South Indian Education Society's

Graduate School of Technology

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

Autonomous Institute Affiliated to University of Mumbai

SIES Graduate School of Technology (Autonomous)

RISE WITH EDUCATION

Electronics and Telecommunication Engineering

Curriculum Structure for Undergraduate Academic Program in

Electronics and Telecommunication Engineering

First and Second Year Syllabi

Board of Studies
Department of Electronics and Telecommunication Engineering

Academic Council
SIES Graduate School of Technology

Effective from: AY 2025-26

PREAMBLE

Dear Students, Faculty, and Stakeholders,

Greetings and congratulations to all the stakeholders of SIES Graduate School of Technology for getting autonomous status to the college from the year 2024-25. University Grant Commission vide letter No. F. 2- 10/2023(AC-Policy) dated 10 July 2024 conferred the autonomous status affiliated to University of Mumbai for a period of 10 years from the academic year 2024-2025 to 2033-2034 as per clause 7.5 of the UGC (Conferment of Autonomous Status Upon Colleges and Measures for Maintenance of Standards in Autonomous Colleges) Regulations,2023. Autonomy will help design and implement curriculum which is more learner centric and robust to cater to the changing need of Society and Industry.

The Department of Computer Engineering SIES Graduate School of Technology, Nerul, Navi Mumbai, was established in 2002 and the current intake capacity is 180.One of the notable achievements is accreditation by the National Board of Accreditation (NBA) in 2011,2021,2024 which reflects our commitment in maintaining high standards of education and infrastructure.
We are delighted to announce the introduction of the newly designed curriculum for autonomy at SIES Graduate School of Technology, The newly designed curriculum for the Computer Engineering course at our autonomous institute is a reflection of our commitment to excellence, innovation, and inclusivity in higher education. Guided by the principles and objectives of the National Education Policy (NEP), this curriculum aims to create a robust framework that not only equips students with in-depth technical knowledge but also fosters holistic development, ethical values, and a lifelong passion for learning.

Curriculum emphases on flexibility, multidisciplinary education, and a learner-centric approach. It aims to develop well-rounded engineers with a strong foundation in core computer engineering skills, while integrating emerging technologies such as AI, machine learning, and cybersecurity. The curriculum also offers flexibility through electives, allowing students to tailor their education and foster interdisciplinary learning for a comprehensive skill set.

This curriculum is designed with strong industry collaboration to provide students with real-world experience through internships and projects, ensuring they are industry-ready upon graduation. We promote lifelong learning, ensuring that students remain curious, adaptable, and committed to growth throughout their careers. This curriculum empowers students to become innovative engineers, ethical leaders, and global citizens who will contribute to the advancement of technology and the betterment of society.

We would like to express our sincere gratitude to the faculty, alumni, students, industry experts, academicians, and stakeholders for their continuous support in strengthening our academics, making SIESGST one of the top engineering colleges in the nation and the premier choice for engineering aspirants.

Chairperson
Board of Studies
Electronics and Telecommunication Engineering
SIES Graduate School of Technology

HEAD
Department of Electronics & Telecommunications
S.I.E.S. Graduate School of Technology
Sri Chandrasekarendra Saraswathy Vidyapuram
Plot 1-C & E, Sector-V, Nerul, Navi Mumbai-400 706.

Chairperson
Academic Council
SIES Graduate School of Technology

I/c PRINCIPAL
SIES GRADUATE SCHOOL OF TECHNOLOGY (AUTONOMOUS)
Plot 1C/D/E Sri Chandrasekarendra Saraswathy Vidyapuram
Sector V Nerul Navi Mumbai-400706

Semester-wise Credit Distribution Structure for Four Year UG Engineering

Program – Electronics and Telecommunication Engineering

Semester		I	II	III	IV	V	VI	VII	VIII	Total Credits
Basic Science Course(BSC)	BSC/ESC	7	6		--	--	--	--	--	13
Engineering Science Course (ESC)		9	10		--	--	--	--	--	19
Programme Core Course (PCC)	Program Courses	--	--	17	11	12	11	04		55
Programme Elective Course (PEC)		--	--	--	--	03	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

AND

FIRST AND SECOND YEAR SYLLABUS
(Electronics and Telecommunication Engineering)
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
PEC	Program Elective Courses
MDM	Multidisciplinary Minor
OE	Open Elective
VEC	Value Education Courses
VSEC	Vocational and Skill Enhancement Courses
AEC	Ability Enhancement Courses
RM	Research Methodology
CEP/FP	Community Engagement Project/Field Project
OJT	On Job Training/Internship
CC	Co-curricular Courses
LLC	Liberal Learning Courses
IKS	Indian Knowledge System
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
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	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**	**17**	--	**12**	**9**	--	**21**

Examination Scheme-FY Semester I

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

@Physics/Chemistry in one semester.
$ ESE of duration 3 hours are of 80 marks and scaled to 60. ESE duration of 2 hours are of 60 marks and scaled to 45.
Theory 1 credit for 1 hour and practical 1 credit for 2 hours.
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 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
ESEP: End Semester Examination Practical

Program Structure for First Year
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/ FEC1022	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/ FEL1012	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
	Total		**13**	**14**	--	**13**	**8**	--	**21**

Examination Scheme-FY Semester II

Course Code	Course Name	Examination Scheme						
		Theory				CIAP	ESEP	Total
		Internal Assessment		ESE$	Exam Duration (Hrs.)			
		ISE	MSE					
FEC201	Applied Mathematics -II	20	20	60	03	--	--	100
FEC2021/ FEC2022	Applied Physics/ Applied Chemistry@	20	20	60	03	--	--	100
FEC203	Engineering Graphics	15	15	45	02	--	--	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 of2 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 of 20/15 marks.
MSE: Mid Semester Examination: To be conducted as written examination for 20/15 marks of duration 1 Hr.
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ESEP: End Semester Examination Practical.

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
ETC301	Applied Mathematics III	PCC	3	--	--	3	--	--	3
ETC302	Electronic Devices and circuits	PCC	3	--	--	3	--	--	3
ETC303	Microprocessor and Microcontroller	PCC	3	--	--	3	--	--	3
ETC304	Network Theory	PCC	3	--	--	3	--	--	3
ETC305	Signals & Systems	PCC	3	--	--	3	--	--	3
ETC306	Engineering Economics	HSSM	2	--	--	2	--	--	2
ETL301	Electronic Devices and circuits Lab	PCC	--	2	--	--	1	--	1
ETL302	Microprocessor and Microcontroller Lab	PCC	--	2	--	--	1	--	1
ETL303	Skill Lab - Python Programming	VSEC	--	2*+2	--	--	2	--	2
ETM301	Mini Project 1A	CEP	--	2#	--	--	1	--	1
Total			**17**	**10**	**--**	**17**	**5**	**--**	**22**

Examination Scheme - EXTC Semester III

Course Code	Course Name	Examination Scheme						
		Theory				CIAP	ESEP	Total
		Internal Assessment		ESE$	Exam Duration (Hrs.)			
		ISE	MSE					
ETC301	Applied Mathematics III	20	20	60	3	--	--	100
ETC302	Electronic Devices and circuits	20	20	60	3	--	--	100
ETC303	Microprocessor and Microcontroller	20	20	60	3	--	--	100
ETC304	Network Theory	20	20	60	3	--	--	100
ETC305	Signals & Systems	20	20	60	3	--	--	100
ETC306	Engineering Economics	50	--	--	--	--	--	50
ETL301	Electronic Devices and circuits Lab	--	--	--	--	25	25	50
ETL302	Microprocessor and Microcontroller Lab	--	--	--	--	25	25	50
ETL303	Skill Lab - Python Programming	--	--	--	--	25	25	50
ETM301	Mini Project 1A	--	--	--	--	25	25	50
Total	--	**125**	**125**	**300**	**--**	**100**	**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
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 of 20/15 marks.
MSE: Mid Semester Examination: To be conducted as written examination for 20/15 marks of duration 1 Hr.
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ESEP: End Semester Examination Practical.

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
ETC401	Applied Mathematics-IV	PCC	3	--	--	3	--	--	3
ETC402	Principles of Communication Engineering	PCC	3		--	3	--	--	3
ETC403	Linear Integrated Circuits	PCC	3		--	3	--	--	3
ETC404	Critical Thinking and Design	HSSM	2	--	--	2	--	--	2
MDMC40X1	Multidisciplinary Minor-I (MDM-I)	MDM	3	--	--	3	--	--	3
ETL401	Principles of Communication Engineering Lab	PCC	--	2	--	--	1	--	1
ETL402	Linear Integrated Circuits Lab	PCC	--	2	--	--	1	--	1
ETL403	Skill Lab - Linux	VSEC	--	2*+2	--	--	2	--	2
ETL404	Value Education (UHV)	HSSM (VEC)	--	4	--	--	2	--	2
ETM401	Mini Project 1B	CEP	--	2#	--	--	1	--	1
Total			**14**	**14**	**--**	**14**	**7**	--	**21**

Examination Scheme - EXTC Semester IV

Course Code	Course Name	Examination Scheme						
		Theory				CIAP	ESEP	Total
		Internal Assessment		ESE$	Exam Duration (Hrs.)			
		ISE	MSE					
ETC401	Applied Mathematics-IV	20	20	60	3	--	--	100
ETC402	Principles of Communication Engineering	20	20	60	3	--	--	100
ETC403	Linear Integrated Circuits	20	20	60	3	--	--	100
ETC404	Critical Thinking and Design	15	15	45	2	--	--	75
MDMC40X1	Multidisciplinary Minor-I (MDM-I)	20	20	60	3	--	--	100
ETL401	Principles of Communication Engineering Lab	--	--	--	--	25	25	50
ETL402	Linear Integrated Circuits Lab	--	--	--	--	25	25	50
ETL403	Skill Lab - Linux	--	--	--	--	25	25	50
ETL404	Value Education (UHV)	--	--	--	--	50	--	50
ETM401	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.
UHV: Universal Human Values
# 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
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 of 20/15 marks.
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ESE: End Semester Examination
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Multidisciplinary Minor - I

Track		
Machine Learning	**Data Science**	**Management**
MDMC4011: Artificial Intelligence	**MDMC4021:** Statistical Foundation for Data Science	**MDMC4061:** Cost Management

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
ETC501	Digital Communication	PCC	3	--	--	3	--	--	3
ETC502	Computer Communication Networks	PCC	3	--	--	3	--	--	3
ETC503	Electromagnetics Engineering and Antenna	PCC	3	--	--	3	--	--	3
MDMC50X2	Multidisciplinary Minor-II (MDM-II)	MDM	3	--	--	3	--	--	3
ETPEC501X	Program Elective-I	PEC	3	--	--	3	--	--	3
ETL501	Digital Communication Lab	PCC	--	2	--	--	1	--	1
ETL502	Computer Communication Networks Lab	PCC	--	2	--	--	1	--	1
ETL503	Electromagnetics Engineering and Antenna Lab	PCC	--	2	--	--	1	--	1
ETL504	Interpersonal and Career Skills	AEC	--	2*+2	--	--	2	--	2
MDML50X1	Multidisciplinary Minor-II Lab/Tut (MDM-II Lab/Tut)	MDM	--	2[&]	--	--	1[&]	--	1
ETM501	Mini Project 2	Project	--	2[#]	--	--	1	--	1
Total			**15**	**14**	--	**14**	**7**	--	**22**

Examination Scheme - EXTC Semester V

Course Code	Course Name	Examination Scheme						
		Theory				CIAP	ESEP	Total
		Internal Assessment		ESE[$]	Exam Duration (Hrs.)			
		ISE	MSE					
ETC501	Digital Communication	20	20	60	3	--	--	100
ETC502	Computer Communication Networks	20	20	60	3	--	--	100
ETC503	Electromagnetics Engineering and Antenna	20	20	60	3	--	--	100
MDMC50X2	Multidisciplinary Minor-II (MDM-II)	20	20	60	3	--	--	100
ETPEC501X	Program Elective-I	20	20	60	3	--	--	100
ETL501	Digital Communication Lab	--	--	--	--	25	25	50
ETL502	Computer Communication Networks Lab	--	--	--	--	25	--	25
ETL503	Electromagnetics Engineering and Antenna Lab	--	--	--	--	25	25	50
ETL504	Interpersonal and Career Skills	--	--	--	--	50	--	50
MDML50X1	Multidisciplinary Minor-II Lab/Tut (MDM-II Lab/Tut)	--	--	--	--	25	--	25
ETM501	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 2A. Faculty Load: ½ hour per week per four groups
$ ESE of duration 3 hours are of 80 marks and scaled to 60. ESE duration of 2 hours is of 60 marks and scaled to 45.
& Tutorials only for management MDM (MDMC5062)
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 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
ESEP: End Semester Examination Practical.

Program Elective – I

Technology Bucket			
Electronics	**Communication and Networking**	**Security/ Block chain**	**Database Technology**
ETPEC5011: Controls and Sensor Technology	**ETPEC5012:** Internet of Things	**ETPEC5013:** Cryptography and Network Security	**ETPEC5014:** Data Structures and Algorithms

Multidisciplinary Minor - II

Track				
Machine Learning		**Data Science**		**Management**
MDMC5012: Machine Learning	**MDML5011:** Machine Learning Lab	**MDMC5022:** Data Analytics & Visualization	**MDML5021:** Data Analytics & Visualization Lab	**MDMC5062:** Supply Chain Management

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
ETC601	Discrete Signal and Image Processing	PCC	3	--	--	3	--	--	3
ETC602	Mobile Communication Systems	PCC	3	--	--	3	--	--	3
ETC603	Digital VLSI	PCC	3	--	--	3	--	--	3
MDMC60X3	Multidisciplinary Minor-III (MDM-III)	MDM	3	--	--	3	--	--	3
ETPEC601X	Program Elective-II	PEC	3	--	--	3	--	--	3
ETL601	Discrete Signal and Image Processing Lab	PCC	--	2	--	--	1	--	1
ETL602	Mobile Communication and Digital VLSI Lab	PCC	--	2	--	--	1	--	1
ETL603	Skill Lab - Cloud Computing	VSEC	--	2*+2	--	--	2	--	2
MDML60X2	Multidisciplinary Minor-III Lab/Tut (MDM-III Lab/Tut)	MDM	--	2&	--	--	1&	--	1
ETP601	Major Project I	MJP	--	4#	--	--	2	--	2
Total			**15**	**14**	--	**15**	**7**	--	**22**

Examination Scheme - EXTC Semester VI

Course Code	Course Name	Examination Scheme						
		Theory				CIAP	ESEP	Total
		Internal Assessment		ESE$	Exam Duration (Hrs.)			
		ISE	MSE					
ETC601	Discrete Signal and Image Processing	20	20	60	3	--	--	100
ETC602	Mobile Communication Systems	20	20	60	3	--	--	100
ETC603	Digital VLSI	20	20	60	3	--	--	100
MDMC60X3	Multidisciplinary Minor-III (MDM-III)	20	20	60	3	--	--	100
ETPEC601X	Program Elective-II	20	20	60	3	--	--	100
ETL601	Discrete Signal and Image Processing Lab	--	--	--	--	25	--	25
ETL602	Mobile Communication and Digital VLSI Lab	--	--	--	--	25	25	50
ETL603	Skill Lab - Cloud Computing	--	--	--	--	25	25	50
MDML60X2	Multidisciplinary Minor-III Lab/Tut (MDM-III Lab/Tut)	--	--	--	--	25	--	25
ETP601	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 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.

& Tutorials only for management MDM (MDMC6063)

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 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

ESEP: End Semester Examination Practical.

Program Elective – II

Technology Bucket			
Electronics	**Communication and Networking**	**Security/ Block chain**	**Database Technology**
ETPEC6011: Embedded Systems	**ETPEC6012:** Error Control Codes	**ETPEC6013:** IT Infrastructure and Security	**ETPEC6014:** Database Management Systems

Multidisciplinary Minor - III

Track				
Machine Learning		**Data Science**		**Management**
MDMC6013: Natural Language Processing	**MDML6012:** Natural Language Processing Lab	**MDMC6023:** Decision Making & Business Intelligence	**MDML6022:** Decision Making & Business Intelligence Lab	**MDMC6063:** Organizational Behaviour and Human Resource Management

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.	Tut.	Total
ETC701	Microwave and Radar Engineering	PCC	3	--	--	3	--	--	3
MDMC70X4	Multidisciplinary Minor-IV (MDM-IV)	MDM	3	--	--	3	--	--	3
ETPEC701X	Program Elective-III	PEC	3	--	--	3	--	--	3
ETPEC702X	Program Elective-IV	PEC	3	--	--	3	--	--	3
OEC701X	Open Elective-I	OE	3	--	--	3	--	--	3
ETL701	Microwave and Radar Engineering Lab	PCC	--	2	--	--	1	--	1
MDML70X3	Multidisciplinary Minor-IV Lab/Tut (MDM-IV Lab/Tut)	MDM	--	2[&]	--	--	1[&]	--	1
ETPEL701X	Program Elective-III Lab	PEC	--	2	--	--	1	--	1
ETP701	Major Project II	MJP	--	4[#]	--	--	2	--	2
Total			**15**	**8**	--	**15**	**5**	--	**20**

Examination Scheme - EXTC Semester VII

Course Code	Course Name	Examination Scheme						
		Theory				CIAP	ESEP	Total
		Internal Assessment		ESE[$]	Exam Duration (Hrs.)			
		ISE	MSE					
ETC701	Microwave and Radar Engineering	20	20	60	3	--	--	100
MDMC70X4	Multidisciplinary Minor-IV (MDM-IV)	20	20	60	3	--	--	100
ETPEC701X	Program Elective-III	20	20	60	3	--	--	100
ETPEC702X	Program Elective-IV	20	20	60	3	--	--	100
OEC701X	Open Elective-I	20	20	60	3	--	--	100
ETL701	Microwave and Radar Engineering Lab	--	--	--	--	25	25	50
MDML70X3	Multidisciplinary Minor-IV Lab/Tut (MDM-IV)	--	--	--	--	25	25	50
ETPEL701X	Program Elective-III Lab	--	--	--	--	25	--	25
ETP701	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.
& Tutorials only for management MDM (MDMC7064)
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 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
ESEP: End Semester Examination Practical.

Program Elective-III

Technology Bucket			
Electronics	**Communication and Networking**	**Security/ Block chain**	**Database Technology**
ETPEC7011: Mixed VLSI	**ETPEC7012:** Wireless Sensor Networks	**ETPEC7013:** Cyber Security and Ethical Hacking	**ETPEC7014:** Advanced Database Management

Program Elective-IV

Technology Bucket			
Electronics	**Communication and Networking**	**Security/ Block chain**	**Database Technology**
ETPEC7021: Robotics	**ETPEC7022:** Satellite and Nano Satellite Communication	**ETPEC7023:** Intelligent Forensics	**ETPEC7024:** Web Technology

Multidisciplinary Minor - III

Track				
Machine Learning		**Data Science**		**Management**
MDMC7014: Deep Learning	**MDML7013:** Deep Learning Lab	**MDMC7024:** Big Data Analytics	**MDML7023:** Big Data Analytics Lab	**MDMC7064:** Marketing Management

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.	Tut.	Total
ETC801	Research Methodology	RM	3	-	--	3	-	--	3
OEC801X	Open Elective-II	OE	3	--	--	3	--	--	3
ETP801	Major Project III	MJP	--	2#	--	--	1	--	1
ETINT801	Internship/Project/Research	Internship	--	--	--	--	12	--	12
Total			**6**	**2**	--	**6**	**13**	--	**19**

Examination Scheme - EXTC Semester-VIII

Course Code	Course Name	Examination Scheme						
		Theory				CIAP	ESEP	Total
		Internal Assessment		ESE$	Exam Duration (Hrs.)			
		ISE	MSE					
ETC801	Research Methodology	20	20	60	3	--	--	100
OEC801X	Open Elective-II	20	20	60	3	--	--	100
ETP801	Major Project III	--	--	--	--	100	50	150
ETINT801	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

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 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

ESEP: End Semester Examination Practical.

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

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 & Visualization	MDMC5022	
				Data Analytics & Visualization Lab	MDML5021	
			TE/VI	Decision Making & Business Intelligence	MDMC6023	
				Decision Making & 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	RTOs and Embedded systems	MDMC5032	
				RTOs and Embedded systems 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 & Network Security	MDMC5042	
				Cryptography & 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	SIESSBS	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
FEC101	Applied Mathematics-I	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE$			
		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$			
		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

Module 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 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$			
		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 Aloys – 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 Gowarikar, 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$			
		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. Kamakshaiah "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$			
		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$			
		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 **4.2**	Motion of particle with variable acceleration, Motion Curve. 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, Gripers 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& Raw 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 Bools
6. Engineering Mechanics (Dynamics) by Meriam and Kraige, Wiley Bools
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:

The term work will consist of 10 experiments. Term work will be assessed as Continuous Internal Assessment Practical (CIAP).

Term work Marks:

25 Marks (Total Marks) = 20 Marks (Experiment) + 05 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:

The term work will consist of 10 experiments. Term work will be assessed as Continuous Internal Assessment Practical (CIAP).

Term work Marks:

25 Marks (Total Marks) = 20 Marks (Experiment) + 05 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:
The term work will consist of 10 experiments. Term work will be assessed as Continuous Internal Assessment Practical (CIAP).
Term work Marks:
25 Marks (Total Marks) = 20 Marks (Experiment) + 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!+……+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:
The term work will consist of 15 experiments. Term work will be assessed as Continuous Internal Assessment Practical (CIAP).
Term work Marks:
25 Marks (Total Marks) = 20 Marks (Experiment) + 05 Marks (Attendance)

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:
The term work will consist of 10 experiments. Term work will be assessed as Continuous Internal Assessment Practical (CIAP).

Term work Marks:
25 Marks (Total Marks) = 20 Marks (Experiment) + 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 Jobon 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:

7. Project-based activities.
8. Presentation, Group Discussions, and Case studies.
9. Flip class mode/ Roleplay
10. Quiz MCQ
11. Assignment as per the modules: 06
12. 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:
1. To explore a holistic perspective of oneself, family, society, and nature through self-exploration.
2. To understand the concept of harmony within the individual, family, society, and nature.
3. To reflect on personal values and beliefs to strengthen self-awareness.
4. To commit to taking actions that align with universal human values with courage and integrity.
5. To prepare oneself to reach full human potential and contribute to an equitable, just society and national development.
6. 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
1. Recognize basic human aspirations and develop a plan to fulfill them.
2. Describe the existing reality of a human being.
3. Explain human values and relationships and outline a program to ensure mutual happiness.
4. Illustrate harmony within one's surroundings, family, and society.
5. 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 linkhttps://nptel.ac.in/courses/109104068
3. NPTEL Course: Moral Thinking: An Introduction to Values and Ethics by Prof. Vineet Sahu, IIT Kanpur: -Web linkhttps://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).

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$			
		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**	**10**

		Rectification:	
	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$			
		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

Module 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$			
		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 Aloys – 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 Gowarikar, 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	Course Name	Teaching Scheme	Credits Assigned

Code		(Hrs.)						
		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$^{\$}$			
		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, Involutes.	
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$			
		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
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	Course Name	Teaching Scheme	Credits Assigned

Code		(Hrs.)						
		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$			
		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:
The term work will consist of 10 experiments. Term work will be assessed as Continuous Internal Assessment Practical (CIAP).

Term work Marks:
25 Marks (Total Marks) = 20 Marks (Experiment) + 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:
The term work will consist of 10 experiments. Term work will be assessed as Continuous Internal Assessment Practical (CIAP).

Term work Marks:
25 Marks (Total Marks) = 20 Marks (Experiment) + 05 Marks (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:

The term work will consist of 10 experiments. Term work will be assessed as Continuous Internal Assessment Practical (CIAP).

Term work Marks:

25 Marks (Total Marks) = 10 Marks (AutoCAD Experiments) + 10 Marks (Sketchbook Experiments) + 05 Marks (Attendance)

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. 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 ensure satisfactory performance of laboratory work and minimum passing marks in term work.

Practical Exam: (2 hours/ 25 Marks)

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

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
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:

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, S wing 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 Swing Application, 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.
2. 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:

The term work will consist of 15 experiments. Term work will be assessed as Continuous Internal Assessment Practical (CIAP).

Term work Marks:

25 Marks (Total Marks) = 15 Marks (Experiment) + 05 Marks(Mini-Project) + 05 Marks (Attendance)

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 forTermWorkinagroupof4students	

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 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, agricu 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, Kauṭilyan 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, Subrahmanyan 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
ETC301	Applied Mathematics-III	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE			
		ISE	MSE				
ETC301	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
5. PO11: Life-long Learning

Course Objectives:

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

Course Outcomes:

After successful completion of the course student will be able to

1. Apply the properties of Laplace&Inverse Laplace transform to the functions.
2. Construct the Fourier series of periodic functions for real life problems and complex engineering problems.
3. Apply the concept of complex numbers, complex functions, and their significance in data science and engineering.
4. Evaluate the strength and direction of relationships between variables using correlation and Regression techniques.
5. Apply the concepts of probability and expectation for getting the spread of the data and distribution of the data.
6. Apply the concept of probability distribution to engineering problems.

Module No.	Unit No.	Topics	Hrs.	CO
1.0		**Laplace and Inverse Laplace Transforms**	**10**	
	1.1	Definition of Laplace transform, Laplace Transform(L) of Standard Functions.		**CO1**
	1.2	Properties of Laplace Transform: First shifting theorem, Change of Scale property, Multiplication by t, Division by t, Laplace Transform of derivatives (with proof) and integrals (without proof).		
	1.3	Evaluation of integrals using Laplace Transformation.		
	1.4	Inverse Laplace Transform: Introduction. Methods of finding Inverse Laplace Transform, using standard results, use of differentiation of f(s), Partial fraction method and convolution.		
		Self-learning Topics: Applications to solve ordinary differential equations.		
2.0		**Fourier Series**	**07**	
	2.1	Dirichlet's conditions, Definition of Fourier series.		**CO2**
	2.2	Fourier series of periodic functions with period 2π *and* $2l$.		
	2.3	Fourier series of even and odd functions. (No examples on Parseval Identity)		
	2.4	Half range Sine and Cosine Series.		
		Self-learning Topics: Complex form of Fourier Series, Orthogonal and orthonormal set of functions. Fourier Transform.		
3.0		**Complex Variables**	**06**	
	3.1	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).		**CO3**
	3.2	Cauchy-Riemann equations in cartesian coordinates (without proof).		
	3.3	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.		
	3.4	Harmonic function, Harmonic conjugate, and orthogonal trajectories		
		Self-learning Topics: Conformal mapping, linear, bilinear mapping, cross ratio, fixed points, and standard transformations.		
4.0		**Statistical Techniques**	**05**	
	4.1	Karl Pearson's Coefficient of correlation (r) and related concepts with problems.		**CO4**
	4.2	Spearman's Rank correlation coefficient (R) (Repeated & non repeated ranks problems).		
	4.3	Lines of regression.		
		Self-learning Topics: Covariance.		
5.0		**Probability Theory**	**06**	
	5.1	Total Probability theorem and Bayes' theorem.		**CO5**
	5.2	Discrete and continuous random variable with probability distribution and probability density function.		
	5.3	Expectation, Variance, Laws of expectation.		
	5.4	Moment generating function, Raw and central moments up to 4th order.		

		Self- learning Topics: Skewness and Kurtosis of distribution (data).		
6.0		**Probability Distributions**	**05**	
	6.1	Revision of Binomial Distribution.		**CO6**
	6.2	Poisson Distribution.		
	6.3	Normal Distribution.		
		Self- learning Topics: Central Limit theorem and its application.		
		Total	**39**	

Textbooks:

1. Higher Engineering Mathematics, Dr. B. S. Grewal, Khanna Publication, 5th edition
2. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley Eastern Limited, 10th Edition 2023-24.

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:

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

End Semester Examination

ESE is of duration 03 hours and 80 marks and will be scaled down to 60.
The question paper will comprise of 03 questions.
Question1(20 marks): - Solve any 04 out of 06. All questions carry 05 marks each.
Question 2 (40 marks): - Solve any 04 out of 06. All questions carry 10 marks each.
Question3(20 marks):- Solve any 04 out of 06. All questions carry 05 marks each.
All COs should be mapped as per the weightage in the syllabus.

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
ETC302	Electronic Devices and circuits	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE$			
		ISE	MSE				
ETC 302	Electronic Devices and circuits	20	20	60	--	--	100

Course pre-requisite:

1. FEC1021:Applied Physics
2. FEC103: Basic Electrical Engineering

Program Outcomes addressed:

1. PO1: Engineering knowledge
2. PO2: Problem analysis
3. PO3: Design and Development of Solution
4. PO12: Lifelong Learning
5. PSO1: Achieve eminence in domains like signal processing, VLSI, embedded IOT, RF &microwave

Course Objectives:

1. To understand physical operation of semiconductor devices.
2. To perform DC and AC analysis of BJT and MOSFET amplifier circuits.
3. To analyze frequency response of single stage and multistage amplifiers.
4. To compare small signal and large signal amplifiers.

Course Outcomes:

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

1. Explain working of various electronics devices with the help of V-I characteristics.
2. Design DC biasing circuits and evaluate the performance parameters of BJT amplifier.
3. Design DC biasing circuits and evaluate the performance parameters of MOSFET amplifier.
4. Evaluate frequency response of BJT and MOSFET amplifier.
5. Analyze multistage BJT, MOSFET amplifiers and derive their performance parameters.
6. Analyze various power amplifier circuits.

Module No.	Unit No.	Topics	Hrs.	CO
1.0		**Introduction to Semiconductor Devices**	06	CO1
	1.1	PN junction diode characteristics, diode current equation, working of Zener diode, Application of Zener diode as voltage regulator		
	1.2	Construction, working, characteristics of BJT, JFET, MOSFET		
		Self learning: Application of Diode: Clipper, Clamper, Rectifier		

2.0		**DC and small signal analysis of BJT amplifier circuits**	**05**	**CO2**
	2.1	Concept of DC load line, Q point and regions of operations, Analysis and design of biasing circuits for BJT (Fixed bias & Voltage divider Bias)		
	2.2	AC load line, Introduction to hybrid-pi model		
	2.3	Small signal analysis of CE amplifier using hybrid pi model. (Zi, Zo, Av and Ai)		
		Self-learning: BJT collector to base bias, emitter follower bias, re-model, hybrid model.		
3.0		**DC and small signal analysis of MOSFETamplifier circuits**	**10**	**CO3**
	3.1	DC load line and region of operation for MOSFETs. Analysis and designof biasing circuits for E-MOSFET (Drain-to-Gate bias & voltage divider bias).		
	3.2	Small signal analysis of CS amplifiers using hybrid pi model (Zi, Zo, Av)		
		Self learning: PMOS/NMOS circuits and logic-gates, Basic commercial audio amplifier (Eg: TI INA1620)		
4.0		**Frequency Response of small signal amplifiers**	**10**	**CO4**
	4.1	Effects of coupling, bypass capacitors and parasitic capacitors on frequency response of single stage amplifier, Miller effect and Miller capacitance		
	4.2	low frequency analysis of CE & CS (EMOSFET)amplifier		
	4,3	High frequency analysis of CE & CS (EMOSFET)amplifier		
		Self learning: Frequency analysis of CB, CC, CG, CD amplifier		
5.0		**Multistage amplifiers**	**04**	**CO5**
	5.1	Introduction to multistage amplifier, Gain bandwidth product		
	5.2	Mid frequency analysis of multistage amplifier CE-CE		
	5.3	Mid frequency analysis of multistage amplifier CS-CS		
		Self learning: Cascode amplifier (CE-CB), (CS-CG), Darlington pair		
6.0		**Large Signal Amplifiers**	**04**	**CO6**
	6.1	Difference between small signal & large signal amplifiers. Classification and working of Power amplifier		
	6.2	Analysis of Class A power amplifier (Series fed and transformer coupled).		
	6.3	Transformer less Amplifier: Class B power amplifier. Class AB output stage with diode biasing		
	6.4	Thermal considerations and heat sinks.		
		Self learning: Class C amplifier, Basic commercial power amplifier (Eg: TI OPA549)		
		Total	**39**	

Text books:

1. D. A. Neamen, "Electronic Circuit Analysis and Design," Tata McGraw Hill, 2nd Edition.
2. A. S. Sedra, K. C. Smith, and A. N. Chandorkar, "Microelectronic Circuits Theory and Applications" International Version, OXFORD International Students, 6th Edition.
3. Franco, Sergio. Design with operational amplifiers and analog integrated circuits. Vol. 1988. New York: McGraw-Hill, 2002.

References:

1. Boylestad and Nashelesky, "Electronic Devices and Circuits Theory," Pearson Education, 11th Edition.
2. A. K. Maini, "Electronic Devices and Circuits," Wiley.
3. T. L. Floyd, "Electronic Devices,"Prentice Hall, 9th Edition, 2012.
4. S. Salivahanan, N. Suresh Kumar, "Electronic Devices and Circuits", Tata Mc-Graw Hill, 3rd Edition.
5. Bell, David A. Electronic devices and circuits. Prentice-Hall of India, 1999.

Online References:

1. Course: Analog Electronic Circuit By Prof. Shouribratachatterjee (IIT Delhi); https://swayam.gov.in/nd1_noc20_ee89/preview

Course Assessment:

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

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

End Semester Examination:
$ ESE of duration 03 hours are of 80 marks and scaled to 60.

1. 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 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
ETC303	Microprocessor and Microcontroller	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE$			
		ISE	MSE				
ETC 303	Microprocessor and Microcontroller	20	20	60	--	--	100

Pre-requisites

1. FEC 204: Digital system design

Program Outcomes addressed:

1. PO1: Engineering knowledge
2. PO2: Problem analysis
3. PO12: Lifelong Learning
4. PSO1: Achieve eminence in domains like signal processing, VLSI, embedded IOT, RF & microwave

Course Objectives:

1. To equip students with the fundamental knowledge and basic technical competence in the field of Microprocessors and microcontroller.
2. To understand architecture of 8086 and 8051.
3. To emphasize on instruction set and logic to build assembly language programs.
4. To prepare students for higher processor / Controller architectures.

Course Outcomes:

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

1. Describe core concepts of 8086 microprocessor.
2. Apply the instructions of 8086 and write assembly language programs.
3. Explain the architecture of advanced processors.
4. Describe core concepts of 8051 microcontroller.
5. Apply the instructions of 8051 and write assembly language programs.
6. Explain the architecture of advanced controller.

Module No.	Unit No.	Topics	Hrs.	CO
1.0		**The Intel Microprocessors 8086 architecture**	**08**	**CO1**
	1.1	8086 CPU Architecture, Functional Pin Diagram		
	1.2	Programmer's Model		
	1.3	Memory Segmentation, Banking in 8086		
	1.4	De-multiplexing 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,		
	3.2	Pentium Architecture		
	3.3	Superscalar Operation		
	3.4	Integer &Floating-Point Pipeline Stages,		
	3.5	Branch Prediction Logic		
	3.6	Cache Organization		
	3.7	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 , Assembler Directives		
	5.2	Programs related to: arithmetic, logical, delay subroutine , input, output, timer, counters, port, serial communication, and interrupts ,Interfacing with LEDs		
		Self learning: Serial communication UART, I2C Protocol		

6.0		**ARM7**	**06**	**CO6**
	6.1	Introduction & Features of ARM 7		
	6.2	Concept of Cortex-A, Cortex-R and Cortex-M		
	6.3	Architectural inheritance, Pipelining		
	6.4	Programmer's model		
	6.5	Brief introduction to exceptions and interrupts handling		
		Self learning: Instruction set		
		Total	**39**	

Textbooks:

1. K. M. Bhurchandani and A. K. Ray, "Advanced Microprocessors and Peripherals", McGraw Hill, 3rd Edition.
2. John Uffenbeck, "8086/8088 family: Design Programming and Interfacing", PHI, Eastern Economy Edition.
3. M. A. Mazidi, J. G. Mazidi and R. D. Mckinlay, "The 8051 Microcontroller & Embedded systems", Pearson Publications, 2nd Edition2006
4. C. Kenneth J. Ayala and D. V. Gadre, "The 8051 Microcontroller & Embedded system using assembly & 'C' ", Cengage Learning, Edition 2010
5. Steve Furber, "ARM System on chip Architecture", Pearson, 2nd Edition

Reference books:

1. Douglas V Hall, SSSP Rao "Microprocessors & Interfacing", McGraw Hill, 2nd Edition
2. "MCS@51 Microcontroller, Family User's Manual" Intel, order no:272383-002, February 1994.
3. James Antonakons," The Pentium Microprocessor ", Pearson Education, 1st Edition,
4. Barry B Brey, "Intel Microprocessors", PEI, 8th Edition
5. James A. Langbridge, "Professional Embedded Arm Development", Wrox, John Wiley Brand& Sons Inc., Edition 2014

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

Course Assessment:-

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

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

End Semester Examination:

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

1. The question paper will comprise of 03 questions.
2. Question 1(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. Question 3(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
ETC304	Network Theory	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE$			
		ISE	MSE				
ETC304	Network Theory	20	20	60	--	--	100

Pre-requisite:

1. FEC103: Basic Electrical and Electronics Engineering

Program Outcomes addressed:

1. PO1: Engineering knowledge
2. PO2: Problem analysis
3. PO5:Modern tool Usage
4. PSO1: Achieve eminence in domains like signal processing, VLSI, embedded IOT, RF and microwave

Course Objectives:

1. To evaluate the Circuits using network theorems.
2. To analyze the Circuits in time and frequency domain.
2. To analyze Electrical Network using Graph Theory.
3. To synthesize passive network by various methods.

Course Outcomes:

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

1. Analyze Circuits by using network theorems.
2. Apply network topology for analyzing the circuit
3. Apply the time and frequency method of analysis.
4. Analyze Electrical Networks using network functions
5. Find the various network parameters for representation of two port network.
6. Synthesize the network using passive elements.

Module No.	Topics	Hrs.	CO
1.0	**Electrical circuit analysis**	**08**	**CO1**
	Circuit Analysis: Analysis of Circuits with and without dependent sources using generalized loop and node analysis, super mesh and super node analysis technique Circuit Theorems: Superposition, Thevenin's, Norton's and Maximum Power Transfer Theorems (Use only DC source).		
	Self learning: Simulation of circuits using SPICE/P SPICE or any open source simulation tools		
2.0	**Graph Theory**	**06**	**CO2**
	Objectives of graph theory, Linear Oriented Graphs, graph terminologies Matrix representation of a graph: Incidence matrix, Circuit matrix, Cut-set matrix, reduced Incident matrix, Tieset matrix, f-cutset matrix. Relationship between sub matrices A, B & Q.		
	Self learning: Application of graph theory in electrical networks.		
3.0	**Time and frequency domain analysis**	**07**	**CO3**
	Time domain analysis of R-L and R-C Circuits: Forced and natural response, initial and final values. Solution using first order and second order differential equation with step signals. Frequency domain analysis of R-L-C Circuits using Laplace T: Forced and natural response, effect of damping factor. Solution using second order equation for step signal		
	Self learning: Transient behavior of an air conditioner, Mechanical equivalents of circuit elements		
4.0	**Network functions**	**06**	**CO4**
	Network functions for the one port and two port networks, driving point and transfer functions, Poles and Zeros of Network functions, necessary condition for driving point functions, necessary condition for transfer functions, testing for Hurwitz polynomial.		
	Self learning: Network function for stability analysis		
5.0	**Two port Networks**	**05**	**CO5**
	Parameters: Open Circuits(Z), short Circuit(Y), Transmission(ABCD) and Hybrid parameters(h), relationship among parameters, conditions for reciprocity and symmetry. Interconnections of Two-Port networks T & π representation		
	Self learning: Analysis of common emitter amplifier using two-port parameters.		
6.0	**Synthesis of RLC circuits**	**07**	**CO6**
	Positive Real Functions: Test for Positive real Functions. LC, RC & RL network Synthesis in Cauer-I &Cauer-II , Foster-I & Foster-II forms		
	Self learning: Signal Processing Filters, Impedance Matching Networks.		
	Total	**39**	

Textbooks:

1. M E Van Valkenburg, "Network Analysis", Prentice-Hall of India Pvt Ltd, New Delhi, 26th Indian Reprint, 2000.
2. Franklin F Kuo, "Network Analysis and Synthesis", Wiley Toppan, 2nd Edition.
3. Network Analysis and Synthesis, K. M. Soni, S. K. Kataria and Sons, 10th Edition.
4. Ravish R Singh." Network Analysis and Synthesis", McGraw Hill, 2nd Edition.

Reference books:

1. A. Chakrabarti, "Circuit Theory", Dhanpat Rai & Co., Delhi, 6th Edition.
2. A. Sudhakar, Shyammohan S. Palli "Circuits and Networks", Tata McGraw-Hill Education, 5th Edition.
3. Smarajit Ghosh "Network Theory Analysis & Synthesis", PHI learning, 1st Edition.
4. K.S. Suresh Kumar, "Electric Circuit Analysis" Pearson, 2013.
5. D. Roy Choudhury, "Networks and Systems", New Age International, 1998.

Online References:

1. NPTEL/Swayam Course: Basic Electrical Circuits by Prof. Nagendra Krishnapura (IIT Madras): https://swayam.gov.in/nd1_noc20_ee64/preview
2. NPTEL/Swayam Course: Network Analysis by Prof. Prof. Tapas Kumar Bhattacharya (IIT Kharagpur): https://onlinecourses.nptel.ac.in/noc20_ee46/preview

Course Assessment:

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

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

End Semester Examination:
$ ESE of duration 03 hours are of 80 marks and scaled to 60.

1. 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 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
ETC305	Signals and Systems	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE$			
		ISE	MSE				
ETC305	Signals and Systems	20	20	60	--	--	100

Prerequisite:

1. ETC301: Engineering Mathematics III

Program Outcomes addressed:

1. PO1: Engineering knowledge
2. PO2: Problem analysis
3. PO12: Lifelong Learning
4. PSO1: Achieve Eminence in domains like signal processing, VLSI, embedded IoT, RF & Microwave.

Course Objectives:

1. To introduce students to the idea of signal and system analysis and characterization in time and frequency domains.
2. To provide foundation of signal and system concepts to areas like communication systems, control systems, digital signal processing and image processing.

Course Outcomes:

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

1. Classify and analyze different types of signals.
2. Classify and analyze different types of systems.
3. Analyze continuous time and discrete time systems in the time domain.
4. Analyze continuous time and discrete time signals and systems in frequency domain using Fourier transform.
5. Analyze continuous time signals and systems in s- domain using Laplace transform.
6. Analyze discrete time signals and systems in the z- domain using z- transform.

Module No.	Unit No.	Topics	Hrs.	COs
1.0		**Introduction to signals**	**05**	**CO1**
	1.1	Introduction to Signals: Definition, Basic elementary signals: exponential, sine, step, impulse, ramp, rectangular, triangular, signum, sinc and $sinc^2$.		
	1.2	Classification of Signals: continuous and discrete time signals, analog and digital signals, even and odd signals, periodic and non-periodic signals, deterministic and non-deterministic signals, energy and power signals.		
	1.3	Mathematical operation on continuous and discrete time signals.		
		Self learning: Investigate the real-world applications of signals in communication systems:		
2.0		**Introduction to systems**	**06**	**CO2**
	2.1	Classification of systems: System representation, continuous time and discrete systems, systems with and without memory, causal and non-causal systems, linear and nonlinear systems, time invariant and time variant systems, stable and unstable systems, feedback and non-feedback systems.		
		Self learning: Applications of systems in communication, control and signal processing.		
3.0		**Time domain analysis of Continuous Time and Discrete Time systems**	**08**	**CO3**
	3.1	Linear Time Invariant (LTI) systems: Representation of systems using differential /difference equation, Impulse, step and exponential response, System stability and causality.		
	3.2	Use of convolution integral and convolution sum for analysis of LTI systems, properties of convolution integral/sum, impulse response of interconnected systems.		
	3.3	Sums on linear and circular convolutions.		
		Self learning: Applications of time domain analysis in communication, control and signal processing.		
4.0		**Analysis of Continuous and Discrete Time Signals and Systems using Fourier Transform**	**06**	**CO4**
	4.1	Fourier transform of periodic and non-periodic functions, Properties of Fourier transform, Inverse Fourier transform, Frequency response: computation of magnitude and phase response, Limitations of Fourier transform.		
	4.2	Applications of Fourier transform in communication systems		
		Self learning: Proof of Fourier transform properties.		
5.0		**Analysis of Continuous time LTI systems using Laplace Transform**	**06**	**CO5**
	5.1	Need of Laplace transform, Concept of Region of Convergence, Properties of Laplace transform, Relation between continuous time Fourier transform and Laplace transform, unilateral Laplace transform, inverse Laplace transform.		
	5.2	Analysis of continuous time LTI systems using Laplace transform: Causality and stability of systems in s-domain, Total response of a system.		
		Self learning: Proof of Laplace transform properties.		
6.0		**Analysis of Discrete time LTI systems using z-Transform**	**08**	**CO6**

	6.1	Need of z-transform, z-transform of finite and infinite duration sequences, Concept of Region of Convergence, z-transform properties, Standard z-transform pairs, relation between z-transform and discrete time Fourier transform, one sided z-transform, and inverse z-transform: Partial fraction method only.		
	6.2	Analysis of discrete time LTI systems using z-transform: Systems characterized by linear constant coefficient difference equation, transfer function, plotting poles and zeros of a transfer function, causality and stability of systems, total response of a system.		
		Self learning: Proof of z-transform Properties.		
		Total	**39**	

Textbooks:

1. Nagoor Kani, Signals and Systems, Tata McGraw Hill, Third Edition.
2. Rodger E Ziemer, William H. Tranter and D. Ronald Fannin, Signals and Systems, Pearson Education, Fourth Edition.
3. Alan V. Oppenhiem, Alan S. Willsky and S. Hamid Nawab, Signals and Systems, Prentice-Hall of India, Second Edition.
4. Simon Haykin and Barry Van Veen, Signals and Systems, John Wiley and Sons, Second Edition.

Reference books:

1. Hwei. P Hsu, Signals and Systems, Tata McGraw Hill, Third Edition.
2. Simon Haykin and Barry Van Veen, Signals and Systems, John Wiley and Sons, Second Edition.
3. V. Krishnaveni and A. Rajeshwari, Signals and Systems, Wiley-India, First Edition.
4. Michael J Roberts, Fundamentals of Signals and systems, Tata McGraw Hill, Indian Edition.

Online References:

1. Signals and Systems Laboratory: Virtual Laboratory http://ssl-itg.vlabs.ac.in/
2. Principles of Signals & Systems By Prof. Aditya K. Jagannatham (IIT Kanpur); https://swayam.gov.in/nd1_noc20_ee15/preview

Course Assessment:

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

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

End Semester Examination:
$ ESE of duration 03 hours are of 80 marks and scaled to 60.

1. The question paper will comprise of 03 questions.
2. Question 1(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. Question 3(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
ETC306	Engineering Economics	02	--	--	02	--	--	02

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE$			
		ISE	MSE				
ETC306	Engineering Economics	50		--	--	--	50

Pre-requisite :
Principles of Basic Mathematics

Program Outcomes addressed:

1. PO1: Engineering knowledge.
2. PO2: Problem analysis.
3. PO11: Project Management and Finance.

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

1. Define the basic concept of micro and macroeconomics, engineering economics and their application in engineering economy.
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.		
	2.2	**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**	**CO5**
	5.1	**Time Value of Money -** Interest - Simple and compound, nominal and effective rate of interest, Cash flow diagrams, Principles of economic equivalence.		
	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**	**CO6**
	6.1	**Money and Interest Rates -** The Evolution of Money, Functions of Money, Interest rates, Price of Money, Demand for money.		
	6.2	**Banking and the supply of money** - Banking definition, Types of Banks, Banking as as a business, The process of Deposits creations.		
	6.3	**Financial Economics** - Financial assets, Risk and return on different assets, The stock market, Personal financial strategies.		
		Self learning: The evolution of financial market.		
		Total	**26**	

Textbooks:

1. Paul A. Samuelson and William D. Nordhaus, “Economics”,Tata McGraw Hill, 20th edition, 2019.
2. "Engineering Economy" by Leland Blank and Anthony Tarquin, 9th edition, 2024.

Reference books:

1 "Introduction to Engineering Economics" by John V. O'Connor, 5th edition, 2013.
2 W S Jawadekar, “Management Information Systems”, Tata McGraw Hill, 6th edition, 2020.
3 "Fundamentals of Engineering Economics" by Chan S. Park,4th edition, 2018.

Online References:

1 https://www.mheducation.com/highered/product/Engineering-Economy-Blank.html
2 https://archive.org/details/engineeringecono0000blan_t5b6

Course Assessment:

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

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
ETL301	Electronic Devices & Circuits Lab	--	02	--	--	01	--	01

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE			
		ISE	MSE				
ETL301	Electronic Devices & Circuits Lab	--	--	--	25	25	50

Pre-requisite:

1. FEL102: Basic Electrical & Electronics Engineering Lab

Program Outcomes addressed:

1. PO1: Engineering knowledge
2. PO2: Problem analysis
3. PO3: Design and Development of Solution
4. PO5: Modern tool usage
5. PO9:Indiviual and Team work
6. PO12: Lifelong Learning
7. PSO1:Achieve eminence in domains like signal processing, VLSI, embedded IOT, RF & microwave.

Lab Objectives:

1. To introduce various lab equipments and measuring instruments used to perform Electronics Devices and Circuits laboratory work
2. Understand the basic principles of semiconductor physics and how they influence the behavior of devices
3. To assess the impact of biasing on the transistor's performance
4. Investigate the design principles of various amplifiers

Lab Outcomes:

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

7. Understand the use of various equipments, electronics devices and components, and measuring instruments used to perform laboratory work and simulation.
8. Analyze and understand the electrical characteristics and behavior of semiconductor devices.
9. Analyze DC biasing circuits of BJT/MOSFET.
10. Analyze the performance of single stage and multistage amplifiers.
11. Analyze power amplifier circuit.

Suggested List of Experiments:		
Sr.No.	**Title of Experiments**	**LO**
1	Obtain characteristics and measure internal parameters of PN junction diode.	LO1,2
2	Investigate the Use of a Zener Diode as a Voltage Regulator for Stabilizing Output Voltage	LO1,2
3	Practical Analysis of BJT Characteristics and Evaluation of internal parameters	LO1,2
4	Practical Analysis of JFET Characteristics and Evaluation of internal parameters	LO1,2
5	Practical Analysis of MOSFET Characteristics and Evaluation of internal parameters.	LO1,2
6	Design and Analyse BJT Biasing Circuit and measure its operating point	LO1,3
7	Design and Analyse MOSFET Biasing Circuit and measure its operating point	LO1,3
8	Performance Analysis of BJT in Common Emitter Configuration for Amplification Applications	LO1,4
9	Frequency response analysis of BJT common emitter amplifier for performance evaluation across different frequencies	LO1,4
10	Performance Analysis of MOSFET in Common source Configuration for Amplification Applications	LO1,4
11	Frequency response analysis of MOSFET common source amplifier for performance evaluation across different frequencies	LO1,4
12	Performance Analysis of CE-CE BJT two stage amplifier.	LO1,4
13	Performance Analysis of CS-CS MOSFET two stage amplifier.	LO1,4
14	Performance Analysis of Cascode amplifier.	LO1,4
15	Comprehensive Study and Performance Analysis of Class A Power Amplifier.	LO1,5
16	Comprehensive Study and Performance Analysis of Class B Power amplifier.	LO1,5

Software Tools:
Before starting the experiments there should be one session on study of development tools like Tina Pro, LT Spice, Virtual Lab, Multi SIM etc. Computation/ Simulation based experiments are also encouraged**.**

Term Work:
The term work should include 8 experiments: 5 hardware experiments, and 3 using simulators or virtual labs. At least 02 assignments covering the entire syllabus must be given on the content of theory and practicals of "Electronic Devices & Circuits". 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) = 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
ETL302	Microprocessor and Microcontroller Lab	--	02	--	--	01	--	01

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE			
		ISE	MSE				
ETL302	Microprocessor and Microcontroller Lab	--	--	--	25	25	50

Pre-requisite:

1. FEL 203: Digital System Design Lab

Program Outcomes addressed:

1. PO1: Engineering knowledge
2. PO2: Problem analysis
3. PO5: Modern tool usage
4. PO12: Lifelong Learning
5. PSO1: Achieve eminence in domains like signal processing, VLSI, embedded IOT, RF & microwave.

Lab Objectives:

1. To emphasize the use of Assembly language program.
2. To equip students with the skills to program microprocessors and microcontrollers.

Lab Outcomes:

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

1. Demonstrate different development tools of microprocessor and microcontroller based systems
2. Develop the program in assembly language for 8086 processor.
3. Develop the program in assembly language for 8051 processor.
4. Develop the program in assembly language for performing input/output operation, serial communication and delay generation

Suggested List of Experiments:		
Sr. No.	**Title of Experiments**	**LO**
1	Assembly Program to Perform Arithmetic Operations(Using Immediate, Direct and Indirect addressing)	LO1,2,3
2	Assembly Program to perform Logical Operations	LO1,2,3
3	Assembly program based on string instruction: Calculate length of string	LO1,2,3
4	Assembly program based to perform BCD to ASCII conversion	LO1,2,3
5	Assembly program based to perform Hexadecimal to decimal conversion	LO1,2,3
6	Assembly program to calculate factorial of number	LO1,2,3
7	Assembly program to transfer of data bytes between Internal and External Memory	LO1,2,3
8	Assembly program to transfer of data bytes between External and External Memory	LO1,2,3
9	Experiment based on Timers	LO1,4
10.	Experiment based on Input /Output ports	LO1,4
11.	Experiment based on Serial Communication	LO1,4
12.	Assembly program to arrange numbers in ascending and descending order	LO1,2,3
13	Assembly program to find minimum and maximum number from given array	LO1,2,3
14	Assembly program to transfer block of data using String or without using string.	LO1,2,3

Software Tools:
Before starting the experiments there should be one session on study of development tools like Editor, Emulator, Linker, Keil etc. Computation/ Simulation based experiments are also encouraged**.**

Term Work:
The term work should include 8 experiments: 4 microprocessor based and 4 microcontroller based experiments. At least 02 assignments covering the entire syllabus must be given on the content of theory and practical of "**Microprocessor and Microcontroller**". 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) = 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
ETL303	Skill Lab - Python Programming	--	02*+02	--	--	02	--	02

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

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE			
		ISE	MSE				
ETL303	Skill Lab - Python Programming	--	--	--	25	25	50

Pre-requisite:

1. FEC104: C-Programming
2. FEL103: C-Programming Lab

Program Outcomes addressed:

1. PO1: Engineering knowledge
2. PO2: Problem analysis
3. PO3: Design/Development of Solutions
4. PO5: Modern tool usage
5. PO9: Individual and teamwork
6. PO10: Communication
7. PO12: Life-long learning
8. PSO2: Become technocrats capable of working in multi-disciplinary fields

Lab Objectives:

1. To introduce the fundamental concepts of Python programming and Python libraries.
2. To explain the concept of data visualization and statistical analysis.
3. To introduce GUI development and basic image processing techniques.
4. To explain the use of Python in embedded systems.

Lab Outcomes:

Students will be able to

1. Write Python programs using basic programming constructs, control structures, and functions to perform data manipulation and file operations.
2. Use NumPy for numerical computations and Pandas for data handling, including reading, writing, and processing structured data.
3. Visualize data using Matplotlib and Seaborn and apply statistical analysis techniques, including regression models, for data-driven insights.
4. Design simple graphical user interfaces and apply basic image processing techniques using OpenCV.
5. Implement IoT-based monitoring systems.
6. Demonstrate a python-based project.

Module No.	Unit No.	Topics	Hrs.	LO
1.0		**Basics of Python programming**	**4**	**LO1**
	1.1	Introduction, Features, Python building blocks – Identifiers, Keywords, Indention, Variables and Comments, Data types (List, tuple, string, dictionary and Arrays) Operators: Arithmetic, comparison, assignment, logical, bitwise, identity operators.		
	1.2	Control flow statements: Conditional statements (if, if…else, nested if) Looping in Python (while loop, for loop), Exceptional Handling		
		Self learning: Object-Oriented Programming (OOP) in Python		
2.0		**Functions and File I/O Handling**	**4**	**LO2**
	2.1	Functions: Built-in functions, library functions, Defining and calling the functions, Return statements, Passing the arguments, Lambda Functions.		
	2.2	File Input/Output: Files I/O operations, Read / Write Operations, File Opening Modes, with keywords, Moving within a file, Manipulating files and directories, OS and SYS modules.		
		Self learning: Recursive function		
3.0		**Libraries in Python**	**5**	**LO3**
	3.1	Use of NumPy for arithmetic operations, Use of Pandas to access and analyze csv files, Use of SciPy for scientific computing and data analysis		
	3.2	Use of Matplotlib and Seaborn libraryfor data visualization, Use of Scikit-Learn (sklearn) for Linear and Logistic Regression		
		Self learning: Implementing of other Machine Learning algorithms		
4.0		**Graphical User Interface and Image processing**	**5**	**LO4**
	4.1	Graphical User Interface using Tkinter Library module, creating simple GUI; Buttons, Labels, entry fields, widget attributes.		
	4.2	Basic Image Processing using OpenCV library, simple image manipulation using image module.		
		Self learning: Implementation of Image Processing Techniques		
5.0		**Python for embedded systems**	**4**	**LO5**
	5.1	Capturing sensor signals using Raspberry Pi, Uploading acquired data to cloud platforms, Processing and analyzing data in cloud.		
	5.2	Implementation of IoT-Based Monitoring systems including sensor and actuators		
		Self learning: Introduction of data processing in Raspberrypi, Architecture and Pinout diagram of Raspberry pi.		
6.0		**Course project**	**4**	**LO6**
		A python-based project.		
		Total	**26**	

Suggested List of Experiments:	
Sr. No.	**Title of Experiments**
1	**Module 1: Basics of Python Programming** Write Python programs to: a) Understand basic data types, operators, expressions, and input-output statements. b) Implement control flow statements: Conditional statements (if, if…else, nested if). c) Perform looping operations using while loop and for loop. d) Perform list and tuple operations using built-in functions. e) Implement built-in set and string functions. f) Perform basic array operations on 1-D and multidimensional arrays.
2	**Module 2: Functions and File I/O Handling** Write Python programs to: a) Implement user-defined functions and lambda functions. b) Demonstrate function arguments (positional, keyword, default, variable-length). c) Work with built-in functions and modules. d) Perform file handling operations: reading, writing, and appending text and CSV files. e) Handle exceptions using try-except-else-finally blocks.
3	**Module 3: Libraries in Python** Write Python programs to: a) Create and manipulate NumPy arrays (Ndarray) and perform basic operations. b) Implement mathematical functions using NumPy. c) Create and manipulate Pandas DataFrames. d) Perform data selection, handling missing values, and data operations using Pandas. e) Perform file read and write operations using Pandas.
4	**Module 4: Graphical User Interface (GUI) & Image Processing** Write Python programs to: a) Create a simple GUI using Tkinter (Buttons, Labels, Entry Fields, and Widget Attributes). b) Implement basic image processing operations using OpenCV. c) Perform image morphological operations and analyze them using OpenCV.
5	**Module 5: Python for Embedded Systems** Write Python programs to: a) Capture sensor signals using Raspberry Pi. b) Upload acquired data to cloud platforms. c) Process and analyze data in the cloud. d) Implement IoT-based monitoring applications.
6	**Module 6: Course Project** Develop a Python-based project integrating concepts from all modules.

Software Tools:

1. Python IDE: https://www.python.org/downloads/
2. Anaconda Environment: https://www.anaconda.com/distribution/

Online Resources:

1. Github
2. Python
3. Documentation: https://docs.python.org/3/
4. "The Python Tutorial", http://docs.python.org/release/3.0.1/tutorial/
5. http://spoken-tutorial.org
6. Python 3 Tkinter library Documentation: https://docs.python.org/3/library/tk.html
7. Numpy Documentation: https://numpy.org/doc/
8. Pandas Documentation: https://pandas.pydata.org/docs/
9. Matplotlib Documentation: https://matplotlib.org/3.2.1/contents.html
10. Scipy Documentation: https://www.scipy.org/docs.html
11. Machine Learning Algorithm Documentation: https://scikit-learn.org/stable/
12. https://nptel.ac.in/courses/106/106/106106182/

Term Work:
The term work should include 8 experiments and one group-wise project. An attempt should be made to make skill lab – python more meaningful, interesting and innovative. 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).

Subject Code	Subject Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
ETM301	Mini-Project 1A	--	02[$]	--	--	01	--	01

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE			
		ISE	MSE				
ETM301	Mini-Project 1A	--	--	--	25	25	50

$ indicates workload of Learner (Not Faculty),for Mini Project 1A.Faculty Load:1hour per week per four groups.

Pre-requisite:

1. FEL102: Basic Electrical & Electronics Engineering Lab
2. FEL 203: Digital System Design 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: Modern tool usage
6. PO6: The Engineer and society
7. PO7: Environment and Sustainability
8. PO8: Ethics
9. PO9: Individual and teamwork
10. PO10: Communication
11. PO11: Project Management and Finance
12. PO12: Life-long learning
13. PSO1:Achieve eminence in domains like signal processing, VLSI, embedded IOT, RF & microwave.

Course Objectives:

1. To make students familiar with the basics of Electronics, Microcontroller, Arduino board, Raspberry Pi, Arduino IDE (Integrated Development Environment) and Python programming.
2. To familiarize the students with the programming and interfacing of different devices with Arduino and Raspberry Pi Board.
3. To increase students critical thinking ability and provide solutions to some real time problems.

Course Outcomes:

After successful completion of the course student will be able to

1. Write basic codes for the Arduino board using the IDE for utilizing the onboard resources.
2. Apply the knowledge of interfacing different devices to the Arduino board to accomplish a given task.
3. Design Arduino based projects for a given problem.
4. Write code using python language using IDE for utilizing the onboard resources.
5. Apply the knowledge of interfacing different devices to raspberry Pi board to accomplish a given task.
6. Design Raspberry Pi based projects for a given problem.

Module No.	Section A: Arduino Board	Hrs.	CO
1.0	**Introduction to Arduino Board**	**1**	**CO1,2,3**
	Introduction to Arduino Uno board and integrated development environment (IDE)		
	Write the code for blinking the on board led with a specified delay Apparatus Requirement: Hardware: Arduino Board LED, Software: Arduino IDE Software.		
2.0	**GPIO(along with Analog pin) Programming**	**2**	**CO1,2,3**
	Introduction to programming GPIO, Analog and PWM PINS.		
	Interface any Digital Sensors to the Arduino board and display sensor values on serial Monitor		
	Interface any Analog sensor to the Arduino board and display sensor values on serial Monitor.		
	Generate varying duty cycle PWM using Arduino.		
3.0	**Controlling output devices/Displaying**	**2**	**CO1,2,3**
	Introduction to different sensor (Analog and Digital), Relays, Motors and display.		
	Interface an Analog Sensors to the Arduino board and display sensor values on LCD/TFT/Seven segment Display.		
	Interface a temperature sensor to Arduino and switch on a relay to operate a fan if temperature exceeds given threshold. Also display the temperature on any of the display device		
4.0	**Interfacing Communication Devices and Cloud Networking**	**2**	**CO1,2,3**
	Introduction to Bluetooth, Zigbee, RFID and WIFI, specifications and interfacing methods.		
	Interface Wi-Fi /Bluetooth/GSM/Zigbee/RF module to Arduino and program it to transfer sensor data wirelessly between two devices. Any two techniques from the above-mentioned modules needs to be interfaced.		
5.0	**Sample Projects**	**5**	**CO1,2,3**
	1. Waste Management System 2. Smart City Solutions 3. Energy Monitoring Systems 4. Smart Classrooms and learning Solutions 5. Home security systems 6. Smart Agriculture solutions 7. Healthcare solutions. 8. Industrial Applications 9. IoT Applications 10. Robotics		
	Total	**12**	

Module No.	Section B: Raspberry PI Board	Hrs.	CO
1.0	**Introduction to Raspberry PI**	**1**	**CO4,5,6**
	What is Raspberry PI? Downloading and Installation of NOOBS, First Power- Up & Having a Look around, Introduction to the Shell and Staying updated.		
	Familiarization with Raspberry PI and perform necessary software installation.		
2.0	**Interfacing with Input / Output Devices using Python**	**2**	**CO4,5,6**
	Introduction to Python, Connecting to the outside World with GPIO.		
	To Interface LED/Buzzer with Raspberry PI and write a program to turn ON LED for 1 sec after every 2 sec.		
	Apparatus Requirement: Raspberry PI with inbuilt Python Package, LED, Buzzer.		
	To interface Push Button / Digital Sensor (IR/LDR) with Raspberry PI and write a program to turn ON LED when Push button is pressed or at sensor detection.		
3.0	**Interfacing Temperature Sensor, Motors, Display Devices.**	**2**	**CO4,5,6**
	Introduction to Temperature sensor (Analog and Digital), Relays, Motors, (DC, Stepper) and Driver circuits.		
	To interface DHT11 sensor with Raspberry PI and write a program to print temperature and humidity readings.		
	Apparatus Requirement: Raspberry PI with inbuilt Python Package, DTH11 Sensor.		
4.0	**Interfacing Communication Devices and Cloud Networking**	**2**	**CO4,5,6**
	Introduction to Bluetooth, Zigbee, RFID and WIFI, specifications and interfacing methods.		
	To interface Bluetooth/Zigbee/RFID/WiFI with Raspberry PI and write a program to send sensor data to smart phone using Bluetooth/Zigbee/RFID/WIFI. (Any one can be used for performing)		
	Apparatus Requirement: Raspberry PI with inbuilt Python Package, Bluetooth/Zigbee/RFID/WIFI.		
5.0	**Understanding of Communication Protocols**	**2**	**CO4,5,6**
	Introduction to MQTT, IFTTT protocols and configuration steps.		
	Write a program on Raspberry PI to publish temperature data to MQTT broker		
	Write a program on Raspberry Pi to subscribe to MQTT broker for temperature data and print it.		
6.0	**Sample Projects**	**5**	**CO4,5,6**
	1. MQTT Based Raspberry Pi Home Automation: Controlling Raspberry Pi GPIO using MQTT Cloud 2. License Plate Recognition using Raspberry Pi and OpenCV 3. Real Time Face Recognition with Raspberry Pi and OpenCV 4. Smart Garage Door Opener using Raspberry Pi 5. Remote Controlled Car Using Raspberry Pi and Bluetooth 6. Fingerprint Sensor based door locking system using Raspberry Pi 7. Raspberry Pi Ball Tracking Robot using Processing 8. Web Controlled Home Automation using Raspberry Pi		

	9. Line Follower Robot using Raspberry Pi 10. Raspberry Pi based Smart Phone Controlled Home Automation 11. Web Controlled Raspberry Pi Surveillance Robotic Car 12. Raspberry Pi Based Weight Sensing Automatic Gate 13. Raspberry Pi Emergency Light with Darkness and AC Power Line Off 14. Detector 15. Detecting Colors using Raspberry Pi and Color Sensor TCS3200 16. Measure Distance using Raspberry Pi and HCSR04 Ultrasonic Sensor 17. Call and Text using Raspberry Pi and GSM Module 18. Raspberry Pi Home Security System with Email Alert 19. Raspberry Pi Based Obstacle Avoiding Robot using Ultrasonic Sensor 20. Web Controlled Notice Board using Raspberry Pi 21. RF Remote Controlled LEDs Using Raspberry Pi 22. RFID and Raspberry Pi Based Attendance System 23. Raspberry Pi Interactive Led-Mirror 24. Garage Door monitor using Raspberry Pi 25. Raspberry Pi Digital Code Lock on Breadboard 26. Electronic Voting Machine using Raspberry Pi		
	A case study on **SPI protocol** is encouraged.		
	Total (B)	**14**	
	Total (A + B)	**26**	

Reference Books:

1. Simon Monk, “Hacking Electronic: Learning Arduino and Raspberry Pi”, McGraw-Hill Education.
2. Simon Monk, “Raspberry PI Cookbook Software and Hardware Problems and Solutions” O’Reilly.
3. Simon Monk, Programming the Raspberry Pi, 2nd Edition: Getting Started with Python” The McGraw Hill.
4. “DK Workbooks: Raspberry Pi Project Workbook”, DK Children; Workbook
5. Donald Norris, “Raspberry Pi Electronic Projects for Evil Genius”, McGraw-Hill Education TAB.

Software Tools:

1. Raspbian OS: https://www.raspberrypi.org/downloads/
2. Win32 Disk Imager: https://sourceforge.net/projects/win32diskimager/
3. SD Card Formatter: https://www.sdcard.org/downloads/formatter/
4. Arduino IDE: https://www.arduino.cc/en/main/software

Online Repository:

1. Git Hub
2. NPTEL Videos on Raspberry Pi and Arduino Programming
3. https://www.electronicsforu.com/raspberry-pi-projects
4. https://circuitdigest.com/simple-raspberry-pi-projects-for-beginners
5. https://www.electronicshub.org/raspberry-pi-projects/

Guidelines for Mini Project

- Students shall form a group of 3 to 4 students, while forming a group shall not be allowed less than three or more than four students, as it is a group activity.
- 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.
- Students shall submit implementation plan in the form of Gantt/PERT/CPM chart, which will cover

weekly activity of mini project.

- A log book to be prepared by each group, wherein group can record weekly work progress, guide/supervisor can verify and record notes/comments.
- Faculty supervisor may give inputs to students during mini project activity; however, focus shall be on self-learning.
- Students in a group shall understand problem effectively, propose multiple solution and select best possible solution in consultation with guide/ supervisor.
- Students shall convert the best solution into working model using various components of their domain areas and demonstrate.
- The solution to be validated with proper justification and report to be compiled in standard format.

Guidelines for Assessment of Mini Project:

Term Work (CIAP)

- The review /progress monitoring committee shall be constituted by head of department 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.

Review/progress monitoring committee may consider following points for assessment based on general guidelines.

Assessment:

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:

Guidelines for Assessment of Mini Project Practical/Oral Examination:

- Report should be prepared as per the standard format..
- 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 organizations 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 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

Term Work:
The term work should include 1 project: **Arduino**based and **Raspberry PI** based. Term work will be assessed as Continuous Internal Assessment Practical (CIAP).
Distribution of Term work (25 Marks)shall be as below:

- Marks awarded by guide/supervisor based on log book : 10
- Marks awarded by review committee :10
- Quality of Project report :05

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

Practical/Oral Exam: (2 hours/ 25 Marks)
End-semester Practical and oral exam will be held based on the demonstration of the projectand 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
ETC401	Applied Mathematics-IV	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE			
		ISE	MSE				
ETC401	Applied Mathematics-IV	20	20	60	--	--	100

Pre-requisite:

1. FEC101: Applied Mathematics -I
2. FEC201: Applied Mathematics -II
3. ETC301: Applied Mathematics -III

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 evaluate eigen values and eigenvectors and apply them to solve systems of linear equations and matrix diagonalization.
2. To develop the ability to analyze and classify quadratic forms using matrix transformations.
3. To evaluate line and contour integrals and construct the power series expansion of a complex-valued function.
4. To develop the ability to formulate and solve optimization problems using the principles of Calculus of Variations and Euler-Lagrange equations.
5. To equip students with the knowledge of vector differentiation and its applications in engineering.
6. To impart knowledge of vector integration and its applications in solving engineering.

Course Outcomes:

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

1. Compute eigenvalues and eigenvectors, analyze their properties, and apply them in engineering problem-solving.
2. Evaluate quadratic forms, classify them using eigenvalues and principal axes transformation, and apply them to solve engineering problems.
3. Apply the concepts of Complex Integration to evaluate integrals, analyze and compute residues, and solve various contour integrals.
4. Evaluate functionals, derive Euler-Lagrange equations, and apply Calculus of Variations to solve mathematical optimization problems in engineering.
5. Evaluate directional derivatives, gradient, divergence, and curl of vector functions, and apply vector differentiation techniques to solve engineering problems.
6. Evaluate line, surface, and volume integrals using Green's, Stokes', and Gauss' theorems, and apply them to solve engineering.

Module No.	Unit No.	Topics	Hrs.	CO
1.0		**Linear Algebra (Theory of Matrices)**	**07**	
	1.1	Characteristic Equation, Eigenvalues and Eigenvectors, and properties (without proof). Cayley-Hamilton Theorem (without proof).		**CO1**
	1.2	Similarity of matrices, diagonalizable and non-diagonalizable matrices.		
	1.3	Functions of Square Matrix, Derogatory and non-derogatory matrices.		
		Self-Learning Topics: Application of Matrix Theory in machine learning and google page rank algorithms.		
2.0		**Quadratic Forms and Matrix Transformations**	**04**	
	2.1	Definition of Quadratic Forms, Matrix Representation, Classification of Quadratic Forms based on eigenvalues and Sylvester's Criterion.		**CO2**
	2.2	Rank, Index and Signature of a Quadratic Form. Reduction of Quadratic form to canonical forms by Orthogonal Transformation. Singular Value Decomposition.		
		Self-Learning Topics: Applications of Quadratic forms and applications of SVD in Engineering.		
3.0		**Complex Integration**	**08**	
	3.1	Line Integral, Cauchy's Integral theorem for simple connected and multiply connected regions (without proof), Cauchy's Integral formula (without proof).		**CO3**
	3.2	Taylor's and Laurent's series (without proof).		
	3.3	Definition of Singularity, Zeroes, poles off(z), Residues, Cauchy's Residue Theorem (without proof).		
		Self-Learning Topics: Application of Residue Theorem to evaluate real integrations.		
4.0		**Calculus of Variations and Its Applications**	**07**	
	4.1	Definition of a Functional, Introduction to Calculus of Variations, Euler-Lagrange Equation.		**CO4**
	4.2	Isoperimetric problems- Lagrange Method. Several dependent variables.		
	4.3	Functions involving higher order derivatives: Rayleigh-Ritz Method.		
		Self-Learning Topics: Hamilton Principle, Principle of Least action, Several dependent variables.		
5.0		**Vector Differentiation**	**06**	
	5.1	Definition of a Vector, Scalar and Vector Triple Product, Gradient, Divergence, and Curl, Directional Derivatives, Angle between surfaces and related problems. Solenoidal and Irrotational (Conservative) Vector Fields.		**CO5**
	5.2	Finding scalar potential function ∅		
		Self-Learning Topics: Identities connecting Gradient, Divergence and Curl.		

6.0		**Vector Integration**	**07**	
	6.1	Line integrals – Definition, work done of a conservative field and problems.		**CO6**
	6.2	Green's theorem (without proof) in a plane, Stokes' theorem (without Proof), Gauss' Divergence theorem (without proof) and problems (only evaluation).		
		Self-Learning Topics: Applications of Green's theorem, Stoke's theorem & Gauss Divergence theorem in Engineering.		
		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.

Reference books:

1. Matrices – Shanti Narayan, S. Chand Publications,10th Edition.
2. Foundations of Complex Analysis, S. Ponnusamy, Narosa Publications, 2nd Edition.
3. Introductory Methods of Numerical Analysis – S. S. Sastry, 2nd Edition.
4. Calculus of Variations with Applications – A. S. Gupta, PHI Learning, 1st Edition.
5. Vector Calculus – Jerrold E. Marsden, Anthony J. Tromba, W. H. Freeman, 6th Edition.
6. Advanced Engineering Mathematics – H. K. Dass, S. Chand Publications, 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 05 marks attendance.

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

End Semester Examination

ESE is of duration 03 hours and 80 marks and will be scaled down to 60.
The question paper will comprise of 03 questions.
Question1(20 marks): - Solve any 04 out of 06. All questions carry 05 marks each.
Question 2 (40 marks): - Solve any 04 out of 06. All questions carry 10 marks each.
Question3(20 marks):- Solve any 04 out of 06. All questions carry 05 marks each.
All COs should be mapped as per the weightage in the syllabus.

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
ETC402	Principles of Communication Engineering	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE$			
		ISE	MSE				
ETC402	Principles of Communication Engineering	20	20	60	--	--	100

Prerequisite:

1. ETC301: Applied Mathematics III
2. ETC302: Electronic Devices and Circuits

Program Outcomes addressed:

1. PO1: Engineering knowledge
2. PO2: Problem analysis
3. PSO1: Achieve Eminence in domains like signal processing, VLSI, embedded IoT, RF & Microwave.

Course Objectives:

1. To understand the fundamentals of basic communication systems.
2. To understand various analog modulation and demodulation techniques.
3. To focus on applications of analog modulation and demodulation techniques.

Course Outcomes:

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

1. Explain the basic components and types of noises in communication systems.
2. Explain about modulation and demodulation.
3. Analyze the concepts of amplitude modulation and demodulation.
4. Analyze the concepts of angle modulation and demodulation.
5. Analyze the techniques of a radio receiver.
6. Describe analog pulse modulation and multiplexing.

Module No.	Unit No.	Topics	Hrs.	COs
1.0		**Basics of communication systems**	**04**	**CO1**
	1.1	Block diagram of a communication system, types of communication channels. Explore various types of communication channels, including wired channels and wireless channels and study the channel bandwidth and channel capacity and their impact on data transmission rates.		
	1.2	Noise: Types of noises, SNR, Noise Factor, Noise Figure, Noise temperature and Friis transmission equation.		
		Self learning: Applications of different types of transmission media.		
2.0		**Basics of modulation and frequency domain analysis**	**06**	**CO2**
	2.1	Average power, Energy, PSD, ESD, Amplitude spectrum, Power spectrum, energy spectrum, power spectrum of a sinusoidal signal and periodic train of pulses, AWGN channel.		
	2.2	Modulation, needs, types, proof of modulation and demodulation using Fourier transform.		
		Self learning: Investigate different modulation techniques and its applications.		
3.0		**Amplitude Modulation**	**10**	**CO3**
	3.1	Basic concepts, mathematical analysis, time domain waveforms, modulation index, percentage modulation, bandwidth, amplitude spectrum, power spectrum of AMDSBFC, AMDSBSC, AMSSBSC (SSB), VSB and ISB modulations.		
	3.2	Generation of AMDSBFC (Low level transistor modulator), AMDSBSC (Balanced Modulator) and SSB (Filter and phase shift methods), envelope detection of AMDSBFC and synchronous detection of suppressed carrier signals, application of amplitude modulations.		
		Self learning: Learn about the various applications of AM in modern communication.		
4.0		**Angle Modulation**	**09**	**CO4**
	4.1	Basic concepts of FM and PM, mathematical analysis, time domain representation, modulation index, bandwidth calculation using Bessel function and Carson's rule.		
	4.2	FM modulator (Varactor diode modulator), Generation of FM using PM modulator and generation of PM using FM modulator, FM detector (Slope detector), Noise triangle, pre-emphasis and de-emphasis, application of angle modulation.		
		Self learning: Learn about the applications of FM in FM radio broadcasting, television sound transmission, and mobile communication.		
5.0		**AM and FM Receivers**	**04**	**CO5**
	5.1	Characteristics of a radio receiver, TRF and super heterodyne AM receivers, FM receiver, Comparison between AM and FM receivers.		
		Self learning: Investigate the concept of digital radio and how modern DAB (Digital Audio Broadcasting) or HD Radio systems use FM technology to provide enhanced audio and data services.		

6.0		**Pulse Modulation and multiplexing**	**06**	**CO6**
	6.1	Sampling theorem for low pass signal and band pass signal, proof, aliasing error.		
	6.2	PAM, PWM and PPM generation, detection and applications.		
	6.2	Multiplexing: FDM, TDM and applications.		
		Self learning: Explore the application of FDM in radio broadcasting and satellite communication.		
		Total	**39**	

Textbooks:

1. Kennedy and Davis, "Electronics Communication System", Tata McGraw Hill, Fourth Edition.
2. B.P. Lathi, Zhi Ding "Modern Digital and Analog Communication system", Oxford University Press.Fourth Edition.
3. Wayne Tomasi, "Electronics Communication Systems", Pearson education, Fifth Edition.

Reference books:

1. Taub, Schilling and Saha, “Principles of Communication systems”, Tata McGraw Hill, Third Edition.
2. P. Sing and S.D. Sapre, “Communication Systems: Analog and Digital”, Tata McGraw Hill, Third Edition.
3. Simon Haykin, Michel Moher, “Introduction to Analog and Digital Communication”, Wiley, second Edition.
4. Dennis Roddy and John Coolen, “Electronic Communication”, Pearson, Fourth Edition.
5. Louis Frenzel, “Communication Electronics”, Tata McGraw Hill, Third Edition.

Online References:

Analog Communication by Prof. Goutam Das (IIT Kharagpur).
https://swayam.gov.in/nd1_noc20_ee69/preview

Course Assessment:

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

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

End Semester Examination:

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

1.The question paper will comprise of 03 questions.
2.Question 1(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.Question 3(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
ETC403	Linear Integrated Circuits	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE$			
		ISE	MSE				
ETC403	Linear Integrated Circuits	20	20	60	--	--	100

Pre-requisite:

1. FEC103: Basic Electrical &Electronics Engineering
2. ETC302: Electronic Devices and Circuits

Program Outcomes addressed:

1. PO1: Engineering knowledge
2. PO2: Problem analysis
3. PO3: Design/Development of Solutions
4. PSO1: Achieve eminence in domains like signal processing, VLSI, embedded IoT, RF & microwave.

Course Objectives:

1. To study basic concepts of operational amplifiers.
2. To analyze and design various linear and non-linear applications of operational amplifiers.
3. To analyze and design astable and monostable multivibrators.
4. To understand the operation of the most commonly used ADC and DAC converter types.
5. To understand the fundamentals of various voltage regulator ICs and PLL and VCO and its applications

Course Outcomes:

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

1. Explain the basic building blocks and fundamentals of operational amplifiers.
2. Design linear applications of op-amp.
3. Design nonlinear applications of op-amp.
4. Design multivibrators using timer IC 555
5. Analyze various ADC and DAC techniques.
6. Explain the functions of various voltage regulator ICs and gain knowledge about PLL IC 565 and VCO IC 566 and its applications.

Module No.	Unit No.	Topics	Hrs	CO
1.0		**Introduction to Operational Amplifier**	**05**	**CO1**
	1.1	Basics of Differential Amplifier, Block diagram of Op-Amp, Ideal and practical characteristics of op-amp.		
	1.2	Configurations of Op-Amp: Operational amplifier open loop and closed loop configurations, Inverting and Non-inverting configuration of Op-amp and voltage follower.		
		Self learning: Configurations of differential amplifier.		
2.0		**Linear Applications of Operational Amplifier**	**09**	**CO2**
	2.1	Summing and difference amplifier, Integrator & differentiator (ideal & practical), Instrumentation amplifier.		
	2.2	Active Filters: First and Second order active low pass, high pass, band pass.		
	2.3	Positive feedback, Barkhausen's criteria, Sine Wave Oscillators: RC phase shift oscillator, Wien bridge oscillator.		
		Self learning: Voltage to current converter and current to voltage converter		
3.0		**Non-Linear Applications of Operational Amplifier**	**07**	**CO3**
	3.1	Comparators: Inverting comparator and non-inverting comparator, zero crossing detectors, window detector.		
	3.2	Schmitt Triggers: Inverting Schmitt trigger, non-inverting Schmitt trigger.		
	3.3	Waveform Generators: square wave generator and triangular wave generator.		
		Self learning: Basics of Precision Rectifiers peak detector, sample and hold circuit		
4.0		**Timer IC 555 and it's applications**	**07**	**CO4**
	4.1	Functional block diagram and working of IC 555.		
	4.2	Design of Astable and Monostable multivibrator using IC 555.		
	4.3	Applications of Astable and Monostable multivibrator as Pulse width modulator and Pulse Position Modulator.		
		Self learning: Bistable multivibrator and its applications		
5.0		**Analog to Digital and Digital to Analog Convertors**	**05**	**CO5**
	5.1	Specifications of DAC converter, DAC techniques: weighted resistor DAC and R-2R ladder DAC.		
	5.2	Specifications of ADC converter, ADC techniques: flash ADC, dual slope ADC, successive approximation ADC.		
	5.3	**Self-learning:** Applications of DAC and ADC converter		
6.0		**Special Purpose Integrated Circuits**	**06**	**CO6**
	6.1	Functional block diagram, working and design of three terminal fixed (78XX, 79XX series) and three terminal adjustable (LM317) voltage regulators.		
	6.2	Functional block diagram and working of VCO IC 566 and application as frequency modulator.		
	6.3	Functional block diagram and working of PLL IC 565 and application as FSK Demodulator.		
		Self learning: Application of IC 566 as frequency modulator and application of PLL IC 565 as FSK Demodulator.		
	Total		**39**	

Textbooks:

1. Ramakant A. Gayakwad, "Op-Amps and Linear Integrated Circuits", Prentice-Hall, 4th Edition
2. D. Roy Choudhury and S. B. Jain, "Linear Integrated Circuits", New Age International Publishers, 4th Edition.

Reference books:

1. K. R. Botkar, "Integrated Circuits", Khanna Publishers (2004).
2. Sergio Franco, "Design with operational amplifiers and analog integrated circuits", Tata McGraw Hill, 3rd Edition.
3. David A. Bell, "Operation Amplifiers and Linear Integrated Circuits", Oxford University Press, Indian Edition.
3. R. F. Coughlin and F. F. Driscoll, "Operation Amplifiers and Linear Integrated Circuits", Prentice Hall, 6th Edition.
4. J. Millman, Christos CHalkias, and Satyabratatajit, Millman's, "Electronic Devices and Circuits," McGrawHill., 3rd Edition.

Online References:

1. NPTEL Course: Integrated Circuits and Applications by Prof. Prof. Shaik Rafi Ahamed, Department of Electrical Engineering IIT Guwahati
   Web link- https://onlinecourses.nptel.ac.in/noc24_ee73/preview
2. NPTEL Course: Analog Circuits, By Prof. Dr. Pramod Agarwal, IIT Roorkee
   Web link- https://nptel.ac.in/courses/117107094

Course Assessment:

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

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

End Semester Examination:

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

1. The question paper will comprise of 03 questions.
2. Question 1(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. Question 3(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
ETC404	Critical Thinking and Design	02	--	--	02	--	--	02

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE$			
		ISE	MSE				
ETC404	Critical Thinking and Design	15	15	45	--	--	75

Pre- requisite: --

Program Outcomes Addressed

1. PO2: Problem analysis
2. PO3: Design/development of solutions
3. PO5: Modern Tool Usage
4. PO6: The Engineer and Society
5. PO7: Environment and Sustainability
6. PO9: Individual and Team Work
7. PO10: Communication
8. PO11: Project Management and Finance
9. PO12: Life Long Learning

Course Objectives:

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

Course Outcomes: Learners will be able to

1. Interpret the fundamentals of critical thinking and fair-minded reasoning for effective decision-making.
2. Identify their cognitive development stage and implement structured strategies to progress as a critical thinker.
3. Apply intellectual standards like clarity, accuracy, and logic to improve reasoning and problem-solving skills.
4. Integrate design thinking principles to create innovative, balanced, and user-centered solutions.
5. Develop a broad perspective in understanding customer needs and effectively define problem statements using diverse methodologies.
6. Implement creative solutions and enhance ideas through iterative prototyping and user feedback using brainstorming techniques.

Module No.	Unit No.	Topics	Hrs.	CO
1.0		**Introduction to Critical Thinking**	**4**	**CO1**
	1.1	**Introduction:** Start-up definition of Critical Thinking, How skilled are you as a Thinker? Hard Work, Concept of Critical Thinking, Establish new habits of thoughts, Develop confidence		
	1.2	**Fair-minded Thinker:** Weak Vs Strong Critical Thinking. Requirement of Fairmindedness Intellectual: Humility, Courage, Empathy, Integrity, Perseverance, Autonomy. Interdependence of Intellectual Virtues.		
		Self learning: Role of Intellectual Humility in Decision-Making, How to Overcome Cognitive Biases for Stronger Reasoning, Practical Techniques to Develop Fair-Minded Thinking. Case Study: The Challenger Disaster: How Ignoring Critical Thinking Led to Catastrophe		
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		
		Self learning: Characteristics and challenges at each stage, Common obstacles and how to address them, Practical ways to enhance critical thinking in work and academics. 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, Case Study: Analyzes how a company applied intellectual standards to refine its business strategies.		
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 & TestScale 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: Understanding the shift from conventional problem-solving to iterative design processes, Designing solutions with user needs at the core while balancing business feasibility. 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: Using metaphors and ideation techniques to expand creative possibilities, How diverse teams enhance innovation and problem-solving,Visualizing stakeholder journeys and structuring problem statements for better solutions. Case Study: How Airbnb used empathy mapping and customer insights to redefine its business model.		
6.0		**Ideate, Prototype and Test**	**6**	**CO5,6**
	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: Exploring structured and unstructured brainstorming approaches, Testing ideas quickly through prototypes and data-driven validation, Using visual storytelling to map user experiences and refine concepts. 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",Authors: Richard Paul, Linda Elder,Pearson Education
2. Pavan Soni, "Design Your Thinking: The Mindsets, Toolsets, and Skill Sets for Creative Problem-solving", Penguin Random House India Private Limited

Reference books:

1. Roger L. Martin,"The Design of Business: Why Design Thinking is the Next Competitive Advantage",Harvard Business Press.
2. Richard Paul, Robert Niewoehner, Linda Elde,"The Thinker's Guide to Engineering Reasoning, Foundation for Critical Thinking Design.
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 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. Question paper will comprise of **6** questions, each carrying **15** marks.
2. The students need to solve a total of **4** questions.
3. Question No.1 will be compulsory and based on entire syllabus.
4. Remaining questions **(Q.2 to Q.6)** will be selected from all the modules

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

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE[$]			
		ISE	MSE				
MDMC4011	Artificial Intelligence	20	20	60	--	--	100

Pre-requisite:

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

Program Outcomes addressed:

1. PO1: Engineering knowledge
2. PO2: Problem analysis
3. PO3: Design/Development of Solutions
4. PSO2: Become technocrats capable of working in multi-disciplinary fields

Course Objectives:

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

Course Outcomes:

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

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

Module No.	Unit No.	Topics	Hrs.	CO
1.0		**Introduction to AI**	**05**	**CO1**
	1.1	Introduction to Artificial Intelligence, Brief history and evolution of AI, Intelligent Systems: Categorization of Intelligent System, Components of AI Program, Foundations of AI, Sub-areas of AI		
		Self learning: Applications of AI, Current trends in AI		
2.0		**Intelligent Agents and Environments**	**09**	**CO2**
	2.1	Definition of an agent and its environment, Structure of Intelligent Agents, Types of agents, Learning Agent.		
	2.2	Solving problem by Searching: Problem Solving Agent, Formulating Problems, Example Problems.		
		Self learning: The concept of rationality		
3.0		**Problem Solving Techniques in AI**	**07**	**CO3**
	3.1	Uninformed search methods: Breadth-First Search (BFS) and Depth-First Search (DFS), Depth Limited Search, Depth First Iterative Deepening (DFID)		
	3.2	Informed Search Methods: Greedy best first Search, A* Search, Memory bounded heuristic Search.		
		Local Search Algorithms and Optimization Problems: Hill climbing search Simulated annealing, Genetic algorithms.		
		Self learning: Adversarial Search: Game Playing, Min-Max Search, Alpha Beta Pruning		
4.0		**Knowledge Representation and Logical Reasoning**	**07**	**CO4**
		Logical Agents: Knowledge based Agents, Fundamentals of logic: propositional logic basics, Representation of knowledge using rules, First Order Logic (FOL): Syntax and Semantic, Basic inference techniques: forward chaining and backward chaining, Simple rule-based systems and examples		
		Knowledge Engineering in First-Order Logic, Propositional vs. First-Order Inference, Unification, Resolution		
		Self Learning: Representing knowledge in an uncertain domain, The semantics of belief network		
5.0		**Planning and Learning**	**05**	**CO5**
		The planning problem, Planning with state space search, Partial order planning, Hierarchical planning, Conditional Planning.		
		Learning: Forms of Learning, Theory of Learning, PAC learning. Introduction to statistical learning (Introduction only) Introduction to reinforcement learning: Learning from Rewards		
		Self-learning: Passive and Active Reinforcement Learning		
6.0		**AI Applications**	**06**	**CO6**
		Introduction to NLP- Language models, Grammars, Parsing Robotics - Robots, Robot hardware, Problems Robotics can solve AI applications in Healthcare, Retail, Banking		
		Self-learning: AI applications inRetail, Banking		
		Total	**39**	

Textbooks:

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

Reference books:

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

Course Assessment:

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

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

End Semester Examination

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

Question paper will comprise of 03 questions.

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

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

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

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

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
MDMC4021	Foundations for Data Science	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE$			
		ISE	MSE				
MDMC4021	Foundations for Data Science	20	20	60	--	--	100

Pre-requisite: Knowledge of
1 CSC301- 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
5 PO11: Lifelong Learning

Course Objectives:
1 To build an intuitive understanding of Mathematics and relate it to Artificial Intelligence, Machine Learning and Data Science.
2 To provide a strong foundation for probabilistic and statistical analysis mostly used in varied applications in Engineering.
3 To focus on exploring the data with the help of graphical representation and drawing conclusions.
4 To explore optimization and dimensionality reduction techniques.

Course Outcomes:
After successful completion of the course student will be able to
1 Use linear algebra concepts to model, solve, and analyze real-world problems.
2 Apply probability distributions and sampling distributions to various business problems.
3 Select an appropriate graph representation for the given data.
4 Apply exploratory data analysis to some real datasets and provide interpretations via relevant visualization
5 Analyze various optimization techniques.
6 Describe Dimension Reduction Algorithms

Module No.	Unit No.	Topics	Hrs.	CO
1.0		**Linear Algebra**	**05**	**CO1**
	1.1	Vectors and Matrices, Solving Linear equations, The four Fundamental Subspaces, Eigen values and Eigen Vectors, The Singular Value Decomposition(SVD).		
		Self-Learning: Applications of Eigen values and Eigenvectors in Machine Learning		

2.0		**Probability and Statistics**	**07**	**CO2**
	2.1	Introduction, Random Variables and their probability Distribution, Random Sampling, Sample Characteristics and their Distributions, Chi-Square, t-, and F-Distributions: Exact Sampling Distributions, Sampling from a Bivariate Normal Distribution, The Central Limit Theorem.		
		Self-Learning: Bayesian Statistics and its Applications		
3.0		**Introduction to Graphs**	**05**	**CO3**
	3.1	Qualitative data, Types of Quantitative data: Continuous data, Discrete data, Types of Qualitative data: Categorical data, Binary data, Ordinary data, plotting data using Bargraph, Piechart, Histogram, Stemand Leafplot, Dotplot, Scatterplot, Time-series graph, Exponential graph, Logarithmic graph, Trigonometric graph, Frequency distribution graph.		
		Self-Learning: Graph-Based Data Structures in Python		
4.0		**Exploratory Data Analysis**	**08**	**CO4**
	4.1	Need of exploratory data analysis, cleaning and preparing data, Feature engineering, Missing values, understanding dataset through various plots and graphs, draw conclusions, deciding appropriate machine learning models.		
		Self-Learning: Handling Imbalanced Datasets in Machine Learning		
5.0		**Optimization Techniques**	**07**	**CO5**
	5.1	Types of optimization-Constrained and Unconstrained optimization, Methods of Optimization-Numerical Optimization, Bracketing Methods-Bisection Method, False Position Method, Newton's Method, Steepest Descent Method, Penalty Function Method.		
		Self-Learning: Hyperparameter Tuning in Machine Learning Models		
6.0		**Dimension Reduction Algorithm**	**07**	**CO6**
	6.1	Introduction to Dimension Reduction Algorithms, Linear Dimensionality Reduction: Principal component analysis, Factor Analysis, Linear discriminant analysis.		
	6.2	Non-Linear Dimensionality Reduction: Multidimensional Scaling, Isometric Feature Mapping. Minimal polynomial		
		Self-Learning: Principal Component Analysis (PCA) vs. Linear Discriminant Analysis (LDA)		
		Total	**39**	

Textbooks:

1 Linear Algebra for Everyone, Gilbert Strang, Wellesley-Cambridge Press, 2020.
2 An Introduction to Probability and Statistics, Vijay K. Rohatgi & A. K. Md. Ehsanes Saleh, Wiley, 3rd Edition, 2015.
3 An Introduction to Optimization, Edwin K. P. Chong & Stanislaw H. Zak, Wiley, 2nd Edition, 2004.
4 Mathematics for Machine Learning, Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, Cambridge University Press, 2020.
5 Exploratory Data Analysis Using R,Pearson, Ronald K, CRC Press, 1st Edition, 2018.

Reference books:

1 Introduction to Linear Algebra – Gilbert Strang, Wellesley-Cambridge Press, 5th Edition, 2016.
2 Advanced Engineering Mathematics – Erwin Kreyszig, Wiley, 10th Edition, 2011.
3 Foundations of Machine Learning – Mehryar Mohri, Afshin Rostamizadeh, and Ameet Talwalkar, MIT Press, 2nd Edition, 2018.
4 Understanding Machine Learning: From Theory to Algorithms – Shai Shalev-Shwartz and Shai Ben-David, Cambridge University Press, 2014.
5 Mathematics and Programming for Machine Learning with R – William B. Claster, CRC Press, 1st Edition, 2020.

Online References:

1 https://math.mit.edu/gs/linearalgebra/
2 https://www.coursera.org/learn/probability-theory-statistics
3 https://nptel.ac.in/courses/111/105/111105090/
4 https://onlinecourses.nptel.ac.in/noc21_ma01/preview
5 https://ocw.mit.edu/courses/mathematics/18-06-linear-algebra-spring-2010/video-lectures/

Course Assessment:

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

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

End Semester Examination

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

1. Question paper will comprise of 03 questions.
2. Question 1(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
MDM C4061	Cost Management	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE$			
		ISE	MSE				
MDM C4061	Cost Management	20	20	60	--	--	100

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

Program Outcomes addressed: PO1, PO2, PO11

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

Course Outcomes: Upon completion of this course, learners will be able to
CO1: To understand and analyze different cost concept and methods.
CO2: To understand the Elements of Cost & Cost classification.
CO3: To apply various material concepts & classifications for preparation of cost sheet.
CO4: To analyze various techniques of costing and its application in Finance, budgets and budgetary control.
CO5: To develop requisite data for cost control and cost reduction.
CO6: To evaluate marginal costing techniques for decision making.

Module No.	Unit No.	Topics	Hrs.	CO
1.0	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 cost accounting concepts		
2.0	2	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	**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**	**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**	**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 varianceDirect 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**	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. P. Shah, *Management Accounting*, 6th ed. New Delhi, India: Oxford University Press, 2015.
2. C. Drury, *Management and Cost Accounting*, 12th ed. Andover, U.K.: Cengage Learning, 2024.

Online References:

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

Course Assessment:

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

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

End Semester Examination:

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

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

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
ETL401	Principles of Communication Engineering Lab	--	02	--	--	01	--	01

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE			
		ISE	MSE				
ETL401	Principles of Communication Engineering Lab	--	--	--	25	25	50

Pre-requisite:

1. FEL102: Basic Electrical& Electronics Engineering Lab.
2. ETL301: Electronic Devices and circuits Lab.

Program Outcomes addressed:

1. PO1: Engineering knowledge
2. PO2: Problem analysis
3. PO3: Design and Development of Solution
4. PO5: Modern tool usage
5. PO9:Individual and Team work
6. PO12: Lifelong Learning
7. PSO1:Achieve eminence in domains like signal processing, VLSI, embedded IOT, RF & microwave.

Lab Objectives:

1. To give an understanding of Time and Frequency domain representation of signals.
2. To demonstrate continuous wave modulation and demodulation.
3. To demonstrate analog pulse communication and multiplexing.
4. Able to use simulation software to build communication circuits.

Lab Outcomes:

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

1. Analyze analog CW modulation techniques.
2. Analyze sampling theorem.
3. Analyze analog pulse modulation.
4. Demonstrate multiplexing techniques.

Suggested List of Experiments:		
Sr.No.	**TitleofExperiments**	**LO**
1	AMDSBFC modulation and demodulation.	LO1
2	AMDSBSC modulation and demodulation.	LO1
3	FM modulation and demodulation.	LO1
4	Analyse the output waveforms of each block of AM transmitter /receiver	LO1
5	Analyse the output waveforms of each block of FM transmitter /receiver	LO1
6	Design and implementation of Pre-emphasis and De-emphasis circuit.	LO1
7	Verification of sampling theorem.	LO2
8	Design of PAM modulator and demodulator.	LO3
9	Design of PWM modulator and demodulator.	LO3
10	Design of PPM modulator and demodulator.	LO3
11	TDM multiplexing and de-multiplexing signals.	LO4
12	FDM multiplexing and de-multiplexing signals.	LO4

Term Work:
The term work should include at least 8 experiments. The experiments should be students' centric, and an attempt should be made to make experiments more meaningful, interesting and innovative. 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
ETL402	Linear Integrated Circuit Lab	--	02	--	--	01	--	01

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE			
		ISE	MSE				
ETL402	Linear Integrated Circuit Lab	--	--	--	25	25	50

Pre-requisite:

1. FEC103: Basic Electrical &Electronics Engineering
2. ETL301: Electronic Devices and Circuits

Program Outcomes addressed:

1. PO1: Engineering knowledge
2. PO2: Problem analysis
3. PO3: Design of Solutions
4. PO5: Modern tool usage
5. PO9: Individual and team work.
6. PSO1: Achieve eminence in domains like signal processing, VLSI, embedded IoT, RF & microwave.

Lab Objectives:

1. To design various linear and nonlinear applications of operational amplifiers.
2. To design ADC and DAC converters.
3. To design multivibrators, PLL and VCO
4. To understand various voltage regulator integrated circuits

Lab Outcomes:

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

1. Explain the basic building blocks and fundamentals of operational amplifiers.
2. Design linear applications of op-amp.
3. Design nonlinear applications of op-amp.
4. Design various ADC and DAC techniques.
5. Design multivibrators using timer IC 555, PLL IC 565 and VCO IC 566
6. Demonstrate various voltage regulator integrated circuits.

Suggested List of Experiments:		
Sr. No.	**Title of Experiments**	**LO**
1	Design inverting, non-inverting amplifier, summing and difference amplifier using IC 741	LO1
2	Design RC phase shift Oscillator/ Wein bridge Oscillator using op-amp IC 741	LO2
3	Design and analyze Integrator/ Differentiator using op-amp IC 741	LO2
4	Design and analyze second order active filters using op-amp IC 741	LO2
5	Implementation of comparator, zero crossing detector.	LO3
6	Design Schmitt trigger using op-amp IC 741	LO3
7	Design and implement DAC/ADC	LO4
8	Design Astable multivibrator using IC 555 for fixed frequency and variable duty cycle	LO5
9	Implementation of voltage regulator using LM317	LO6
10	SPICE simulation on op amp parameters	LO1
11	SPICE simulation on design of linear application using op amp	LO2
12	SPICE simulation of non-linear applications of Op amp	LO3
13	SPICE simulation of Active filters	LO2
14	SPICE simulation of oscillators	LO2

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 "Linear Integrated Circuits". 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) = 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
ETL403	Skill Lab - Linux	--	2*+2	--	--	02	--	02

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE[$]			
		ISE	MSE				
ETL403	Skill Lab - Linux	--	--	--	25	25	50

* Theory class to be conducted for full class

Course pre-requisite:

1. FEL103: C-Programming

Program Outcomes addressed:

1. PO1: Engineering knowledge
2. PO2: Problem analysis
3. PO3: Design and Development of Solution
4. PO4: Conduct investigations of complex problems
5. PO5: Modern tool Usage
6. PO9: Individual and Team work
7. PO12: Lifelong Learning
8. PSO2: Work in a multi-disciplinary environment

Lab Objectives:

1. To introduce the concept of open-source software
2. To Install Linux and implement standard commands (file, process, memory, user, group and device management)
3. To provide comprehensive exposure to server configurations and Linux networking: configuration, troubleshooting, and management commands.
4. To impart a comprehensive introduction to SHELL programming, services and utilities.
5. To introduce Linux security and virtualization technologies like Hypervisor, emulation and application.
6. To implement Case-study on Linux based operating systems for IoT and Cloud.

Lab Outcomes:

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

1. Describe open-source operating systems.
2. Perform file, process, memory, user group and device management on Linux system Configure, troubleshoot, and manage network and servers.
3. Perform shell scripting and illustrate the use of services and utilities.
4. Demonstrate the use of hypervisors, virtual machines and implement security measures in Linux.
5. Explain the applications of operating systems meant for IoT and Cloud.

		Detailed Content	Hours	LO
1		**Open-Source Software**	**03**	**LO1**
		Need of Open Sources, Advantages and applications of Open sources, Free open-source software usage, Free Software Movement, Open-Source Software Development Model, comparison with close source / Proprietary software, widely used open-source software licenses.		
2		**Installation of Linux, Architecture and Functions**	**05**	**LO2**
	2.1	Installing Software on Debian Based Linux: Debian, Ubuntu, Kali Linux, Red Hat Linux.		
	2.2	Overview of Unix and Linux architectures, Linux files system, Linux standard directories, and Linux Directory Structure.		
	2.3	Basic Linux Commands, Linux Networking commands, Viewing Files and the Nano Editor, Editing Files in Vi, Graphical Editors, Deleting, Copying, Moving, and Renaming Files. Process management, Memory management, User- group and device management.		
3		**Linux Network and Server Configurations**	**06**	**LO3**
	3.1	Basics of Network Management, Setting up Dynamic and Static Addressing, Monitoring network services, Talking with DNS Servers, Remote System, Administration with OpenSSH-Server & Putty.		
	3.2	TCP/IP Networking for Linux System Administrators, DNS and hostnames, DHCP, Network Troubleshooting, server configurations: LAMP Stack, NFS, FTP, TFTP, Squid, Apache, Mail, Samba and TELNET.		
4		**Bash Shell Scripting**	**04**	**LO4**
	4.1	Basics of shell programming, various types of shell available in Linux, Shell programming in bash, Conditional statements, Looping statements, Case statements, Parameter passing and arguments.		
	4.2	Temporary disabling of user's accounts, Creating and mounting file system, becoming super user using su, Getting system information with username, host name. Disk partitions & sizes, users, kernel, installing and removing packages, rpm command		
	4.3	System shell variables, Shell variables, shell keywords, Creating Shell programs for automating system tasks, scheduling repetitive jobs using cron.		
5		**Security and Virtualization**	**03**	**LO5**
	5.1	SE Linux and Firewalld: SE Linux Overview, SE Linux Tools, SE Linux Contexts, SE Linux Booleans, Use SE Linux port labeling to allow services to use non-standard ports, Diagnose and address SE Linux policy violations, Configure Firewalld, Understand Firewalld Components, Setting Default Firewalld Zone, Creating Own Services in Firewalld, Assigning Services to Firewalld Zones, Adding Rich Rules for Network Range		
	5.2	Virtualization: Introduction to virtualization and its types, need of virtualization, Benefits of Virtualization, Virtualization Implementation, Kernel based Virtual Machines (KVM) and XE		

6		Advanced Operating Systems	05	LO6
		Case Study: • IoT OS Requirements: Resource Constraints, Real-time Capabilities, Low Power Consumption • Contiki OS: Features, RPL Protocol, Simulation with Cooja • RIOT OS: Architecture, Multi-threading, Energy Efficiency • Free RTOS: Task Scheduling, Inter-process Communication, Memory Management • TinyOS: Nes C Language, Event-driven Programming		
		Case Study: • Characteristics of Cloud OS: Scalability, Virtualization, Multi-tenancy • Virtualization Technologies: Hypervisors (Type 1 & 2), Docker, Kubernetes • AWS, Azure, and Google Cloud OS Architectures • OpenStack: Components and Use Cases • Serverless Computing and OS Implications		
		Total	**26**	

Textbooks:

1. W. Stevens, Stephen Rago, "Advanced Programming in the UNIX Environment", Addison Wesley Professional Computing Series
2. Yeswant Kanetkar – "UNIX Shell Programming", First edition, BPB.
3. Cristopher Negus – "Red Hat Linux Bible", Wiley Dreamtech India 2005 edition.
4. Jason Cannon," Linux for Beginners: An Introduction to the Linux Operating System and Command line"
5. Linux: The Complete Reference, Sixth Edition by Richard Petersen, McGraw Hill Education.
6. Linux Command Line and Shell Scripting Bible by Richard Blum Wiley
7. Red hat Linux Networking and System Administration, by Terry Collings and Kurt Wall, Wiley.Wiley3rd edition 2005

Reference Books:

1. Linux Administration: A Beginner's Guide by Wale Soyinka, McGraw-Hill Education
2. Red Hat Enterprise Linux 6 Administration, Real World Skills for Red Hat Administrators by Sander van Vugt, John Wiley and Sons
3. Official Red Hat Linux Users guide by Redhat, Wiley Dreamtech India
4. Graham Glass & King Ables – UNIX for programmers and users, Third Edition, Pearson Education.
5. Neil Mathew & Richard Stones – Beginning Linux Programming, Fourth edition, Wiley Dreamtech India.
6. Richard Petersen, Linux: The Complete Reference, Sixth Edition

Software Tools:

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
6. https://ubuntu.com/tutorials/install-ubuntu-desktop#1-overview
7. https://docs.redhat.com/en/documentation/red_hat_enterprise_linux/7/html/installation_guide/chap-simple-install#sect-simple-install
8. https://www.kali.org/docs/installation/

Online Repository (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
5. https://www.tecmint.com/install-dhcp-server-in-ubuntu-debian/
6. https://www.digitalocean.com/community/tutorials/how-to-install-and-configure-postfix-as-a-send-only-smtp-server-on-ubuntu-16-04
7. https://ubuntu.com/server/docs/about-dynamic-host-configuration-protocol-dhcp
8. https://images.app.goo.gl/mypTBT2fhv9iaZyZA--------Kubernetes
9. https://images.app.goo.gl/ByTvR4hc1fuenhtA6---------Docker

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/

Suggested List of Programming Assignments/laboratory Work:	
Sr. No.	**Title of Experiments**
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
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 f. creates users, groups, change permission, software selection and installation and make changes in Grub file. Creating, modifying and deleting users Creating, modifying and deleting groups g. Managing file permissions, attributes and ownerships h. Setting Default Permissions with umask i. Setting up access control list for files and directories
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

4	Learning and executing Linux commands for managing Storagedrives in Linux environment a. Create partitions b. Install file system c. Mount and unmount partitions manually from CLI d. Automated mounting using fstab e. Encrypt volumes f. SWAP, LVM, RAID, Primary Partition, Extended Partition and Linux files system
5	Learning and executing Linux commands for managingnetworking in Linux environment a. Enable networking services from command line b. Configure IP and other network settings from command line. c. Configure IP and other network settings from configuration files. d. Configure SSH based services for CLI and GUI access on remote machines.
6	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 Samba file server and share files across local network.
7	Install and configure DHCP server, DNS server
8	Install and configure TELNET server, SSH server
9	Install and configure a LAMP stack and deploy a full stack web application on it with SSL/TLS security.
10	Shell Scripting: a. Write a shell script program to display list of user currently logged in. b. Write a shell script to add user and password on Linux system c. Write a shell script that deletes all lines containing a specified word d. Write a shell Script program to check whether the given number is even or odd. e. Write a shell script program to check variable attributes of file and processes. f. Write a shell script program to check and list attributes of processes. g.Write an awk script to find the number of characters, words and lines in a file h. Write an awk script to develop a Fibonacci series. i. Write an awk script to display the pattern of given string or number.
11	Configuring security for the Linux Server environment using SELinux and FirewallD.
12	Case Study on Docker, Kubernetes.
13	Case Study on AWS, Azure, and Google Cloud OS Architectures.

Suggested List of Course project:	
Sr. No.	**Title of Experiments**
1	Develop a scientific calculator using shell script.
2	Installation of Contiki /RIOT Operating System.
3	Install and set up KVM to run isolated instances of other operating systems inside a Linux host system
4	Creation of a network bridge.
5	Configuration of Linux box as a router or a packet forwader.
6	Case Study on Docker, Kubernetes
7	Case Study on AWS, Azure, and Google Cloud OS Architectures
8	Network Attached Storage(NAS)
9	Network monitoring service.
10	Automation using Bash.

This is suggested list and changes can be done as per content of syllabus.

Term Work:

1 Term work should consist of 10 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 satisfactory performance of laboratory work and minimum passing marks in term work.
4 Total 25-Marks (Experiments: 15-marks, Attendance: 05-marks, Course Project: -5-marks)
Term work will be assessed as Continuous Internal Assessment Practical (CIAP).

Oral & Practical exam

Based on the entire syllabus of ETL403: Skill Laboratory: Linux Networking & Server Configuration 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
ETL404	Value Education (UHV)	--	04	--	--	02	--	01

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE			
		ISE	MSE				
ETL404	Value Education (UHV)	--	--	--	50	--	50

Pre-requisite: --

Program Outcomes addressed:

1. PO1: Engineering knowledge
2. PO2: Problem analysis
3. PO3: Design and Development of Solution
4. PO4: Conduct investigations of complex problems
5. PO5: Modern tool usage
6. PO6: The engineer and society
7. PO7: Environment and sustainability
8. PO8: Ethics
9. PO9:Indiviual and Team work
10. PO10: Communication
11. PO11: Project management and finance
12. PO12: Life-Long Learning

Course Objectives:

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

Course Outcomes:

1. After successful completion of the course, students will be able to:
2. Understand and Explain (*Understand*) the basic concepts of human values and their significance in personal and professional contexts, particularly in the IT industry.
3. Explore and Internalize (*Apply*) human values to guide personal behavior and professional conduct in IT roles such as software development, data analysis, and cybersecurity.
4. 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.
5. 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.
6. 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.
7. 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**	**LO1, LO4**
	1.1	Definition, Intrinsic & Extrinsic values, Shalom Schwartz's Theory of Basic Human Values, Value education: Need, Basic Guidelines and Scope, Self-exploration, Happiness and Prosperity, Harmony, Self-awareness: JOHARI window and SWOT analysis	LO1
	1.2	Ethical Challenges in IT: Data privacy, cybersecurity, AI ethics, and intellectual property rights	LO4
2.0		**Understanding Human Beings and Harmony at Various Levels of Existence**	**LO3, LO6**
	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**	**LO4**
	3.1	Definition, Characteristics, Profession, Professionalism, Morality, Moral issues in the IT profession, Understanding Ethics, Ethical Standards, Work Ethics, Engineering Ethics	LO4
	3.2	Types of Inquiries, Kohlberg's Theory, Heinz Dilemma, Gilligan's Theory, and Ethical Theories	LO4
	3.3	Ethical Challenges in IT: Data privacy, cybersecurity, AI ethics, and intellectual property rights	LO4
4.0		**Ethics, Integrity, and Aptitude in IT**	**LO5**
	4.1	Essence, determinants, and consequences of ethics in human actions, Dimensions of ethics, Ethics in private and public relationships	LO5

Module No.	Unit No.	Topics	LO
	4.2	Key contributions from Indian and global moral thinkers and philosophers, emphasizing integrity, impartiality, and non-partisanship in professional settings	LO5
	4.3	Upholding objectivity and dedication to public service, Cultivating empathy, tolerance, and compassion, with a focus on their application in IT and public welfare	LO5
5.0		**Understanding Harmony in Nature and Sustainable IT Practices**	**LO6**
	5.1	Concept of harmony in Nature: Meaning of harmony in nature, Disharmony with Nature -- causes, Implications of disharmony with nature	LO6
	5.2	Maintaining harmony with nature: Harmony through mutual fulfilment of the four orders in nature, Harmony through symbiotic relationship with nature, Achieving competence in maintaining harmony with nature in professional life	LO6
	5.3	Sustainable IT Practices: Green computing, energy-efficient algorithms, and eco-friendly technology development	LO6
6.0		**Practicum Project -- Community Engagement and IT for Social Good**	**LO2, LO5, LO6**
	6.1	Students carry out a community engagement project to benefit the local community through IT-based initiatives (e.g., developing apps for social causes, organizing digital literacy camps, or creating awareness about cybersecurity).	LO2, LO5, LO6
	6.2	Students write a reflective report on how the understanding of universal human values has been integrated into their IT project.	LO5, LO6

Textbooks:

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

Reference Books:

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

Online References:

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

Course Assessment:

Internal Assessment Method (With Rubrics)

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

Assessment Component	Weightage (%)	Evaluation Criteria (Rubrics)
Assignment on Human Values	20%	- Excellent (5): Demonstrates deep understanding with real-life examples - Good (4): Good understanding with relevant examples - Satisfactory (3): Basic understanding with minimal examples - Needs Improvement (2): Partial understanding with errors - Poor (1): Little to no understanding
Case Study on Ethical Issues in IT	20%	- Excellent (5): In-depth analysis with ethical theories and solutions - Good (4): Covers major ethical aspects with examples - Satisfactory (3): Identifies ethical concerns with some analysis - Needs Improvement (2): Limited understanding with minor errors - Poor (1): Lacks analysis and ethical reasoning
Presentation on Sustainability in IT	20%	- Excellent (5): Well-structured, engaging, innovative ideas - Good (4): Clear and logical presentation with good insights - Satisfactory (3): Covers major points but lacks depth - Needs Improvement (2): Some points missing, lacks clarity - Poor (1): Unstructured, lacks coherence
Reflection Report on Practicum Project	20%	- Excellent (5): Thoughtful reflection, well-articulated impact - Good (4): Covers personal learning and impact clearly - Satisfactory (3): General reflection with limited depth - Needs Improvement (2): Superficial understanding - Poor (1): Minimal effort, lacks insight
Participation in Discussion & Engagement	20%	- Excellent (5): Actively participates, provides insightful contributions - Good (4): Engaged, contributes relevant thoughts - Satisfactory (3): Participates but with limited contribution - Needs Improvement (2): Rarely participates, minimal effort - Poor (1): No participation

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

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

Digital Literacy Program for Underprivileged Communities

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

Implementation:

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

Human Values & Ethics Integration:

- **Empathy & Compassion** – Address digital divide and empower underprivileged individuals.
- **Integrity & Responsibility** – Teach ethical use of technology and responsible online behavior.
- **Public Welfare** – Ensure safe digital access for vulnerable communities.

AI-Based Cyberbullying Detection for Schools & Colleges

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

Implementation:

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

Human Values & Ethics Integration:

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

Green Computing Awareness & E-Waste Management App

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

Implementation:

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

Human Values & Ethics Integration:

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

Cybersecurity Awareness Chatbot for Senior Citizens

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

Implementation:

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

Human Values & Ethics Integration:

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

AI Ethics Awareness in IT Companies & Colleges

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

Implementation:

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

Human Values & Ethics Integration:

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

Mobile App for Volunteer & Donation Matching

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

Implementation:

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

Human Values & Ethics Integration:

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

Ethical Hacking & Cybersecurity Training for Students

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

Implementation:

- Develop training modules on ethical hacking, cryptography, and network security.
- Conduct capture-the-flag (CTF) cybersecurity challenges for hands-on learning.

- Educate students on responsible disclosure of vulnerabilities.
- Partner with cybersecurity firms for internships and projects.

Human Values & Ethics Integration:

- **Ethical Responsibility** – Train IT students to prevent cybercrimes.
- **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.

SIES Graduate School of Technology
Department of Electronics and Telecommunication Engineering
Bachelor of Technology

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
ETM401	Mini Project 1B	--	02$	--	--	01	--	01

Course Code	Course Name	Examination Scheme					
		Theory Marks			CIAP	ESEP	Total
		Course Assessment		ESE			
		ISE	MSE				
ETM401	Mini Project 1B	--	--	--	25	25	50

$ Indicates work load of a learner (Not Faculty) for Mini Project 1B. Faculty Load: 1/2 hour per week per four groups.

Pre-requisite:

ETM301: Mini Project 1A

Program Outcomes addressed:

1. PO1: Engineering knowledge
2. PO2: Problem Analysis
3. PO3: Design/Development of Solutions
4. PO4: Conduct investigations of complex problems
5. PO5: Modern Tool Usage
6. PO6: The Engineer & Society
7. PO7: Environment & Sustainability
8. PO8: Ethics
9. PO9: Individual & team work
10. PO10: Communication
11. PO11: Project Management & Finance
12. PO12: Life-long learning
13. PSO1: Achieve eminence in domains like signal processing, VLSI, embedded IoT, RF & microwave

Objectives

1. To acquaint with the process of identifying 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.
5. To enhance written and oral communication skills.
6. To foster ethical leadership and responsible decision making

Course Outcomes:

After successful completion of the course student will be able to

1. Identify problems based on societal /research needs.
2. Develop interpersonal skills to work as member of a group or leader.
3. Apply Knowledge and skill to solve societal problems in a group.
4. Analyze available results through theoretical/ experimental/simulations
5. Excel in written and oral communication.
6. Apply standard norms of engineering practices and demonstrate project management principles during project work.

Guidelines for Mini Project:

- Students shall form a group of 3 to 4 students, while forming a group shall not be allowed less than three or more than four students, as it is a group activity.
- Mini project 1B should be hardware and software based. Boards like NodeMcU,ESP32 etc.other than Arduino and Rpi preferred.
- 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.
- Students shall submit implementation plan in the form of Gantt/PERT/CPM chart, which will cover weekly activity of mini project.
- A log book to be prepared by each group, wherein group can record weekly work progress, guide/supervisor can verify and record notes/comments.
- Faculty supervisor may give inputs to students during mini project activity; however, focus shall be on self-learning.
- Students in a group shall understand problem effectively, propose multiple solution and select best possible solution in consultation with guide/ supervisor.
- Students shall convert the best solution into working model using various components of their domain areas and demonstrate.
- The solution to be validated with proper justification and report to be compiled in standard format.

Guidelines for Assessment of Mini Project:

Term Work (CIAP)

- The review /progress monitoring committee shall be constituted by head of department 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.

Review/progress monitoring committee may consider following points for assessment based general guidelines.

Assessment:

- 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 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

Guidelines for Assessment of Mini Project Practical/Oral Examination:

- Report should be prepared as per the standard format.
- 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 organizations 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 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

Term Work:

The term work should include 1 project. Term work will be assessed as Continuous Internal Assessment Practical (CIAP).

Distribution of Term work (25 Marks)shall be as below:

- Marks awarded by guide/supervisor based on log book : 10
- Marks awarded by review committee :10
- Quality of Project report :05

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

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

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

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)

ISE 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)	05Marks
2	Literature review of papers/journals	05Marks
3	Participation in event/ workshop/ talk / competition followed by small report and certificate of participation relevant to the subject	05Marks
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	10Marks
7	Case study, Presentation, group discussion, technical debate on recent trends in the said course	10Marks
8	NPTEL/Coursera/Udemy/anyMOOCCertificatecoursefor4weeksormore	10Marks
9	Creating Proof of Concept	10Marks
10	MiniProject	10Marks
11	GATE Based Assignment test/Tutorials etc.	10Marks

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