, Using Graphical Applications with SSH, Using SSH Port Forwarding, Configuring VNC Server Access		
		Self-Learning Topics: Automating Storage Management with LVM, Setting Up a Secure File Server with NFS and Samba		
4.0		Open-Source Operating System: Server Administration Task	5	LO4
	4.1	Configuring Server for File Sharing: What is NFS? Advantages and Disadvantages of NFS, Configuring NFS4, Setting Up NFSv4, Mounting an NFS Share, Making NFS Mounts Persistent, Configuring Automount, Understanding the features and advantages of FTP server, Configuring FTP server and FTP clients, Understanding FTP Basic Commands		
		Self-Learning: Database Optimization in MySQL ,Advanced Apache Web Server Configuration		
5.0		Advanced Shell Scripting:	4	LO5
	5.1	Advanced Shell Scripting Concepts: I/O Redirections, Functions, Arrays, Process Substitution, Command Chaining		
	5.2	Text Processing & Manipulation: AWK, GAWK, SED, CUT, REGEX		
	5.3	Web using Shell Script: Downloading web pages, Parsing Data, Using CURL		
		Self-Learning: Web Scraping Using Shell Scripts, Regular Expressions in Shell Scripting		
6.0		Advanced System Security and Performance Optimization:	4	LO6
	6.1	Vulnerability Assessment and Penetration Testing : Advanced Port Scanning & Service Detection using Nmap, Vulnerability Scanning with OpenVAS/Nessus, Phases of penetration testing, Overview of Metasploit		

	6.2	Kernel and Network Performance Optimization: Kernel Parameters for Network Performance (sysctl optimizations), Buffer Tuning for improved system efficiency, Using ethtool for Interface Optimization Load Balancing & Traffic Shaping, Network Throughput Testing with iperf3		
		Self-Learning: Kernel Performance Optimization, Network Performance Optimization.		
		Total		
			26	

Suggested List of Experiments:			
Sr. No.	Title of Experiments	LO	
1.	Installation of Red HAT/Centos/Fedora Linux operating system using following method CD-ROM, Network Installation or Kickstart Installation. a. Partitioning drives b. Configuring boot loader (GRUB/LILO) c. Updating and upgrading the system d. Shutting down and reboot	LO1	
2.	Learning and executing Linux commands for a. Interacting with BASH shell and built-in shell variables b. Navigation c. File and directory management d. Working with links e. Searching files	LO1, LO2	
3.	Learning and executing Linux commands for Process management tasks like a. Executing a process b. Getting process info c. Killing a process d. Changing process attributes e. Managing foreground and background processes f. Scheduling automated jobs using CRON jobs	LO1, LO2	
4.	Learning and executing Linux commands for managing Users, Groups, and Permissions a. Creating, modifying and deleting users b. Creating, modifying and deleting groups c. Managing file permissions, attributes and ownerships d. Setting Default Permissions with umask e. Setting up access control list for files and directories	LO1	
5.	Learning and executing Linux commands for managing Storage drives in Linux environment a. Create partitions b. Install file system c. Mount and unmount partitions manually from CLI d. Automated mounting using fstab	LO1	

	e. Encrypt volumes	
6.	<p>Learning and executing Linux commands for managing networking in Linux environment</p> <ol style="list-style-type: none"> Enable networking services from command line Configure IP and other network settings from command line. Configure IP and other network settings from configuration files. Configure SSH based services for CLI and GUI access on remote machines. 	LO2
7.	<p>Install and configure an NFS server and mount NFS shares on Linux Environment, Install and configure files sharing services using FTP server, Install and configure DHCP server, DNS server, Install and configure TELNET server, SSH server</p>	LO3
8.	Understand the working of networking devices.	LO4
9.	<p>Use Wire shark to understand the operation of TCP/IP layers:</p> <ul style="list-style-type: none"> 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. <p>Application Layer: DHCP, FTP, HTTP header formats</p>	LO5
10.	Design a network and understand the basic working of PING (ICMP) and ARP (DLL).	LO4
11.	<ol style="list-style-type: none"> Setup a LAN network using Static/ Dynamic IPs and assign multiple IPs . Using netstat and route commands of Linux, do the following: <ul style="list-style-type: none"> View current routing table Add and delete routes Change default gateway Perform packet filtering by enabling IP forwarding using IP tables in Linux. 	LO4, LO6
12.	Configure a network and Implement Static Routing.	LO6
13.	<p>Configure a Network and Distance Vector Routing protocol (RIP).</p> <p>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:</p> <ul style="list-style-type: none"> One subblock of 120 addresses. <p>One subblock of 60 addresses. One subblock of 10 addresses.</p>	LO6
14.	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.	LO6
15.	Use simulator (Eg. NS2) to understand functioning of ALOHA, CSMA/CD	LO4

Text Books:

1. Linux: The Complete Reference, Sixth Edition by Richard Petersen, McGraw Hill Education; 6th edition
2. Linux Command Line and Shell Scripting Bible by Richard Blum Wiley; 3rd edition
3. Red hat Linux Networking and System Administration, by Terry Collings and Kurt Wall,
4. Wiley 3rd edition 2005

Reference Books:

1. Linux Administration: A Beginner's Guide by Wale Soyinka, McGraw-Hill Education; 8th edition.
2. Sander van Vugt, "Red Hat Enterprise Linux 6 Administration", Real World Skills for Red Hat Administrators by John Wiley and Sons 2013.
3. Rhcsa Red Hat Enterprise Linux 8: Training and Exam Preparation Guide, Asghar Ghori, Endeavor Technologies.

Software Resources:

1. <https://www.virtualbox.org/wiki/Downloads>
2. <https://getfedora.org/>
3. <https://www.centos.org/download/>
4. <https://ubuntu.com/download/desktop>
5. <https://developers.redhat.com/products/rhel/download>

Online Resources: (browser-based terminals)

1. <https://distrotest.net/>
2. <https://bellard.org/jslinux/>
3. <http://www.webminal.org/terminal/>
4. https://www.tutorialspoint.com/unix_terminal_online.php

Online Resources: (Study Resources)

1. <https://training.linuxfoundation.org/training/introduction-to-linux/>
2. <https://www.netacad.com/courses/os-it/ndg-linux-unhatched>
3. <https://www.netacad.com/courses/os-it/ndg-linux-essentials>
4. <https://www.edx.org/course/fundamentals-of-red-hat-enterprise-linux>
5. <https://linuxhandbook.com/tag/bash-beginner/>
6. <https://www.learnshell.org/>
7. <https://itsfoss.com/shell-scripting-resources/>

Term Work:

Term work shall consist of at least 12 experiments (Ensure that all the LOs are covered.)

The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. Term work will be assessed as Continuous Internal Assessment Practical (CIAP).

Term work Marks:

- 25 Marks (Total Marks) = 20 Marks (Experiment) + 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 Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
AIMLL404	Value Education (UHV)	--	04	--	--	02	-	02

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE			
		ISE	MSE				
AIMLL404	Value Education (UHV)	--	--	--	50	--	50

Program Outcome mapped:

1. PO1: Engineering Knowledge
2. PO2: Problem Analysis
3. PO3: Design/Development of
4. PO4: Investigation of Complex
5. PO5: Engineering Tool
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: Lifelong 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.	Topics	LO
1.0		Introduction to Human Values and Their Relevance in IT	
	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	
	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
3.0		Professional Ethics in IT	
	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	
	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	
	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
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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%	<ul style="list-style-type: none"> - 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	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
AIMLM401	Mini Project 1 B	--	02	--	--	01	-	01

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE			
		ISE	MSE				
AIMLM401	Mini Project 1 B	--	--	--	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 & The World
7. PO7: Ethics
8. PO8: Individual & 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

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.		