Agnel Charities'

Fr. C. Rodrigues Institute of Technology

Sector 9A, Vashi, Navi Mumbai, 400703, Maharashtra, India

www.fcrit.ac.in

An Autonomous Institute Affiliated to the University of Mumbai

Department of Information Technology

Curriculum Structure FY to B.Tech

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First Year and Second Year Syllabus

Prepared by : Board of Studies for Information Technology

Approved By: Academic Council of Fr.C.Rodrigues Institute of Technology

Revision: 2024

Effective from :2024-25

PREAMBLE FROM DEAN ACADEMICS

Accelerating Towards Excellence: Unveiling a New Era in Education

Dear Students, Faculty, and Stakeholders,

It is with great pleasure and anticipation that we introduce the newly designed curriculum for autonomy at Agnel Charities' Fr. C. Rodrigues Institute of Technology. This pioneering initiative aims to revolutionize engineering education, ensuring our graduates are equipped with not only technical prowess but also the holistic skills necessary for thriving in today's dynamic professional landscape.

1. **Purpose of Autonomy:** Our commitment to autonomy is rooted in the imperative to bridge the gap between academia and industry. We envision education as a catalyst for individual growth, fostering self-sustainability and enhancing employability. Through our curriculum, we strive to nurture engineers who not only excel in their fields but also contribute meaningfully to society.
2. **Curriculum Design: A Top-to-Down Approach:** Our curriculum is meticulously crafted with a top-to-down approach, encompassing all 12 attributes of Program Outcomes mandated by regulatory bodies. Emphasizing a blend of theoretical knowledge and practical application, it is designed to cultivate well-rounded professionals capable of tackling real-world challenges with confidence and competence.
3. **Alignment with National Education Policy-2020:** In adherence to the guidelines laid out in the National Education Policy-2020, our curriculum embodies a multidisciplinary approach, offering a diverse array of core and elective courses. It integrates hands-on learning experiences such as mini and major projects, skill-based labs, and one-semester internships to nurture innovation and problem-solving skills. Additionally, the inclusion of value-added courses, honours, and minors ensures a comprehensive educational journey tailored to individual interests and aspirations.
4. **Opportunities for Teachers in Innovation:** We recognize the pivotal role of our faculty in shaping the educational experience. Our curriculum provides ample opportunities for teachers to innovate in teaching-learning methodologies and evaluation techniques. Through continuous professional development programs and collaborative platforms, we empower our educators to experiment with innovative pedagogies, leverage technology for enhanced learning outcomes, and implement novel assessment strategies. By fostering a culture of innovation among our faculty, we aim to enrich the learning experience and inspire a passion for lifelong learning among our students.

As we embark on this transformative journey, we invite all stakeholders to join us in shaping the future of engineering education. Together, let us strive towards excellence, innovation, and societal impact.

Sincerely,

Dean of Academics Agnel Charities' Fr. C. Rodrigues Institute of Technology

PREAMBLE FROM BOS CHAIRMAN

Dear Students and Stakeholders,

It is with great pleasure and anticipation that Board of Studies of Information Technology introduce the newly designed curriculum at Agnel Charities' Fr. C. Rodrigues Institute of Technology. This pioneering initiative aims to equip students with a robust foundation in theoretical principles, practical skills, and ethical considerations essential for success in the IT industry. Through a multidisciplinary curriculum designed under Autonomy, students are empowered to tackle complex challenges with confidence and creativity in an era defined by technological innovation and rapid advancements. Furthermore, the course is designed to cultivate critical thinking, problem-solving abilities, teamwork, and effective communication skills, fostering well-rounded professionals capable of thriving in dynamic work environments.

Department has taken a lead in incorporating philosophy of outcome based education in the process of curriculum development. Curriculum is aligned with Institute, Department vision and mission and with National Education Policy-2020. Designed curriculum is responsive to the diverse needs of students, the larger society and even the global community. At the core of our educational philosophy lies a commitment to holistic development, recognizing that true excellence encompasses not only technical proficiency but also personal growth, ethical integrity, and social responsibility

While designing the curriculum framework, explicit and clear learning purpose is established through vision, mission and program outcomes. Program outcomes are referred as per the guidelines mentioned in NBA SAR-January 2016. Positioning of learning in real world is ensured to keep abreast of latest trends and technologies as per industry requirement. Well thought has been given to selection of courses while structuring the curriculum. Core courses, elective courses, Lab courses, skill based lab courses and Honours/Minor verticals such as Security, Artificial Intelligence & Machine Learning, Internet of Things, Data science are identified. Information Technology course integrates a range of experiential learning opportunities, including internships, mini and major projects, industry projects and collaborative research initiatives. Additionally, emphasis is placed on promoting a culture of lifelong learning, encouraging students to stay abreast of emerging trends, engage in continuous professional development, and contribute meaningfully to the advancement of the field.

Department has taken an initiative to design course syllabus by adapting leaner centered approach through backward design method facilitating the creation of more cohesive, clear and intentional learning experiences for learners. While designing the syllabus teacher has identified the desired results through setting the course and learning objectives aligned with Bloom taxonomy and Performance Indicators. Teacher has identified the assessments that students will complete in order to demonstrate evidence of learning and even progress towards achievement of learning objectives. Based on this teacher has planned the contents. While planning the content points are considered as what enabling knowledge & skills will learner need in order to achieve desired results, what ways they will be evaluated along the way, what activities will equip learner with needed knowledge and skills, what will need to be taught and how should it best be done using pedagogical and innovative methods. The draft scheme and syllabus were presented to all stakeholders for receiving critical feedback and suggestions. Important and relevant suggestions were incorporated.

We invite all stakeholders to join us on this transformative educational journey, where students are empowered to become catalysts of innovation, drivers of change, and leaders of tomorrow's digital landscape. By embracing a holistic approach to learning, grounded in academic rigor, practical relevance, and ethical values, we strive to nurture a new generation of IT professionals poised to make a positive impact on society and shape a brighter future for generations to come.

Sincerely,
Chairman, Board of Studies-Information Technology, Agnel Charities' Fr. C. Rodrigues Institute of Technology

Contents

A. Abbreviations

AEC	Ability Enhancement Course
AU	Audit Course
BSC	Basic Science Course including Mathematics
BSC-LC	Basic Science Laboratory Course
ELC	Experiential Learning Course
ESC	Engineering Science Course
ESC-LC	Engineering Science Laboratory Course
HSSM	Humanities Social Sciences and Management Course
IKS	Indian Knowledge System Course
INTR	Internship
L	Lecture
LC	Laboratory Course
LLC	Liberal Learning Course
MDM	Multidisciplinary Minor Course
MJP	Major project
MP	Mini Project
OE	Open Elective Course
P	Practical
PCC	Program Core Course
PE	Program Elective Course
SBL	Skill Based Laboratory
SEC	Skill Enhancement Course
T	Tutorial
VEC	Value Education Course

B. Credit Structure

B. Tech. in Information Technology											
Type of Course	**Semester-wise Credit Distribution**									**FCRIT Credit Distribution**	**DTE Credit Distribution**
	I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**Total**		
Basic Science Course (BSC)	08	08	--	--	--	--	--	--	**16**	**18**	**14-18**
Basic Science Laboratory Course (BSC-LC)	01	01	--	--	--	--	--	--	**02**		
Engineering Science Course (ESC)	05	02	--	--	--	--	--	--	**07**	**16**	**12-16**
Engineering Science Laboratory Course (ESC-LC)	04	05	--	--	--	--	--	--	**09**		
Program Core Course (PCC)	--	--	14	13	06	03	03	--	**39**	**51**	**44-56**
Laboratory Course (LC)	--	--	02	03	03	02	02	--	**12**		
Program Elective (PE)	--	--	--	--	03	03	06	03	**15**	**15**	**20**
Multidisciplinary Minor (MDM)	--	--	03	03	03	03	--	--	**12**	**12**	**14**
Open Elective (OE)	--	--	--	--	--	--	03	03	**06**	**06**	**08**
Skill Enhancement Course (SEC)	01	01	--	--	--	--	--	--	**02**	**08**	**08**
Skill Based Laboratory (SBL)	--	--	02	02	--	02	--	--	**06**		
Ability Enhancement Course (AEC)	--	03	--	--	02	--	--	--	**05**	**05**	**04**
Humanities Social Sciences and Management (HSSM)	--	--	02	--	02	--	02	--	**06**	**06**	**04**
Indian Knowledge System (IKS)	--	02	--	--	--	--	--	--	**02**	**02**	**02**
Value Education Course (VEC)	02	--	--	02	--	--	--	--	**04**	**04**	**04**
Experiential Learning Course (ELC)	--	--	--	--	--	02	--	--	**02**	**02**	**04**
Mini Project (MP)	--	--	01	01	01	01	--	--	**04**	**10**	**04**
Major Project (MJP)	--	--	--	--	--	--	02	04	**06**		
Internship (INTR)	--	--	--	--	--	--	--	08	**08**	**08**	**12**
Liberal Learning Course (LLC)	--	--	--	--	--	02	--	---	**02**	**02**	**04**
Total Credits	**21**	**22**	**24**	**24**	**20**	**18**	**18**	**18**	**165**	**165**	**160-176**

C. Curriculum Structure and Examination Scheme for B. Tech. in Information Technology

(FY and SY with Effect from AY 2024-2025)
Curriculum Structure – FY Semester-I

Course Type	Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
			L	P	T	L	P	T	Total
BSC	BSC101	Engineering Mathematics- I	3	--	1	3	--	1	4
BSC	BSC102	Engineering Physics-I	2	--	--	2	--	--	2
BSC	BSC103	Engineering Chemistry-I	2	--	--	2	--	--	2
ESC	ESC101	Engineering Mechanics	3	--	--	3	--	--	3
ESC	ESC102	Basic Electrical Engineering	2	--	--	2	--	--	2
BSC-LC	BSCLC101	Engineering Physics-I Laboratory	--	1	--	--	0.5	--	0.5
BSC-LC	BSCLC102	Engineering Chemistry-I Laboratory	--	1	--	--	0.5	--	0.5
ESC-LC	ESCLC101	Engineering Mechanics Laboratory	--	2	--	--	1	--	1
ESC-LC	ESCLC102	Basic Electrical Engineering Laboratory	--	2	--	--	1	--	1
ESC-LC	ESCLC103	Programming Laboratory-I (C)	--	2*+2	--	--	2	--	2
SEC	SEC101	Basic Workshop Practice-I	--	2	--	--	1	--	1
VEC	VEC101	Universal Human Values	2	--	--	2	--	--	2
		Total	**14**	**12**	**1**	**14**	**6**	**1**	**21**

*** Instructions should be conducted for the entire class.**

NOTE 1: Compulsory Non-Credit Activities: Participation and/or coordination of co-curricular and extra-curricular events at the Institute or Department level is mandatory for all students from semesters I to VIII as part of non-credit liberal education. These activities do not yield credits. Upon successful participation or organization of activities, a certificate will be awarded at the conclusion of semester VIII.

NOTE 2: Please note that during semesters I to VIII some of the non-technical courses such as Humanities Social Sciences and Management (HSSM), Open Electives (OE), Value Education Course (VEC), and Liberal Learning Course (LLC) may be conducted either online synchronously or asynchronously.

Examination Scheme – FY Semester-I

Course Type	Course Code	Course Name	Examination Scheme					Total
			In-Semester Assessment$		End Sem. Exam (ESE)	Exam Duration for Theory (in Hrs)		
			Continuous Assessment	Mid-Sem Exam		Mid-Sem	End-Sem	
BSC	BSC101	Engineering Mathematics-I	20+25@	30	50	1.5	2	125
BSC	BSC102	Engineering Physics-I	15	20	40	1.0	1.5	75
BSC	BSC103	Engineering Chemistry-I	15	20	40	1.0	1.5	75
ESC	ESC101	Engineering Mechanics	20	30	50	1.5	2	100
ESC	ESC102	Basic Electrical Engineering	15	20	40	1.0	1.5	75
BSC-LC	BSCLC101	Engineering Physics-I Laboratory	25	--	--	--	--	25
BSC-LC	BSCLC102	Engineering Chemistry-I Laboratory	25	--	--	--	--	25
ESC-LC	ESCLC101	Engineering Mechanics Laboratory	25	--	--	--	--	25
ESC-LC	ESCLC102	Basic Electrical Engineering Laboratory	25	--	25	--	--	50
ESC-LC	ESCLC103	Programming Laboratory-I (C)	50	--	50	--	--	100
SEC	SEC101	Basic Workshop Practice-I	50	--	--	--	--	50
VEC	VEC101	Universal Human Values	50	--	--	--	--	50
		Total	**360**	**120**	**295**	--	--	**775**

$Please refer to the syllabus for guidelines on in-semester assessments for both theory and laboratory courses.

@For continuous assessment of tutorials.

Curriculum Structure – FY Semester-II

Course Type	Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
			L	P	T	L	P	T	Total
BSC	BSC204	Engineering Mathematics-II	3	--	1	3	--	1	4
BSC	BSC205	Engineering Physics-II	2	--	--	2	--	--	2
BSC	BSC206	Engineering Chemistry-II	2	--	--	2	--	--	2
AEC	AEC201	Professional Communication and Ethics-I	2	2	--	2	1	--	3
ESC	ESC203	Basic Electronics Engineering	2	--	--	2	--	--	2
BSC-LC	BSCLC203	Engineering Physics-II Laboratory	--	1	--	--	0.5	--	0.5
BSC-LC	BSCLC204	Engineering Chemistry-II Laboratory	--	1	--	--	0.5	--	0.5
ESC-LC	ESCLC204	Engineering Graphics Laboratory	--	2*+2	--	--	2	--	2
ESC-LC	ESCLC205	Programming Laboratory-II (Java)	--	2*+2	--	--	2	--	2
ESC-LC	ESCLC206	Basic Electronics Engineering Laboratory	--	2	--	--	1	--	1
SEC	SEC202	Basic Workshop Practice-II	--	2	--	--	1	--	1
IKS	IKS201	Indian Knowledge System	2	--	--	2	--	--	2
		Total	**13**	**16**	**1**	**13**	**8**	**1**	**22**

*** Instructions should be conducted for the entire class.**

Examination Scheme – FY Semester-II

Course Type	Course Code	Course Name	Examination Scheme					Total
			In-Semester Assessment$		End Sem Exam (ESE)	Exam Duration for Theory (in Hrs)		
			Continuous Assessment	Mid-Sem Exam		Mid-Sem	End-Sem	
BSC	BSC204	Engineering Mathematics-II	20+25@	30	50	1.5	2	125
BSC	BSC205	Engineering Physics-II	15	20	40	1.0	1.5	75
BSC	BSC206	Engineering Chemistry-II	15	20	40	1.0	1.5	75
AEC	AEC201	Professional Communication and Ethics-I	50	--	--	--	--	50
ESC	ESC203	Basic Electronics Engineering	15	20	40	1.0	1.5	75
BSC-LC	BSCLC203	Engineering Physics-II Laboratory	25	--	--	--	--	25
BSC-LC	BSCLC204	Engineering Chemistry-II Laboratory	25	--	--	--	--	25
ESC-LC	ESCLC204	Engineering Graphics Laboratory	50	--	50	--	--	100
ESC-LC	ESCLC205	Programming Laboratory-II (Java)	50	--	50	--	--	100
ESC-LC	ESCLC206	Basic Electronics Engineering Laboratory	25	--	25	--	--	50
SEC	SEC202	Basic Workshop Practice-II	50	--	--	--	--	50
IKS	IKS201	Indian Knowledge System	50	--	--	--	--	50
		Total	**415**	**90**	**295**	--	--	**800**

$Please refer to the syllabus for guidelines on in-semester assessments for both theory and laboratory courses.

@For continuous assessment of tutorials.

Curriculum Structure – SY Semester-III

Course Type	Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
			L	P	T	L	P	T	Total
PCC	ITPCC301	Engineering Mathematics-III	3	--	1	3	--	1	4
PCC	ITPCC302	Computer Organization & Architecture	3	--	1	3	--	1	4
PCC	ITPCC303	Data Structures & Analysis	3	--	--	3	--	--	3
PCC	ITPCC304	Database Management System	3	--	--	3	--	--	3
MDM	ITMDM301	Digital Logic Design & Analysis	3	--	--	3	--	--	3
LC	ITLC301	Data Structure Laboratory	--	2	--	--	1	--	1
LC	ITLC302	SQL Laboratory	--	2	--	--	1	--	1
SBL	ITSBL301	Python Laboratory	--	4	--	--	2	--	2
MP	ITMP301	Mini Project – 1A	--	3	--	--	1	--	1
HSSM	HSSM301	Product Design	2	--	--	2	--	--	2
		Total	**17**	**11**	**2**	**17**	**5**	**2**	**24**

Examination Scheme – SY Semester-III

Course Type	Course Code	Course Name	Examination Scheme					Total
			In-Semester Assessment$		End Sem. Exam (ESE)	Exam Duration for Theory (in Hrs)		
			Continuous Assessment	Mid-Sem Exam		Mid-Sem	End-Sem	
PCC	ITPCC301	Engineering Mathematics-III	20+25@	30	50	1.5	2	125
PCC	ITPCC302	Computer Organization & Architecture	20+25@	30	50	1.5	2	125
PCC	ITPCC303	Data Structures & Analysis	20	30	50	1.5	2	100
PCC	ITPCC304	Database Management System	20	30	50	1.5	2	100
MDM	ITMDM301	Digital Logic Design & Analysis	20	30	50	1.5	2	100
LC	ITLC301	Data Structure Laboratory	25	--	25	--	--	50
LC	ITLC302	SQL Laboratory	25	--	25	--	--	50
SBL	ITSBL301	Python Laboratory	50	--	50	--	--	100
MP	ITMP301	Mini Project – 1A	50	--	--	--	--	50
HSSM	HSSM301	Product Design	50	--	--	--	--	50
		Total	**350**	**150**	**350**	--	--	**850**

$Please refer to the syllabus for guidelines on in-semester assessments for both theory and laboratory courses.

@For continuous assessment of tutorials.

Curriculum Structure – SY Semester-IV

Course Type	Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
			L	P	T	L	P	T	Total
PCC	ITPCC405	Engineering Mathematics-IV	3	--	1	3	--	1	4
PCC	ITPCC406	Computer Network	3		--	3	--	--	3
PCC	ITPCC407	Operating System	3	--	--	3	--	--	3
PCC	ITPCC408	Software Engineering	3	--	--	3	--	--	3
MDM	ITMDM402	Microcontroller & Embedded System	3	--	--	3	--	--	3
LC	ITLC403	Networks Laboratory	--	2	--	--	1	--	1
LC	ITLC404	Linux Laboratory	--	2	--	--	1	--	1
LC	ITLC405	Software Development Laboratory	--	2	--	--	1	--	1
SBL	ITSBL402	Full stack Development Laboratory	--	4	--	--	2	--	2
MP	ITMP402	Mini Project – 1B	--	3	--	--	1	--	1
VEC	VEC402	Environment and Sustainability	2	--	--	2	--	--	2
		Total	**17**	**13**	**1**	**17**	**6**	**1**	**24**

Examination Scheme – SY Semester-IV

Course Type	Course Code	Course Name	Examination Scheme					Total
			In-Semester Assessment$		End Sem Exam (ESE)	Exam Duration for Theory (in Hrs)		
			Continuous Assessment	Mid-Sem Exam		Mid-Sem	End-Sem	
PCC	ITPCC405	Engineering Mathematics-IV	20+25@	30	50	1.5	2	125
PCC	ITPCC406	Computer Network	20	30	50	1.5	2	100
PCC	ITPCC407	Operating System	20	30	50	1.5	2	100
PCC	ITPCC408	Software Engineering	20	30	50	1.5	2	100
MDM	ITMDM402	Microcontroller & Embedded System	20	30	50	1.5	2	100
LC	ITLC403	Networks Laboratory	25	--	25	--	--	50
LC	ITLC404	Linux Laboratory	25	--	25	--	--	50
LC	ITLC405	Software Development Laboratory	25	--	25	--	--	50
SBL	ITSBL402	Full stack Development Laboratory	50	--	50	--	--	100
MP	ITMP402	Mini Project – 1B	50	--	50	--	--	100
VEC	VEC402	Environment and Sustainability	50	--	--	--	--	50
		Total	**350**	**150**	**425**	--	--	**925**

$Please refer to the syllabus for guidelines on in-semester assessments for both theory and laboratory courses.

@For continuous assessment of tutorials.

Curriculum Structure – TY Semester-V

Course Type	Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
			L	P	T	L	P	T	Total
PCC	ITPCC509	Automata Theory	3	--	--	3	--	--	3
PCC	ITPCC510	Artificial Intelligence	3	--	--	3	--	--	3
MDM	ITMDM503	Image Processing	3	--	--	3	--	--	3
PE	ITPE501X	Program Elective Course-I	3	--	--	3	--	--	3
LC	ITLC506	Cloud Computing Laboratory	--	2	--	--	1	--	1
LC	ITLC507	Data Science Laboratory	--	2	--	--	1	--	1
LC	ITLC508	Mobile Application Development Laboratory	--	2	--	--	1	--	1
AEC	AEC502	Professional Communication and Ethics-II	1	2	--	1	1	--	2
MP	ITMP503	Mini Project-2A	--	3	--	--	1	--	1
HSSM	HSSM502	Entrepreneurship	2	--	--	2	--	--	2
		Total	**15**	**11**	**--**	**15**	**5**	**--**	**20**

NOTE: Students who choose not to pursue Honours or Minor are welcome to register for the initial two courses of the fifth and sixth semesters' Honours or Minor track in 'Audit' mode (AU). This allows them to explore the course material without the expectation of earning a letter grade. Upon fulfilling the requirements in 'Audit' mode, their participation will be acknowledged on the grade sheet. Audit courses are excluded from grade point averages and have no impact on SGPI/CGPI calculations. For more information on Honours and Minor track courses, please refer to the Institute Handbook for Honours/Minor/Honours in Research degree programs.

Program Elective Course-I:

Students should take one PE from the following list of Program Elective Course- I.

Course Code	Program Elective Course-I
ITPE5011	Analysis of Algorithms
ITPE5012	Cloud Computing Services
ITPE5013	Data Warehousing & Mining

Examination Scheme – TY Semester-V

Course Type	Course Code	Course Name	Examination Scheme					Total
			In-Semester Assessment$		End Sem Exam (ESE)	Exam Duration for Theory (in Hrs)		
			Continuous Assessment	Mid-Sem Exam		Mid-Sem	End-Sem	
PCC	ITPCC509	Automata Theory	20	30	50	1.5	2	100
PCC	ITPCC510	Artificial Intelligence	20	30	50	1.5	2	100
MDM	ITMDM503	Image Processing	20	30	50	1.5	2	100
PE	ITPE501X	Program Elective Course-I	20	30	50	1.5	2	100
LC	ITLC506	Cloud Computing Laboratory	25	--	25	--	--	50
LC	ITLC507	Data Science Laboratory	25	--	25	--	--	50
LC	ITLC508	Mobile Application Development Laboratory	25	--	25	--	--	50
AEC	AEC502	Professional Communication and Ethics-II	50	--	--	--	--	50
MP	ITMP503	Mini Project-2A	50	--	--	--	--	50
HSSM	HSSM502	Entrepreneurship	50	--	--	--	--	50
		Total	**305**	**120**	**275**	--	--	**700**

$Please refer to the syllabus guidelines on in-semester assessments for both theory and laboratory courses

Curriculum Structure – TY Semester-VI

Course Type	Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
			L	P	T	L	P	T	Total
PCC	ITPCC611	Cryptography & Network Security	3		--	3	--	--	3
MDM	ITMDM604	Internet of Everything	3		--	3	--	--	3
PE	ITPE602X	Program Elective Course-II	3	--	--	3	--	--	3
LC	ITLC609	Cryptography & Network Security Laboratory	--	2	--	--	1	--	1
LC	ITLC610	Internet of Everything Laboratory	--	2	--	--	1	--	1
SBL	ITSBL603	DevOps Laboratory	--	4	--	--	2	--	2
MP	ITMP604	Mini Project-2B	--	3	--	--	1	--	1
ELC	ELC601	Research Methodology	2	--	--	2	--	--	2
LLC	LLC601X*	Liberal Learning Course	2	--	--	2	--	--	2
		Total	**13**	**11**	**--**	**13**	**5**	**--**	**18**

NOTE: Students who choose not to pursue Honours or Minor are welcome to register for the initial two courses of the fifth and sixth semesters' Honours or Minor track in 'Audit' mode (AU). This allows them to explore the course material without the expectation of earning a letter grade. Upon fulfilling the requirements in 'Audit' mode, their participation will be acknowledged on the grade sheet. Audit courses are excluded from grade point averages and have no impact on SGPI/CGPI calculations. For more information on Honours and Minor track courses, please refer to the Institute Handbook for Honours/Minor/Honours in Research degree programs.

***Liberal Learning Course:**

Every student should take one Liberal Learning Course for Semester VI. Students can take this course from the following list of Liberal Learning Courses.

Course Code	Liberal Learning Course
LLC6011	Art of Living
LLC6012	Yoga and Meditation
LLC6013	Health and Wellness
LLC6014	Diet and Nutrition
LLC6015	Personality Development

Program Elective Course-II:

Students should take one PE from the following list of Program Elective Course- II.

Course Code	Program Elective Course-II
ITPE6021	Infrastructure Management
ITPE6022	Machine Learning**
ITPE6023	Wireless Technology

** Students who opted the Honours/Minor vertical as Artificial Intelligence & Machine Learning should not opt Machine Learning as Program Elective Course-II.

Examination Scheme – TY Semester-VI

Course Type	Course Code	Course Name	Examination Scheme					Total
			In-Semester Assessment$		End Sem. Exam (ESE)	Exam Duration for Theory (in Hrs)		
			Continuous Assessment	Mid-Sem Exam		Mid-Sem	End-Sem	
PCC	ITPCC611	Cryptography & Network Security	20	30	50	1.5	2	100
MDM	ITMDM604	Internet of Everything	20	30	50	1.5	2	100
PE	ITPE602X	Program Elective Course-II	20	30	50	1.5	2	100
LC	ITLC609	Cryptography & Network Security Laboratory	25	--	25	--	--	50
LC	ITLC610	Internet of Everything Laboratory	25	--	25	--	--	50
SBL	ITSBL603	DevOps Laboratory	50	--	50	--	--	100
MP	ITMP604	Mini Project-2B	50	--	50	--	--	100
ELC	ELC601	Research Methodology	50	--	--	--	--	50
LLC	LLC601X	Liberal Learning Course	50	--	--	--	--	50
		Total	**310**	**90**	**300**	--	--	**700**

$Please refer to the syllabus for guidelines on in-semester assessments for both theory and laboratory courses.

Curriculum Structure – B. Tech Semester-VII

Course Type	Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
			L	P	T	L	P	T	Total
PCC	ITPCC712	Edge Computing	3	--	--	3	--	--	3
PE	ITPE703X	Program Elective Course-III	3	--	--	3	--	--	3
PE	ITPE704X	Program Elective Course-IV	3	--	--	3	--	--	3
OE	OE701X	Open Elective Course –I	3	--	--	3	--	--	3
LC	ITLC711	Edge Computing Laboratory	--	2	--	--	1	--	1
LC	ITLC712	High Performance Computing Laboratory	--	2	--	--	1	--	1
MJP	ITMJP701	Major Project-A	--	6	--	--	2	--	2
HSSM	HSSM703	Financial Planning	2	--	--	2	--	--	2
		Total	**14**	**10**	--	**14**	**4**	--	**18**

Program Elective Course-III and IV:

Every student is required to take two Program Elective Courses for Semester VII. Students can take these courses from the following list of Program Elective Course-III and IV.

Course Code	Program Elective Course-III
ITPE7031	Quantum Computing
ITPE7032	Human Computer Interaction
ITPE7033	Ethical Hacking & Digital Forensics

Course Code	Program Elective Course-IV
ITPE7041	Big Data Analytics
ITPE7042	Augmented Reality & Virtual Reality
ITPE7043	Information Retrieval System

Open Elective Course-I:

Every student is required to take one Open Elective Course-I for Semester VII. Students can take this course from the following list of Open Elective Course-I.

Course Code	Open Elective Course-I
OE7011	Product Lifecycle Management
OE7012	Reliability Engineering
OE7013	Management Information System
OE7014	Design of Experiments
OE7015	Operation Research
OE7016 @@	Cyber Security and Laws
OE7017	Disaster Management and Mitigation Measures
OE7018	Energy Audit and Management
OE7019	Development Engineering

@@Students opting for Honours/Minor degree in Cybersecurity domain should not opt Cyber Security and Laws as Open Elective Course-I.

Examination Scheme – B. Tech. Semester-VII

Course Type	Course Code	Course Name	Examination Scheme					Total
			In-Semester Assessment$		End Sem Exam (ESE)	Exam Duration for Theory (in Hrs)		
			Continuous Assessment	Mid-Sem Exam		Mid-Sem	End-Sem	
PCC	ITPCC712	Edge Computing	20	30	50	1.5	2	100
PE	ITPE703X	Program Elective Course-III	20	30	50	1.5	2	100
PE	ITPE704X	Program Elective Course-IV	20	30	50	1.5	2	100
OE	OE701X	Open Elective Course –I	20	30	50	1.5	2	100
LC	ITLC711	Edge Computing Laboratory	25	--	25	--	--	50
LC	ITLC712	High Performance Computing Laboratory	25	--	25	--	--	50
MJP	ITMJP701	Major Project-A	50	--	--	--	--	50
HSSM	HSSM703	Financial Planning	50	--	--	--	--	50
		Total	**230**	**120**	**250**	--	--	**600**

$Please refer to the syllabus for guidelines on in-semester assessments for both theory and laboratory courses.

Curriculum Structure – B. Tech. Semester-VIII

Course Type	Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
			L	P	T	L	P	T	Total
PE	ITPE805X	Program Elective Course-V	3	--	--	3	--	--	3
OE	OE802X	Open Elective Course-II	3	--	--	3	--	--	3
MJP	ITMJP802	Major Project-B	--	12	--	--	4	--	4
INTR	INTR801	Internship~	--	--	--	--	8	--	8
		Total	**6**	**12**	**--**	**6**	**12**	**--**	**18**
~ Students have the opportunity to engage in a three-month internship within industry, research organizations, foreign universities, or internal internship for research and product development during the VIII semester, provided they meet the semester requirements and receive approval from the institute.									

Program Elective Course-V:

Every student is required to take Program Elective Course for Semester VIII. Students can choose program Elective Course-V, from one of domains listed below. The list of courses within the individual domains will be made available before the course registration

Course Code	Program Elective Course-V
ITPE8051	Blockchain
ITPE8052	Network and Security
ITPE8053	Computational Intelligence
ITPE8054	Internet of Things

Open Elective Course-II:

Every student is required to take one Open Elective Course-II for Semester VIII. Students can take this course from the following list of Open Elective Course-II.

Course Code	Open Elective Course-II
OE8021	Project Management
OE8022	Finance Management
OE8023	Entrepreneurship Development and Management
OE8024	Human Resource Management
OE8025	Professional Ethics and CSR
OE8026	Circular Economy
OE8027	IPR and Patenting
OE8028	Digital Business Management
OE8029	Environmental Management

Examination Scheme – B. Tech. Semester-VIII

Course Type	Course Code	Course Name	Examination Scheme					Total
			In-Semester Assessment$		End Sem Exam (ESE)	Exam Duration for Theory (in Hrs)		
			Continuous Assessment	Mid-Sem Exam		Mid-Sem	End-Sem	
PE	ITPE805X	Program Elective Course-V	20	30	50	1.5	2	100
OE	OE802X	Open Elective Course-II	20	30	50	1.5	2	100
MJP	ITMJP802	Major Project-B	50	--	50	--	--	100
INTR	INTR801	Internship	50	--	50	--	--	100
		Total	**140**	**60**	**200**	--	--	**400**

$Please refer to the syllabus for guidelines on in-semester assessments for theory, laboratory, and internship courses.

NOTE: Please note that due to the internship requirement in the VIII semester, theory courses during this semester will be conducted either online synchronously or asynchronously. For more information, please refer Institute Handbook.

D. Honours,Minor & Honours in Research Degree Program

The Honours, Minor, and Honours in Research degree programs aim to empower students by offering specialized courses/research internships or projects in emerging fields of their interest, thus enhancing their proficiency in those areas. Students who achieve a CGPI of 7.5 or higher by the end of the fourth semester are eligible to pursue an additional 18 credits from the fifth to eighth semesters to qualify for a B. Tech degree with Honours, Minor, or Honours in Research designation. Students need to refer to the Institute level Handbook for Honours/Minor/Honours in Research Degree Programs for further details.

E. First Year Syllabi

Course Type	Course Code	Course Name	Credits
BSC	BSC101	ENGINEERING MATHEMATICS-I	03+01*

Examination Scheme					
Distribution of Marks			Exam Duration (Hrs.)		Total Marks
In-semester Assessment		End Semester Exam (ESE)			
Continuous Assessment	Mid-Semester Exam (MSE)		MSE	ESE	
20 + 25*	30	50	1.5	2	125

*For Tutorial

Program Outcomes addressed:

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

Course Objectives:

1. To provide the basic knowledge of the concepts of Mathematics applicable to the field of engineering.
2. To build a mathematical foundation of the methodology required for solving application based problems in the field of engineering.

Module	Detailed Contents	Hrs	CO
00.	**Course Introduction** Mathematics is the fundamental step which creates a solid foundation for all Applied fields of Engineering. Professional Engineering applications have Mathematics as an integral part of their evolution. For example: 1. Formulation in Mathematics to various engineering field using case study 2. Application of matrices in control systems, wireless signals and computer graphics. 3. Introduction to function of several variables to apply in Marginal rate of technical substitution, Elasticity of substitution. 4. Use the concept of vector differentiation into Fluid Mechanics. Hence, Formulation Based Mathematics is a fundamental requisite to all fields of Engineering for analyzing their performances.	**1**	
01.	**Matrices - I** ***Learning Objective/s:*** *Learner will be able to* • *Analyse and interpret the basic fundamentals of matrices.* • *Determine the rank of a matrix by applying the concepts of elementary transformation of a matrix.*	**7-9**	**CO- 1**

	Contents: Type of Matrices and Properties, Symmetric, Skew-Symmetric, Orthogonal Matrices, Complex Matrix, Hermitian, skew-Hermitian, Unitary Matrices, Rank of a Matrix, Elementary transformation, Normal Form, Echelon Form. ***Learning Outcomes:*** *A learner will be able to* 1. *Express a square matrix as the sum of a Symmetric and Skew-Symmetric Matrix by identifying the correct definition. (2.1.1)* 2. *Identify the correct procedure to express a square matrix as the sum of a Symmetric and Skew-Symmetric Matrix. (2.2.3)* 3. *Express a square matrix as the sum of a Hermitian and Skew-Hermitian Matrix by identify the correct definition and. (2.1.1)* 4. *Identify the correct procedure to express a square matrix as the sum of a Hermitian and Skew-Hermitian Matrix. (2.2.3)* 5. *Use elementary transformations to determine the rank of a matrix. (1.1.1)* 6. *Determine the rank of a matrix by finding its normal form/canonical form.(1.2.1)*		
02.	**Matrices - II** ***Learning Objective/s:*** *Learner will be able to* • *Analyse the differences between homogeneous and non-homogeneous simultaneous equations* • *Apply these concepts to find their solutions, if they exist.* **Contents:** Solution of system of Linear Equations, Condition for consistency of Non-Homogeneous Equations, Condition for consistency of Homogeneous Equations, Row Vector and Column Vector, Linearly dependence and Independence of vectors, Linear Combination of Vectors ***Self-Learning Topics:*** ***Coding Theory*** ***Learning Outcomes:*** *A learner will be able to* 1. *Identify homogeneous and non-homogeneous simultaneous equations and express them into matrix form. (2.1.1)* 2. *Identify unknown variables to solve homogeneous and non-homogeneous simultaneous equations. (2.1.2)* 3. *Identify the appropriate method to solve homogeneous and non-homogeneous simultaneous equations. (2.2.3)* 4. *Interpret & use the concept of rank to solve simultaneous equations. (1.1.1)* 5. *Interpret & solve simultaneous equations based on the concept of rank. (1.2.1)*	**5-7**	**CO- 2**
03.	**Matrices-III** ***Learning Objective/s:*** • *Analyse and compute the Eigen Value and Eigen Vectors.* • *Enumerate and apply the concept of Eigen value and Eigen vector to Engineering Models.*	**6-8**	**CO- 2**

	Contents: Introduction to Eigen Values, Characteristic equation, Characteristic roots & Eigen vectors. Finding Eigen values and Eigen vectors for different types of Matrices: Non Symmetric Matrices with non-repeated Eigen Values, Non Symmetric Matrices with Repeated Eigen Values, Symmetric Matrices with non-repeated Eigen Values, Symmetric Matrices with Repeated Eigen Values Cayley-Hamilton Theorem (Without proof), Statement and verification, Function of square matrix as an application.		
	Self-Learning Topics: *Singular value Decomposition* ***Learning Outcomes:*** *A learner will be able to* 1. *Apply fundamentals of determinant to find Eigen Values and Eigen Vectors. (1.1.1)* 2. *Determine Eigen Values and Eigen Vectors by applying fundamentals of determinant. (1.2.1)* 3. *Analyse and Identify whether Cramer's Rule/homogeneous equation is applicable to find Eigen vectors. (2.1.1)* 4. *Identify and apply Cramer's Rule/ concept of homogeneous equations to find Eigen vectors. (2.1.3)* 5. *Determine Eigen vectors using Cramer's Rule/homogeneous equation.(2.2.4)*		
04	**Differential Calculus of Several Variables-I** ***Learning Objective/s:*** *Analyse the fundamentals of Differentiations of functions of two or more independent variables and apply this concept in function of functions, composite functions and implicit functions.*	**7-9**	**CO- 3**
	Contents: Introduction to Partial Differentiation, Geometrical meaning of $\frac{\partial u}{\partial x}$ & $\frac{\partial u}{\partial y}$ Partial derivatives of first and higher order, Differentiation of function of function, Differentiation of composite function.		

	Self-Learning Topics: *Jacobian of two and Three variable* ***Learning Outcomes:*** *A learner will be able to* 1. *Identify the basic concepts of partial differentiation (PD) with the prerequisite of differentiation of function of a single variable (calculus). (2.2.3)* 2. *Identify the suitable procedure to partially differentiate a function of several variables. (2.1.3)* 3. *Apply the learned concept to solve problems for several types of functions. (1.1.1)* 4. *Solve problems for several types of functions by applying the learned concept. (1.2.1)*		
05.	**Differential Calculus of Several Variables-II** ***Learning Objective/s:*** • *Apply the concept of PD to solve problems by using Euler 's Theorem on Homogeneous functions with two independent variables.* • *Analyse the learned concept of PD and apply it to find maxima and minima of functions of two variables.* **Contents:** Homogeneous functions, Euler's Theorem on Homogeneous functions with two Independent variables(With Proof) , Deductions from Euler's Theorem, Maxima and Minima of a function of two independent variables. ***Self-Learning Topics:*** *Euler's Theorem on Homogeneous functions with three Independent variables* *Learning Outcomes:* *A learner will be able to* 1. *Apply Euler's Theorem of two variables to solve problems (1.1.1)* 2. *Solve problems based on homogeneous function of two variables by applying Euler's Theorem of to (1.2.1)* 3. *Identify the conditions for maxima and minima of functions of two variables and determine it. (2.1.3)* 4. *Determine maxima and minima of functions of two variables by identify its conditions. (2.2.3)*	**5-7**	**CO- 3**
06.	**Vector Differentiation** ***Learning Objective/s:*** *Analyze the fundamentals of Gradient of scalar point function, Divergence & Curl of a vector point function and apply it to verify whether the field is irrotational or solenoidal.*	**7-9**	**CO- 4**

	Contents: Scalar and Vector point function, Differentiation of vector, Level surface, Gradient of scalar point function and its properties, Vector differential operator, geometrical meaning of $\nabla\emptyset$, directional derivative Divergence of a vector point function, Curl of a vector point function.		
	Self-Learning Topics: *Tangent and normal to the surface, angle between two surfaces at a common point.* ***Learning Outcomes:*** *A learner will be able to* 1. *Apply fundamentals of differentiation of several variables to evaluate Gradient, Divergence & Curl. (1.1.1)* 2. *Apply fundamentals of scalar product and vector product to evaluate Gradient, Divergence & Curl. (1.2.1)* 3. *Identify whether the given vector field is irrational or solenoidal and solve the problem. (2.1.3)* 4. *Identify the appropriate procedure to check whether a vector field is irrational or solenoidal and solve the problem. (2.2.3)*		
	Course Conclusion	**1**	
	Total	**45**	

Course Outcomes:

A Learner will be able to

1. Apply the concept of rank of a matrix to find the solution of homogeneous and non-homogeneous system of equations by analyzing their consistency.
2. Analyse the characteristic equation to determine the Eigen value, Eigen vector, also function of a matrix by applying Cayley-Hamilton theorem.
3. Implement the fundamentals of partial differentiation to evaluate the maxima and minima of functions of several variables.
4. Apply the concepts of Gradient, Divergence, and Curl in order to analyse and state the two types of fields, Irrotational and Solenoidal

Performance Indicators:

P.I. No.	P.I. Statement
1.1.1	Apply mathematical techniques as calculus/algebra to solve problems.
1.2.1	Apply laws of natural science to an engineering problem.
2.1.1	Articulate problem statements and identify objectives.
2.1.2	Identify engineering systems, variables, and parameters to solve the problems
2.1.3	Identify the mathematical knowledge that applies to a given problem.
2.2.3	Identify existing processes/solution methods for solving the Problems.
2.2.4	Compare and contrast alternative solution processes to select the best process.

Text Books:

1. Higher Engineering Mathematics, Dr. B. S. Grewal, Khanna Publication, forty fourth Edition, 2021
2. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley Eastern Limited, Tenth Edition, 2011.

Reference Books:

1. Engineering Mathematics by Srimanta Pal and Subodh, C. Bhunia, Oxford University Press, First Edition, 2015

IN-SEMESTER ASSESSMENT (75 Marks)

1. Continuous assessment (45 Marks)

Continuous Internal Evaluation of Theory (20 Marks)

1. Numerical Assignments (Minimum 20 problems): 5 marks
2. Class test based on above Numerical assignment: 5 marks
3. Team – Pair - Solo: 5 marks
4. Regularity and active participation: 5 marks

Continuous internal evaluation of Tutorial (25 Marks)

1. Tutorials: 20 Marks
2. Regularity and active participation: 5 marks
3. Students must be encouraged to write atleast 6 class tutorials. Atleast class tests will be conducted based on class tutorials on entire syllabus. Each class test carries 20 Marks. Average will be taken of all class tests.

2. Mid Semester Exam (30 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

END SEMESTER EXAMINATION (50 Marks)

End semester will be based on the syllabus coverage upto Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Type	Course Code	Course Name	Credits
BSC	BSC102	ENGINEERING PHYSICS-I	02

Examination Scheme					
Distribution of Marks			Exam Duration (Hrs.)		Total Marks
In-semester Assessment		End Semester Exam (ESE)			
Continuous Assessment	Mid-Semester Exam (MSE)		MSE	ESE	
15	20	40	1	1.5	75

Program Outcomes addressed:

1. PO1: Engineering knowledge
2. PO2: Problem analysis
3. PO6: The engineer and society
4. PO7: Environment and sustainability

Course Objectives:

1. To provide the Basic knowledge on the concepts of physics pertaining to the field of engineering.
2. To build a foundation to the methodology necessary for solving problems by applying the knowledge of physics in the field of engineering.

Module	Detailed Content	Hrs	CO
00.	**Course Introduction** Importance of physics in various engineering field: Application of thin film Interference and diffraction in measurement techniques: Introduction to laser and fibre optics its utilization in optoelectronics field: Use of semiconductor devices and superconductors in technology.	**1**	
01.	**Interference in Thin Film and Diffraction** ***Learning Objective/s:*** •*To apply the basic concept of interference and diffraction phenomena in various measurements.* •*To identify the principles of interference and diffraction to solve practical problems.*	**6-8**	**CO-1**
	Contents: Interference: Interference by division of amplitude; Interference in thin film of constant thickness: Application in Anti-reflecting films. Wedge shaped film: Newton's rings - Diameters of dark Newton's rings; Applications in determination of refractive index of liquid. Diffraction: Diffraction Grating, Diffraction due to grating; Resolving power of a grating; Applications of diffraction grating; Determination of wavelength of light using plane transmission grating.		

	Self-Learning Topics: *Origin of colours in thin film, Diameters of Bright Newton's rings, Determination of wavelength of incident light using Newton's rings experiment.* ***Learning Outcomes:*** *A learner will be able to* 1. *Diagrammatically describe the mechanism of thin film interference and diffraction. (P.I.-1.2.1)* 2. *Observe the interference phenomena in real life examples. (P.I.-1.2.1).* 3. *Solve problems using the concepts of thin film interference and diffraction. (P.I.-1.2.2)* 4. *Identify the parameters which defines the quality of a grating and solve the relevant problems. (P.I.-2.1.2)* 5. *Derive the conditions for maxima and minima in interference and diffraction. (P.I.-2.1.3)* 6. *Analyze the concept of thin film interference and diffraction for using in thin film coating and other measurements. (P.I.-2.2.3)*		
02.	**Laser** ***Learning Objective/s:*** *•To apply knowledge of absorption and emission in production of laser.* *•To identify the use of lasers in technical fields and associate the impact of laser applications in environment and societal context.*	**3-5**	**CO3**
	Contents: Laser: Stimulated emission and multiplication process; Population inversion; Pumping; Metastable state: Resonant cavity; Helium Neon laser: Principle, construction and working; Nd:YAG laser: Principle, construction and working; Applications of LASER.		
	Self-Learning Topics: *Spontaneous emission, Methods of Pumping, Advantages, disadvantages and limitations of He-Ne and Nd:YAG laser.* ***Learning Outcomes:*** *A learner will be able to* 1. *Differentiate between spontaneous emission and stimulated emission. (P.I.-1.2.1)* 2. *State various parameters related to lasers. (P.I.-1.2.1)* 3. *Identify different types of lasers in terms of principle, construction and working for public use. (P.I.-2.2.3)* 4. *State the advantages, disadvantages and limitations in using lasers. (P.I.-6.2.2)* 5. *Identify the industrial and medical applications of laser. (P.I.-6.1.1)*		
03.	**Fiber Optics** ***Learning Objective/s:*** *•To apply knowledge of optical phenomena in propagation of light through optical fibre.* *•To analyze the role of optical fibre in fibre optics communication.* *•To associate the use of fibre optics communication in societal issues and identify the principle of fibre optics to solve engineering problem..*	**3-5**	**CO-3**

	Contents: Optical Fibre; Numerical aperture; Angle of acceptance; V-number; Types of optical fibres; Numerical aperture for step index fibre; Fibre optic communication system.		
	Self-Learning Topics: *Critical angle, Fractional index change, Modes of propagation.* ***Learning Outcomes:*** *A learner will be able to* 1. *State various parameters related to the optical fibre. (P.I.-1.2.1)* 2. *Solve problems on optical fibre using the concepts and basic formulae. (P.I.-1.2.2)* 3. *Classify the optical fibre in terms of various properties. (P.I.-2.1.2)* 4. *Derive the expression of numerical aperture for step index fibre. (P.I.-2.1.3)* 5. *Apply the concept of optical fibre in fibre optic communication system. (P.I.-6.1.1)* 6. *State the merits, demerits and challenges in using Fibre optic communication system in the society. (P.I.-6.2.2)*		
04.	**Semiconductor Physics** ***Learning Objective/s:*** *•To apply the fundamental knowledge of band gap in semiconductors* *•To evaluate the concept of fermi level in semiconductor for solving problems.*	**4-6**	**CO-2**
	Contents: Energy bands in semiconductor; Direct & indirect band gap semiconductor; Determination of energy band gap in semiconductor. Fermi level; Fermi Dirac distribution, Fermi level in intrinsic semiconductors, Fermi level in extrinsic semiconductors: Effect of temperature and impurity concentration on fermi level in extrinsic semiconductors, Significance of Fermi level.		
	Self-Learning Topics: *Effect of temperature on fermi level in P-type semiconductor, Effect of impurity concentration on fermi level in N-type semiconductors, p-n junction diode.* ***Learning Outcomes :*** *A learner will be able to* 1. *State various parameters which defines a semiconductor. (P.I.-1.2.1)* 2. *Solve the problems involving fermi level. (P.I.-1.2.2)* 3. *Identify the types of semiconductors based on band gap. (P.I.-2.1.2)* 4. *Interpret the applications of semiconductors based on its band gap property. (P.I.-2.1.2)* 5. *Sketch the effect of temperature and impurities on fermi level of semiconductor. (P.I.-2.1.3)*		

05.	**Semiconductor Devices** ***Learning Objective/s:*** *•To apply the fundamental knowledge of semiconductor in various semiconductor devices.* *•To assess the applicability of semiconductor devices in different societal issues.* *•To identify impact of semiconductor devices in society in terms of sustainability.*	**3-5**	**CO-4**
	Contents: Semiconductor Devices: Hall sensor: Principle, construction, working and application; Semiconductor laser: Principle, construction, working and application; Solar cell: Principle, construction, working and application. Importance of semiconductor devices in terms of sustainability.		
	Self-Learning Topics: *Light Emitting Diode (LED), Photodiode.* ***Learning Outcomes:*** *A learner will be able to* 1. *State the principles of various semiconductor devices. (P.I.-1.2.1)* 2. *Use the Hall Effect phenomena in determination of magnetic field. (P.I.-2.1.3)* 3. *Analyse Semiconductor devices in terms of their principle, construction, working. (P.I.-2.2.3)* 4. *State applications of semiconductor devices in society. (P.I.-7.1.2)* 5. *identify the role of semiconductor devices as a solution for sustainable development. (P.I.-7.2.1)*		
06.	**Superconductors** ***Learning Objective/s:*** *•To summarize the properties of superconductors.* *•To evaluate practical problems using the principles of superconductors.* *•To apply the concept of superconductors in MAGLEV train.*	**3-5**	**CO-4**
	Contents: Superconductivity, critical temperature, critical magnetic field, Meissner effect; Type I and Type II superconductors; Applications of superconductor in MAGLEV.		
	Self-Learning Topics: *High temperature superconductor and its importance.*		

	Learning Outcomes: *A learner will be able to* *1. Recall the definitions of superconductor and its related parameters. (P.I.-1.2.1)* *2. Solve problems on superconductor using the concepts and basic formulae. (P.I.-1.2.2)* *3. Write the qualitative description of the Meissner effect. (P.I.-2.2.3)* *4. Differentiate Type I and Typr II superconductors in terms of their behaviour in magnetic field. (P.I.-2.1.2)* *5. State the principle, construction, working of MAGLEV. (P.I.-2.2.3)* *6. State the advantages, disadvantages and limitations of using MAGLEV in terms of socio-economic sustainability. (P.I.-7.1.2)* *7. identity the impact of superconductor applications in society. (P.I.-7.1.1)*		
	Course Conclusion	**1**	
	Total	**30**	

Course Outcomes:

A learner will be able to

1. Apply the fundamental knowledge of optical phenomena to analyse the relevant basic engineering problems and draw the conclusions.
2. Use the fundamental knowledge of semiconductor physics to identify the various parameters to solve the problem.
3. Apply the knowledge of Laser, fiber optics for health and safety issues by analyzing their properties and parameters.
4. Identify the role and impact of the semiconductor devices and superconductors for sustainable development by knowing their applications.

Performance Indicators:

P.I. No.	**P.I. Statement**
1.2.1	Apply laws of physics to an engineering problem.
1.2.2	Apply the formulae derived from the concept to solve engineering problem.
2.1.2	Identify engineering systems, variables, and parameters to solve the problems
2.1.3	Identify the mathematical, engineering and other relevant knowledge that applies to a given problem
2.2.3	Identify existing processes/solution methods for solving the problem, including forming justified approximations and assumptions.
6.1.1	Identify and describe various role of science particularly as pertains to protection of the public and public interest at global, regional and local level.

6.2.2 Interpret and explain the limitations in the usage of devices for protection of the public.

7.1.2 Understand the relationship between the technical, socio economic and environmental dimensions of sustainability.

7.2.1 Describe devices and techniques for sustainable development.

Text Books:

1. A Textbook of Engineering physics, Dr. M. N. Avadhanulu and Dr. P. G. Kshirsagar Revised Edition, 2014, S. Chand Publishing.
2. Engineering physics, R. K. Gaur and S. L. Gupta, Revised Edition, 2012, Dhanpat Rai Publications.

Reference Books:

1. Fundamentals of Physics, Halliday /Resnick/Walker, Twelve Edition, 2021, Wiley
2. Optics, Ajoy Ghatak, Seventh Edition, 2020, Tata McGraw Hill
3. Introduction to solid state physics, Charles Kittel, Eighth Edition, 2005, Wiley
4. A textbook of Optics - N. Subramanyam, Brijlal and Avadhanulu, 23rd Edition, 2006, S.Chand Publishing.

Other Resources:

1. Online physics library, California State University:-Web link- https://phys.libretexts.org/
2. Physics website, The State University of New Jersey :-Web link- www.physics.rutgers.edu
3. NPTEL Course: Fundamentals of semiconductor devices, by Prof. Digbijoy N. Nath, IISc Bangalore:- Web link- https://nptel.ac.in/courses/108108122

IN-SEMESTER ASSESSMENT (35 Marks)

1. Continuous Internal Evaluation of Theory (15 Marks)

1. MCQ test: 4 marks
2. Class test: 4 marks
3. Open book test/Open notes test: 4 marks
4. Regularity and active participation: 3 marks

2. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

END SEMESTER EXAMINATION (40 Marks)

End semester will be based on the syllabus coverage upto Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Type	Course Code	Course Name	Credits
BSC	BSC103	ENGINEERING CHEMISTRY- I	02

Examination Scheme					
Distribution of Marks			Exam Duration (Hrs.)		Total Marks
In-semester Assessment		End Semester Exam (ESE)			
Continuous Assessment	Mid-Semester Exam (MSE)		MSE	ESE	
15	20	40	1	1.5	75

Program Outcomes addressed:

1. PO1: Engineering knowledge
2. PO2: Problem analysis
3. PO6 -The engineer and society
4. PO7 - Environment and sustainability

Course Objectives:

1. To enable the students to apply the laws of chemistry to an engineering problem.
2. To enable the students to appreciate material properties and their engineering applications.
3. To enable the students to analyze and select the most appropriate engineering material
4. To acknowledge the current developments in the field of nanotechnology, energy storage systems and green chemistry for sustainable development.

Module	Detailed Content	Hrs	CO
00.	**Course Introduction** Engineering chemistry provides the fundamental understanding of materials, substances and processes that engineers need to design, develop and manufacture products and systems.	1	
01.	**Green Chemistry** ***Learning Objectives:*** *To state the principles of green chemistry and apply them in the synthesis of various industrially important chemical substances and drugs in order to exhibit the social and environmental impact of chemical industry practices for the sustainable design and development.*	4-6	CO- 2 CO- 3 CO-4

	Contents: Introduction, 12 principles of green chemistry with examples as Conventional and green synthesis of carbaryl and ibuprofen, adipic acid and Indigo with special emphasis on bioenzymes. Numericals on atom economy. Carbon Sequestering and Carbon Credit. Green solvents: -water as green solvent, supercritical solvents and DMC. ***Self-Learning Topics:*** *Latest research areas in the field of green chemistry.* ***Learning Outcomes:*** *A learner will be able to* 1. *Apply green chemistry principles for environmental benign practices for industries (1.3.1)* 2. *Use the principles of green chemistry as standard guidelines for various chemical industry processes. (6.2.1)* 3. *Identify the hazards involved in the use of conventional synthesis of drugs, chemical pesticides and industrial precursors in order to protect health and environment. (6.1.1)* 4. *Synthesize drugs, chemical pesticides and industrial precursors using green approach. (2.2.3)* 5. *Analyze Bhopal gas tragedy reaction (2.1.3)* 6. *Identify the impact of Bhopal gas tragedy reaction on society. (6.1.1)* 7. *Apply the concept of green solvents in chemical industries for the sustainable development, (7.2.2)* 8. *Use the concept of Carbon Sequestering and Carbon Credit to assess public health and environment. (6.1.1)* 9. *Calculate atom economy of the given reaction. (1.2.2)* 10. *Identify the principle of prevention of waste to the drug synthesis (7.2.2)*		
02.	**Water quality management** ***Learning Objectives:*** *To analyze the quality of water and use the modern methods of water treatment and to understand the impact of water pollution in order to practice the sustainable water quality management.* **Contents:** Quality of water: Boiler troubles (Scale and Sludge, Boiler Corrosion, Caustic Embrittlement) Hardness and its types and numericals. Determination of hardness by EDTA method and Numericals. Membrane filtration technology: - Ion exchange and reverse osmosis. Numericals based on ion exchange method. Water pollution: - Water quality indices- BOD and COD with numericals.	**4-6**	**CO- 1** **CO- 2** **CO- 3** **CO- 4**

	Learning Outcomes: *A learner will be able to* 1. *Analyze the impurities in water (2.1.3)* 2. *Classify different types of hardness in water (2.1.3)* 3. *Identify the effect of hard water in boiler and other chemical industries for assessing the public safety. (6.1.1)* 4. *Calculate the various types of hardness in water sample using EDTA method. (1.2.2)* 5. *apply various water treatments for assessing the public health (6.1.1)* 6. *Identify and estimate water quality indices to (7.2.1)* 7. *Calculate BOD and COD of sewage sample (1.2.2)*		
03.	**Science of Corrosion** ***Learning Objective:*** *To identify the different types of corrosion using the theories of electrochemistry and suggest the corrosion control methods for the same in Industry.* **Contents:** Introduction to corrosion, mechanism of dry corrosion – Oxidation corrosion, Pilling Bedworth rule and wet Corrosion-Mechanisms of wet corrosion, Types of wet corrosion (galvanic, differential aeration, stress and Intergranular corrosion). Methods of prevention of Corrosion- cathodic protection (Sacrificial, impressed current) Protective coatings- Metallic coatings (tinning and galvanizing). ***Self-Learning Topics****: Factors affecting rate of corrosion-size of electrodes, passivity, position of metal in galvanic series and polarization.* ***Learning Outcomes:*** *A learner will be able to* 1. *Define corrosion and its types. (1.3.1)* 2. *State the mechanism of oxidation corrosion. (1.3.1)* 3. *Define the role of oxide layers in deciding the rate of corrosion. (1.3.1)* 4. *State the pilling Bedworth rule (1.2.1)* 5. *state the conditions for wet corrosion (1.2.1)* 6. *State the mechanisms of wet corrosion with the help of diagrams. (1.3.1)* 7. *State different types wet corrosion. (1.3.1)* 8. *Apply the various protection methods for safety of metallic equipments1 and structures. (6.1.1)* 9. *Apply the metallic coatings on various metal surfaces for protection of machine health. (6.1.1)*	**4-6**	CO- 1 CO- 3

04.	**Introduction to Thermodynamics** ***Learning Objective:*** *To state the fundamentals of thermodynamics and apply them in engineering.*	**4-6**	CO- 1
	Contents: Concepts of system, types of systems, surroundings. Extensive and intensive properties, Macroscopic and microscopic approach, heat and work, Thermodynamic equilibrium, reversible and irreversible process, First law of thermodynamics – internal energy and enthalpy. Applications of thermodynamics in engineering. ***Learning Outcomes:*** *A learner will be able to* 1. *Define a system, surroundings and variables. (1.3.1)* 2. *State first law of thermodynamics (1.2.1)* 3. *Apply first law of thermodynamics for calculation of work done or heat evolved. (1.2.2)* 4. *To show energy conversion in different forms. (1.3.1)* 5. *To calculate the enthalpy of given chemical system. (1.2.2)* 6. *To apply the concepts of thermodynamics in engineering (1.3.1)*		
05.	**Phase Equilibria** ***Learning Objective:*** *To interpret the various phase transformations using thermodynamics.*	**3-5**	CO- 1
	Contents: Gibb's Phase Rule, Terms involved with examples, One Component System (Water) and its applications, reduced Phase Rule, Two Component System (Pb- Ag), and Eutectic system: Applications in solder alloys and Numericals. ***Learning Outcomes:*** *A learner will be able to* 1. *Apply phase rule equation to the given system, (1.2.1)* 2. *Draw the phase diagrams (1.3.1)* 3. *Identify various phase transformations occurring in a given 0system due to effect of different variables (1.3.1)* 4. *Calculate the number of degrees of freedom for each phase. (1.2.2)* 5. *Apply the condensed phase rule to the eutectic alloys. (1.2.1)* 6. *State the applications of eutectics in the solder alloys (1.3.1)*		

06.	**Energy from non-conventional sources** ***Learning Objective:*** *To apply the knowledge of synthesis of non-conventional chemical fuels and deal with the challenges involved in their implementation with respect to sustainable development.*	**3-5**	CO- 1 CO- 2 CO- 3
	Contents: Synthesis and applications of Biodiesel, Hydrogen production by steam reforming of methane and electrolysis of water, challenges in hydrogen storage and transport. ***Learning Outcomes:*** *A learner will be able to* 1. *Apply the concept of transesterification for the production of biodiesel (1.3.1)* 2. *Identify the properties of biodiesel as a green fuel for sustainability. (7.2.2)* 3. *Synthesize hydrogen by steam reforming of methane and electrolysis of water. (2.2.3)* 4. *Identify the challenges in hydrogen production, storage and transport for the benefit of society. (6.1.1)*		
	Course Conclusion	**1**	
	Total	**30**	

Course Outcomes:

A learner will be able to

1. Apply the laws of electrochemistry and thermodynamics for solving engineering problems.
2. Analyze the quality of water and challenges in non-conventional energy sources for solving the real-world problems.
3. Identify the suitable chemical product or material for the protection of environment and public health.
4. Interpret the impact of modern chemical industrial practices and energy sources for sustainable development.

Performance Indicators:

P.I. No.	**P.I. Statement**
1.2.1	Apply laws of natural science to an engineering problem.
1.2.2	Apply the formulae based on the concepts of engineering chemistry for solving the numerical problems.
1.3.1	Apply fundamental engineering chemistry concepts to solve engineering problems.
2.1.3	Identify the engineering chemistry knowledge to analyse a given problem.
2.2.3	Identify existing processes/solution methods for solving the problems.
6.1.1	Identify and describe the role of engineering chemistry pertaining to the protection of the public and public interest at global regional and local level.

6.2.1 To identify and interpret standard guidelines for various standard chemical industry practices.

7.2.1 Describe management technique for sustainable development.

7.2.2 Apply principles of preventive engineering and sustainable development to an engineering

Text Books:

1. A textbook of engineering chemistry by S. Dara, 2014 edition, Chand Publication.
2. A Textbook of chemistry by Shashi Chawla, First edition, 2019, Dhanpatrai and Co.
3. Textbook of green chemistry by AK Ahluwalia, 2008, Ane Book India

Reference Books:

1. Engineering Chemistry by Jain and Jain, 17th edition, 2018, Dhanpatrai publications
2. Engineering Chemistry by Raghupati Mukhopadhyay, First edition, 2007, New Age International Publisher
3. Engineering Chemistry by Payal Joshi and Shashank Deep, First edition, 2019, Oxford University press

Other Resources:

1. Online chemistry library for open access text books: https://chem.libretexts.org

IN-SEMESTER ASSESSMENT (35 Marks)

1. **Continuous Internal Evaluation of Theory (15 Marks)**
   1. Numerical Assignment/s (min 20 problems):4 Marks
   2. Class test based on numerical assignment: 4 Marks
   3. Article reading & summarization: 4 Marks
   4. Regularity and active participation: 3 Marks
2. **Mid Semester Exam (20 Marks)**

Mid semester examination will be based on 40 % to 50% of the syllabus.

END SEMESTER EXAMINATION (40 Marks)

End semester will be based on the syllabus coverage upto Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Type	Course Code	Course Name	Credits
ESC	ESC101	ENGINEERING MECHANICS	03

Examination Scheme					
Distribution of Marks			Exam Duration (Hrs.)		Total Marks
In-semester Assessment		End Semester Exam (ESE)			
Continuous Assessment	Mid-Semester Exam (MSE)		MSE	ESE	
20	30	50	1.5	2	100

Program Outcomes addressed:

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

Course Objectives:

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

Module	Detailed Content	Hrs	CO
00.	**Course Introduction** The Engineering Mechanics Course marks the transition from physics to engineering applications. This course develops the ability to apply and analyze, which are paramount in engineering profession.	1	
01.	**Coplanar force System: System of Coplanar Forces:** ***Learning Objective/s:*** *To impart the knowledge of fundamental concepts of Mathematics and Physics to analyse forces in engineering system..*	5-7	CO- 1
	Contents: Classification of force systems (Concurrent, Parallel and General Force systems). Principle of Transmissibility, Composition and Resolution of Forces. Resultant of Coplanar Force Systems:		

	Resultant of coplanar force system (Concurrent, Parallel and non-concurrent non-parallel force systems). Moment of force about a point, Couples, Varignon 's Theorem and its significance. Force couple system.		
	Self-Learning Topics: *Composition and Resolution of Forces.* ***Learning Outcomes :*** *A learner will be able to* 1. *To apply fundamental engineering concepts for resolution of system of forces. (P.I.-1.3.1)* 2. *Apply mechanical engineering concepts to find resultant forces acting in a system under the action of load. (PI-1.4.1)* 3. *To identify unknown forces in engineering systems due to application of load. (PI-2.1.2)* 4. *To apply the concepts of physics and mathematics to locate the position on resultant forces acting on a structural member in engineering application. (P.I.-2.1.3).*		
02.	**Equilibrium of Rigid Bodies in Statics. Equilibrium of Coplanar Force System:** ***Learning Objective/s:*** *To use fundamental concepts of engineering knowledge of equilibrium and to analyse reactions under the influence different types of loading conditions.*	**7-9**	**CO- 1**
	Contents: Conditions of equilibrium for Concurrent, Parallel and General Force System (Non-Concurrent Non- Parallel forces) and Couples. Application of Equilibrium Concepts on rigid bodies in Equilibrium. Equilibrium of Beams: Different Types of Supports and Loading. Determination of reactions at supports for various types of loads including distributed system on beams. (Excluding problems on internal hinges). Friction: Concepts of Angle of Friction, Angle of Repose, Cone of Friction. Equilibrium of bodies kept on inclined plane. Application of Friction Concepts to problems involving ladders and the tipping over of bodies		
	Learning Outcomes: *A learner will be able to….* 1. *Apply fundamental mathematical knowledge for application of equilibrium concepts on rigid bodies(P.I.-1.1.2).* 2. *Apply mechanical concepts to coplanar force systems and calculate reactions in beams(P.I.-1.4.1).* 3. *Apply fundamental mathematical knowledge to find frictional parameters of a rigid body (P.I.-2.1.2).* 4. *Apply friction concepts to real-world scenarios involving inclined planes and ladders (P.I.-2.2.1).*		

03.	**Kinematics of Particle** ***Learning Objective/s:*** *Learner will be able to understand kinematics, including variable acceleration, motion curves, curvilinear motion, and projectile motion, applying concepts to real-life situations through problem-solving.* **Contents:** Motion of particle with **Variable Acceleration**. Motion Curves (a-t, v-t, s-t curves). General Curvilinear Motion. Tangential and Normal Component of Acceleration. Projectile Motion: Trajectory Equation of Projectile. Application of the concepts of Projectile Motion in real life and related numerical. ***Self-Learning Topics:*** *Projectile Motion Basics, Variable acceleration concept.* ***Learning Outcomes:*** *A learner will be able to* 1. *apply knowledge to identify the motion of the object using the equations of motion (P.I.- 1.2.1).* 2. *apply the fundamental mathematics and mechanical engineering concepts to analyze different types of motions (P.I.-1.4.1).* 3. *Identify system variables to formulate trajectory equation of projectile motion (P.I.2.1.2).* 4. *Apply mathematical and engineering knowledge to find motion of the object in the real life situations (P.I.-2.1.3).*	**8-10**	**CO- 2**
04.	**Kinematics of Rigid Body** ***Learning Objective/s:*** *To understand the parameters required to quantify the Kinematics of Particle and Rigid body*. **Contents:** Rigid Body Motions: Translation, Rotation and General Plane motion. Kinematics of Rotation and related numerical. The concept of Instantaneous center of rotation (ICR) for the velocity. Location of ICR for 2 link mechanism. Velocity analysis of rigid body using ICR. ***Learning Outcomes:*** *A learner will be able to* 1. *Apply engineering knowledge to identify the general plane motion(P.I.-1.3.1).* 2. *Apply mathematical knowledge to find translational, rotational and general plane motion of rigid bodies(P.I.-1.4.1).* 3. *Identify engineering systems and variables to find instantaneous center of rotation for link mechanism (P.I-2.2.1).* 4. *Use mathematical knowledge to find general plane motion analytically. (P.I.-2.1.3).*	**5-7**	**CO- 3**

05.	**Kinetics of Particle: D'Alembert's** ***Learning Objective/s:*** *To understand the concept of kinetics of particle and the different methods to solve the engineering problems.*	**9-11**	**CO- 4**
	Contents: Introduction to basic concepts of D'Alemberts Principle, Concept of Inertia force, Equations of Dynamic Equilibrium,. (Analysis limited to simple systems only.) **Work – Energy Principle:** Work Energy principle for a particle in motion. Application of Work – Energy principle to a system consists of connected masses and Springs. **Impulse – Momentum Principle:** Principle of linear Impulse and Momentum. Application of Impulse Momentum Principle to particles in motion. **Impact and Collisions:** Law of conservation of momentum, Coefficient of Restitution, Direct Central Impact and Oblique Central Impact. Loss of Kinetic Energy in collision of inelastic bodies.		
	Self-Learning Topics: *basic concepts and application in dynamic equilibrium for simple systems.* ***Learning Outcomes :*** *A learner will be able to* 1. *Apply D'Alembert's Principle to analyze the particles in dynamic equilibrium, (P.I.-1.3.1)* 2. *Apply mechanical engineering knowledge to use work-energy principle for mechanical systems(P.I.-1.4.1).* 3. *To use mathematical knowledge, to analyze the systems using Work-Energy and Impulse-Momentum Principles(P.I.-2.1.3).* 4. *To reframe complex problem in to sub problems to analyze the collisions occurring in the force system(P.I-2.2.1).*		
06.	**Centroid** ***Learning Objective/s:*** *To understand the importance of Centroid which can affect the stability of the objects in the real life situations.*	**3-5**	**CO- 5**
	Contents: First Moment of Area. Centroid of Composite Plane Lamina.		
	Self-Learning Topics: *Explore methods for calculating the First Moment of Area.* ***Learning Outcomes:*** *A learner will be able to* 1. *Apply fundamental knowledge to find first moment of area. (P.I.-1.1.1).* 2. *Apply mechanical engineering knowledge to find centroid of composite body(P.I.-1.4.1).*		
	Course Conclusion	**1**	
	Total	**45**	

Course Outcomes:

Learner will be able to

1. Apply the concepts of resolution and composition of forces to find the Resultant and static equilibrium to find reactive forces with and without friction.
2. Analyze the motion of a particle using kinematic equations.
3. Analyze the General plane motion of a rigid body using the concepts of Instantaneous Center of Rotation to find velocity and acceleration for a link Mechanism.
4. Analyze the motion of a Particle using Kinetic equations.
5. Apply the concept of Centroid to locate it for a plane lamina

Performance Indicators:

P.I. No.	P.I. Statement
1.1.1	Apply mathematical techniques such as calculus, linear algebra, and statistics to solve problems.
1.1.2	Apply advanced mathematical techniques to model and solve mechanical engineering problems.
1.2.1	Apply laws of natural science to an engineering problem.
1.3.1	Apply fundamental engineering concepts to solve engineering problems.
1.4.1	Apply Mechanical engineering concepts to solve engineering problems.
2.1.2	Identify engineering systems, variables, and parameters to solve the problems
2.1.3	Identify the mathematical, engineering and other relevant knowledge that applies to a given problem
2.2.1	Reframe complex problems into interconnected sub problems.

Text Books:

1. Engineering Mechanics by A K Tayal, Fourteenth Edition, 2011 Umesh Publication.
2. Engineering Mechanics by Kumar, Fourth Edition, 2017 Tata McGraw Hill
3. Engineering Mechanics by F. L. Singer, Third Edition, 1975, Harper & Raw
4. Engineering Mechanics by R. C.Hibbeler , Fourth Edition, 2017, Pearson Education

Reference Books:

1. Engineering Mechanics by Beer &Johnston, Fourth Edition, 1987 ,Tata McGrawHill
2. Engineering Mechanics (Statics) by Meriam and Kraige, Fourth Edition, 1999 WileyBooks
3. Engineering Mechanics by Tmoshenkos Fifth Edition,2015 , generic

Other Resources:

1.NPTEL Course: NOC Engineering Mechanics Statics and Dynamics by Prof. Mahesh Panchagnula offered by IIT Madras Web link-https://nptel.ac.in/courses/112/106/112106180.

IN-SEMESTER ASSESSMENT (50 Marks)

1. **Continuous Internal Evaluation of Theory (20 Marks)**

   Numerical Assignments (minimum 20 problems): 5 Marks

   Class Test based on similar problems which were given as an assignment: 5 Marks

   Open book test/Open notes test: 5 Marks

   Regularity and active participation: 5 Marks

2. **Mid Semester Exam (30 Marks)**

   Mid semester examination will be based on 40 % to 50% of the syllabus.

END SEMESTER EXAMINATION (50 Marks)

End semester will be based on the syllabus coverage upto Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Type	Course Code	Course Name	Credits
ESC	ESC102	BASIC ELECTRICAL ENGINEERING	02

Examination Scheme					
Distribution of Marks			Exam Duration (Hrs.)		Total Marks
In-semester Assessment		End Semester Exam (ESE)			
Continuous Assessment	Mid-Semester Exam (MSE)		MSE	ESE	
15	20	40	1	1.5	75

Program Outcomes addressed:

1. PO1: Engineering knowledge
2. PO2: Problem analysis
3. PO6: The engineer and society
4. PO9: Individual and teamwork

Course Objectives:

1. To impart knowledge on fundamentals of electrical power system, conventional and non- conventional energy sources.
2. To impart knowledge on basic electrical systems, DC circuits, AC circuits, Residential Electrical System, Residential Energy Metering and Electrical Machines to solve engineering problems.
3. To introduce concept to analyse DC circuits, AC circuits.
4. To introduce safety devices incorporated in residential electrical system for professional engineering practice.

Module	Detailed Content	Hrs	CO
00	**Course Introduction** Overview of Basic Electrical Engineering, application of Basic Electrical Engineering in Industry/real life problem. It is a foundational course designed to provide students with a comprehensive understanding of fundamental electrical concepts and principles.	**1**	
01.	**Introduction to Basic Electrical Systems** ***Learning Objective/s:*** *To acquire knowledge on various components of electrical powers system and compare different sources of electrical energy.*	**2-4**	**CO- 1**
	Contents: Components of Electrical power System, Role of each component, Structure of electrical power system, Introduction to transformer, Conventional sources of electric energy, Renewable energy sources, Comparison of various energy sources.		

	Self-Learning Topics: *Comparison of conventional and nonconventional energy sources.* ***Learning Outcomes:*** *A learner will be able to* 1. *Apply the concepts of electrical engineering to understand role of each component of electrical power system. (P.I.-1.4.1)* 2. *Compare different sources of electrical energy using fundamental engineering concepts. (P.I.-1.3.1)*		
02.	**DC Circuits with independent sources** ***Learning Objective/s:*** *To apply the concepts of various theorems and laws to analyze DC circuits.* **Contents:** Ohm's Law, Kirchhoff's Laws, Star Delta transformation, Ideal and practical voltage and current sources, Mesh and Nodal Analysis, Superposition theorem, Thevenin's theorem, Maximum power transfer theorem. ***Self-Learning Topics:*** *Series and parallel connections of resistances.* ***Learning Outcomes:*** *A learner will be able to* 1. *Apply concepts of Ohm's law and Kirchoff's laws to solve DC circuits. (P.I.-1.4.1)* 2. *Use concepts of star delta transformation to simplify DC circuits. (P.I.-1.3.1)* 3. *Apply network theorems to analyze current distribution in DC circuits. (P.I.-2.1.3)* 4. *Apply the concepts of ideal and practical electrical sources to solve DC circuits using Thevenin's and Norton's theorems. (P.I.-2.1.2)*	**5-7**	**CO- 2**
03.	**AC Fundamentals** ***Learning Objective/s:*** *To analyze AC circuit and interpret the condition of resonance by using concepts of current, voltage, power factor and power calculation in AC circuits.* **Contents:** Single-phase AC series circuits consisting of R, L, C, RL, RC, RLC combinations, definitions -real, reactive, and apparent power. Series Resonance. ***Self-Learning Topics:*** *Parallel AC circuits.* ***Learning Outcomes:*** *A learner will be able to* 1. *Analyze the performance of AC circuit by calculating phase angle (power factor) between voltage and current waveform. (P.I.-2.1.2)* 2. *Identify condition of resonance and calculate resonant frequency by overserving current and reactance in series AC circuits. (P.I.-2.1.3)*	**5-7**	**CO- 2**

04.	**Residential Electrical Systems** ***Learning Objective/s:*** *To acquire knowledge on residential electrical wiring incorporating suitable safety devices, testing and up-keeping of household electrical appliances and residential lighting system.*	**4-6**	**CO- 1** **CO- 3** **CO- 4**
	Contents: Components of residential electrical system, Residential wiring System, load calculation, Electrical safety Devices, Fuse, MCB, ELCB, grounding issues, safety precautions, Testing of domestic appliances and up-keeping, Luminous flux, Luminous intensity, Lumination, Types of lamps in residential lighting. Case study on residential lighting.		
	Self-Learning Topics: *Basic requirements of electrical system.* ***Learning Outcomes:*** *A learner will be able to* 1. *Identify components in residential electrical system by understanding basic system requirements. (P.I.-1.3.1)* 2. *Test and repair domestic appliances by applying concepts of basic electrical engineering. (P.I.-1.4.1)* 3. *Identify safety devices for the protection of residential electrical system. (P.I.-6.1.1)* 4. *Conduct a case study on residential lighting in a group to demonstrate communication, conflict resolution and leadership skills. (P.I.-9.2.1)* 5. *Present the case study on residential lighting system design effectively as a team. (P.I.-9.3.1)*		
05.	**Introduction to Residential Energy Measurements** ***Learning Objective/s:*** *To acquire knowledge on residential energy metering, energy tariff and understanding the residential electricity bill.*	**2-4**	**CO- 1** **CO- 4**
	Contents: Measurement of Energy, Understanding of electricity bill, energy tariff electricity bill calculation.		
	Self-Learning Topics: *Types of meters used for energy metering.* ***Learning Outcomes:*** *A learner will be able to* 1. *Calculate the electrical energy consumed over a specified time by applying concepts of electrical engineering. (P.I.-1.4.1)* 2. *Determine the energy tariff by referring meter reading and government guidelines. (P.I.-1.3.1)*		

06.	**Introduction to Electrical Machines** ***Learning Objective/s:*** *To identify motors for given application using concepts of construction, working and characteristics of different machines.*	**4-6**	**CO-5**
	Contents: Construction, working, characteristics and application of DC machines, Single phase Induction Motor, Servo motors, Brushless DC motor, Stepper motor. Factors to be considered for selection of motor and its rating. Selection of motors from motor and load characteristics.		
	Self-Learning Topics: *Working principle of electric motor.* ***Learning Outcomes:*** *A learner will be able to* 1. *Compare and identify electrical motors for given application based on characteristics of load and motor. (P.I.-2.2.4)* 2. *Decide the rating of motor by considering factors like power, speed, torque etc. of the given application. (P.I.-2.2.3)*		
	Course Conclusion	**1**	
	Total	**30**	

Course Outcomes: Learner will be able to

1. Apply fundamental engineering concept to interpret Basic Electrical Systems, Residential Electrical System and Residential Energy Metering.
2. Apply concepts of electrical engineering to solve problems on DC circuits and AC circuits.
3. Interpret and identify safety devices for professional engineering practice.
4. Conduct case study on residential lighting and present it to demonstrate effective communication and problem solving.
5. Identify electrical motors based on requirement of application and characteristics of motor.

Performance Indicators:

P.I. No.	**P.I. Statement**
1.3.1	Apply fundamental engineering concepts to solve engineering problems.
1.4.1	Apply Electrical engineering concepts to solve engineering problems.
2.1.2	Identify engineering systems, variables, and parameters to solve the problems.
2.1.3	Identify the mathematical, engineering and other relevant knowledge that applies to a given problem.
2.2.3	Identify existing processes/solution methods for solving the problem, including forming justified approximations and assumptions.
2.2.4	Compare and contrast alternative solution processes to select the best process.
6.1.1	Identify and describe various engineering roles; particularly as pertains to protection of the public and public interest at global, regional and local level.
9.2.1	Demonstrate effective communication, problem solving, and conflict resolution and leadership skills.

9.3.1 Present results as a team, with smooth integration of contributions from all individual efforts.

Text Books:

1. Electrical Power Systems,S.L. Uppal and Prof. Sunil S. Rao 15th Edition, Khanna Publishers
2. Basic Electrical Engineering, B.R Patil, 2nd Edition Oxford Higher Education, 2019
3. Art & Science of Utilization of electrical Energy, H Partab, Dhanpat Rai & Co., 2004.
4. Electrical and Electronic Measurements and Measuring Instruments, A K Sawhney Dhanpat Rai and Sons
5. Special Electrical Machines, E G Janardanan PHI 2014
6. Electrical Power Systems, S.L. Uppal and Prof. Sunil S. Rao, 15th Edition, Khanna Publishers

Reference Books:

1. Power System Engineering, D P Kothari and I J Nagrath, 3rd Edition, Mac Graw Hills,
2. Electrical Engineering Fundamentals, Vincent Del Toro, PHI Second edition, 2011
3. Utilization of Electric Power & Electric Traction, J B Gupta, 10th Edition, Dhanpat Rai and Sons 2012.
4. Electrical Engineering, B.L.Theraja Vol-I and II
5. Basic Electrical Engineering, S.N.Singh PHI, 2011

Other Resources:

1. NPTEL course on Basic Electrical Technology, IISc Bangalore Prof. L. Umanand https://nptelvideos.com/course.php?id=460

IN-SEMESTER ASSESSMENT (35 Marks)

1. **Continuous Internal Evaluation of Theory (15 Marks)**

   Numerical Assignments (minimum 20 problems): 4 Marks

   Class Test based on similar problems which were given as an assignment: 4 Marks

   Open book test/Open notes test: 4 Marks

   Regularity and active participation: 3 Marks

2. **Mid Semester Exam (20 Marks)**

   Mid semester examination will be based on 40 % to 50% of the syllabus.

END SEMESTER EXAMINATION (40 Marks)

End semester will be based on the syllabus coverage upto Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Type	Course Code	Course Name	Credits
BSC-LC	BSCLC101	ENGINEERING PHYSICS-I LABORATORY	0.5

Examination Scheme		
Continuous Assessment	**End Semester Exam(ESE)**	**Total Marks**
25	-	25

Program Outcomes addressed:

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

Course Objectives:

1. To demonstrate the fundamental concepts of physics and evaluate the process of an experiment/project quantitatively and qualitatively.
2. To improve the knowledge gained in the theory course.
3. To develop the abilities of measurements, observations and analyzing data.
4. To develop the experimental skill in assembling and handling laboratory instruments.

Module	Detailed Contents	Hrs	CO
00.	**Course Introduction** Introduction to various instruments and components used in physics lab; Rules and regulations to be followed; The fundamental concepts for all experiments, Explanation for performing the experiments.	**01**	
01.	***Learning Objective/s:*** • *To apply the knowledge of interference of light in thin film.* • *To determine a radius of curvature of lens and write valid conclusion.*	**02**	**CO- 1**
	Experiment 1 : Newton's Rings: Determine the radius of curvature (R) of given plano convex lens using Newton's Rings.		
	Learning Outcomes: *A learner will be able to* *1. Apply the concepts of interference in thin film for execution of experiment. (1.2.1)*		

	2. *Write the required theory and procedure for the experiment. (4.3.1)* 3. *Familiarize the apparatus like sodium lamp, travelling microscope. (4.3.1)* 4. *Assemble the set up for Newton's ring pattern. (4.2.1)* 5. *Observe the phenomenon for interference pattern ie formation of Newton's ring for reflected rays. (1.2.1)* 6. *Calculate radius of curvature of the given plano convex lens and write the result. (1.2.2, 4.3.3)*		
02.	***Learning Objective/s:*** • *To apply the knowledge of diffraction through multiple slit.* • *To find the wavelength of the LASER and write valid conclusion.*	**02**	**CO- 1**
	Experiment 2 : Diffraction through Grating: Measurement of wavelength of He-Ne laser		
	Learning Outcomes: *A learner will be able to* 1. *Apply the concepts of diffraction through multiple slit for execution of experiment. (P.I.- 1.2.1)* 2. *Write the required theory and procedure for the experiment. (P.I.- 4.3.1)* 3. *Familiarize the apparatus like laser source, single slit set up. (P.I.- 4.3.1)* 4. *Assemble the set up for diffraction pattern. (P.I.- 4.2.1)* 5. *Observe the phenomenon for diffraction through single slit. (P.I.- 1.2.1)* 6. *Calculate width of the given slit and write the result. (P.I.- 1.2.2, 4.3.3)*		
03.	***Learning Objective/s:*** • *To apply the knowledge of optical fibre.* • *To determine the numerical aperture of an optical fibre and write the conclusion.*	**02**	**CO- 1**
	Experiment 3: Optical Fibre: Measurement of Numerical aperture.		
	Learning Outcomes: *A learner will be able to* 1. *Apply the knowledge of numerical aperture for execution of experiment. (P.I.- 1.2.1)* 2. *Write the required theory and procedure for the experiment. (P.I.- 4.3.1)* 3. *Familiarize the apparatus like Fibre optic kit, numerical aperture measurement zig., optical fibre cable. (P.I.- 4.3.1)* 4. *Assemble the set up to get illumination circular patch of light on the screen. (P.I.- 4.2.1)* 5. *Observe the phenomena for different tip height of the optical fibre from the surface. (P.I.- 1.2.1)* 6. *Calculate numerical aperture of the given fibre and write the result. (P.I.- 1.2.2, 4.3.3)*		

04.	*Learning Objective/s:* • *To apply the knowledge of Hall effect.* • *To determine a magnetic field using Hall effect in semiconductors.*	**02**	**CO- 1**
	Experiment 4: Hall effect: Determination of magnetic field.		
	Learning Outcomes: *A learner will be able to* 1. *Apply the hall effect phenomena for execution of experiment. (P.I.- 1.2.1)* 2. *Write the required theory and procedure for the experiment. (P.I.- 4.3.1)* 3. *Familiarize the apparatus like Gauss meter, electromagnet, power supply. (P.I.- 4.3.1)* 4. *Assemble the set up for Hall effect experiment. (P.I.- 4.2.1)* 5. *Observe the Hall effect phenomena in given semiconductor. (P.I.- 1.2.1)* 6. *Calculate the number of carriers in the semiconductor and write the result. (P.I.- 1.2.2, 4.3.3)*		
05.	***Learning Objective/s:*** • *To gain the knowledge on working of a photodiode.* • *To study the V-I characteristic curve of a photodiode*	**02**	**CO- 1**
	Experiment 5 *:* Photodiode: Drawing the I-V characteristics of photo diode		
	Learning Outcomes : *A learner will be able to* 1. *Apply the working principle of photodiode for execution of experiment. (P.I.- 1.2.1)* 2. *Write the required theory and procedure for the experiment. (P.I.- 4.3.1)* 3. *Identify the photodiode. (P.I.- 4.2.1)* 4. *Draw the circuit diagram and connect the components accordingly. (P.I.- 4.2.1)* 5. *Draw the I-V characteristics of photo diode and analyze the characteristic curve and the result. (P.I.- 1.2.2, 4.3.3)*		
06.	***Learning Objective/s:*** • *To apply various concepts of physics in a project.* • *To develop the skill of execution of project through practical demonstration.*	**03**	**CO- 1** **CO- 2** **CO- 3**
	Project: Selection of a project based on physics concepts, Literature survey, and Topic presentation. ***Learning Outcomes:*** *A learner will be able to* 1. *Apply the concepts of physics for execution of project. (P.I.- 1.2.1, 1.2.2.)* 2. *Familiarize with the books, authors, work done on the selected topic through literature survey. (P.I.- 10.1.1)* 3. *Select a mini project and work as an individual and as a team in development of the project in a chosen area. (P.I.- 9.3.1)* 4. *Identify, discuss and justify the technical aspects of the chosen project with a Comprehensive and systematic approach. (P.I.- 9.1.2)* 5. *Write a report on the chosen project. (P.I.- 10.1.2)* 6. *Communicate and present effectively project related activities. (P.I.- 10.2.2)*		
	Course Conclusion	**01**	
	Total	**15**	

Course Outcomes:

A learner will be able to

1. Apply the fundamental knowledge of optical phenomena, optical fibre and semiconductor devices to determine various parameters through relevant experiments.
2. Use fundamental knowledge of physics for the effective preparation and execution of the chosen project as a team.
3. Apply the technical information required for the project to present proposed project work, write effective reports, and communicate effectively.

Performance Indicators:

P.I. No.	P.I. Statement
1.2.1	Apply laws of natural science to an engineering problem
1.2.2	Apply the formulae derived from the concept to solve engineering problem.
4.2.1	Design and develop experimental approach, specify appropriate equipment and procedures
4.3.1	Use appropriate procedures, tools and techniques to conduct experiments and collect data
4.3.3	Represent data (in tabular and/or graphical forms) so as to facilitate analysis and explanation of the data, and drawing of conclusions.
9.1.2.	Implement the norms of practice (e.g. rules, roles, charters, agendas, etc.) of effective teamwork, to accomplish a goal.
9.3.1	Present results as a team, with smooth integration of contributions from all individual efforts
10.1.1	Read, understand and interpret technical and non- technical information
10.1.2	Produce clear, well-constructed, and well- supported written engineering documents
10.2.2	Deliver effective oral presentations to technical and non- technical audiences

Text Books:

1. A Textbook of Engineering physics, Dr. M. N. Avadhanulu and Dr. P. G. Kshirsagar Revised Edition, 2014, S. Chand Publishing.
2. Engineering physics, R. K. Gaur and S. L. Gupta, Revised Edition, 2012, Dhanpat Rai Publications.

Reference Books:

1. Fundamentals of Physics, Halliday /Resnick/Walker, Twelve Edition, 2021, Wiley
2. Optics, Ajoy Ghatak, Seventh Edition, 2020, Tata McGraw Hill
3. Introduction to solid state physics, Charles Kittel, Eighth Edition, 2005, Wiley
4. A textbook of Optics - N. Subramanyam, Brijlal and Avadhanulu, 23rd Edition, 2006, S.Chand Publishing.

Other Resources:

1. Online physics library, California State University:-Web link- https://phys.libretexts.org/
2. Physics website, The State University of New Jersey :-Web link- www.physics.rutgers.edu
3. NPTEL Course: Fundamentals of semiconductor devices, by Prof. Digbijoy N. Nath, IISc Bangalore:- Web link- https://nptel.ac.in/courses/108108122

CONTINUOUS INTERNAL EVALUATION (25 Marks)

1. Lab Performance: 10 Marks
2. Project (Synopsis writing and Topic presentation): 10 marks
3. Regularity and active participation: 5 marks

Course Type	Course Code	Course Name	Credits
BSC-LC	BSCLC102	ENGINEERING CHEMISTRY - I LABORATORY	0.5

Examination Scheme		
Continuous Assessment	**End Semester Exam (ESE)**	**Total Marks**
25	-	25

Program Outcomes addressed:

1. PO1: Engineering Knowledge
2. PO2: Problem Analysis
3. PO6: The engineer and society
4. PO9: Individual and teamwork

Course Objectives:

1. To enable the students to utilize fundamental laboratory techniques for analysis and synthesis of chemical products.
2. To enable the students to learn various laboratory safety rules in standard laboratory practices.

Module	Detailed Contents	Hrs	CO
00.	**Course Introduction** • Laboratory familiarization • Code of conduct in chemistry laboratory • Safety and precautions to be observed in chemistry laboratory • Orientation on evaluation of laboratory performance	**01**	
01.	***Learning Objective/s:*** *To estimate the total, temporary and permanent hardness of water using EDTA method to understand its quality for industrial use.*	**02**	**CO- 3**
	Experiment 1: Estimation of Total, temporary and permanent hardness of water by EDTA method.		
	Learning Outcomes: *A learner will be able to* *1. Use the basics of titrimetric experiments. (1.3.1)* *2. Use complexometric titration method. (1.3.1)* *3. Analyse the quality of water (2.1.3)* *4. Distinguish between different types of hardness present in water. (1.3.1)* *5. To calculate various types of hardness (2.2.3)* *6. Determine the suitability of water for industrial use. (6.1.1)*		
02.	***Learning Objective/s:*** **T**o determine the chloride content of water to understand its suitability for domestic use.	**02**	**CO- 3**
	Experiment 2: Estimation of chloride content of water sample		

	Learning Outcomes: *A learner will be able to* 1. *Use the basics of titrimetric experiments. (1.3.1)* 2. *Use precipitation titration method. (Mohr's method) (1.3.1)* 3. *Analyse the quality of water (2.1.3)* 4. *Calculate the amount of chloride ions present in the water sample. (2.2.3)* 5. *Identify the type of hardness. (1.3.1)* 6. *Determine the suitability of water for domestic use. (6.1.1)*		
03.	***Learning Objective/s:*** *To synthesise aspirin by using acetylation process and calculate its percent yield and atom economy to determine the nature of reaction.* **Experiment 3:** To synthesize aspirin from salicylic acid ***Learning Outcomes:*** *A learner will be able to* 1. *Apply acetylation process (1.3.1)* 2. *Use pyridine as a catalyst (1.3.1)* 3. *Synthesize aspirin in cold conditions (2.2.3)* 4. *Use the process of filtration (1.3.1)* 5. *Calculate practical and theoretical yield. (2.2.3)* 6. *Calculate percentage yield. (2.2.3)* 7. *Interpret the uses of aspirin (1.3.1)* 8. *calculate atom economy. (2.2.3)* 9. *Distinguish between green and non -green reaction. (1.3.1)*	**02**	**CO- 2**
04.	***Learning Objective/s:*** *To calculate the enthalpy of dissolution of copper sulphate in water using simple calorimeter.* **Experiment 4:** To determine the enthalpy of dissolution of copper sulphate at room temperature using water as a reaction medium. ***Learning Outcomes*** *A learner will be able to* 1. *Use the basics of thermochemical experiments. (1.2.1)* 2. *Use calorimeter (1.3.1)* 3. *Apply the laws of thermodynamics (1.2.1)* 4. *Distinguish between endothermic and exothermic reactions (1.3.1)* 5. *Define specific heat (1.3.1)* 6. *Calculate enthalpy of the given system (2.2.3)*	**02**	**CO- 1**
05.	***Learning Objective/s:*** *To determine the effect of various factors affecting the rate of corrosion of iron* **Experiment 5:** To determine the factors affecting rate of corrosion. ***Learning Outcomes:*** *A learner will be able to* 1. *Apply the knowledge of electrochemistry to study rate of corrosion (1.2.1) (1.3.1)* 2. *Determine the effect of moisture, oxygen, pH and presence of salt on the rate of corrosion of Fe. (1.2.1) (1.3.1)*	**02**	**CO- 1**

	3. *Distinguish between dry and wet corrosion. (1.2.1) (1.3.1)*		
06.	***Learning Objective/s:*** *To develop the basic knowledge of analytical chemistry using titrimetric experiments* **Designing of experiment and presentation:** Standardization/estimation of chemical substances using titrimetric analysis. Selection of a chemical substance and specific method of titrimetry based on literature survey and presentation. **Learning Outcomes:** Learners will be able to 1. *Apply the knowledge of engineering chemistry. (1.3.1)* 2. *Identify existing processes to analyze the given substance. (2.2.3)* 3. *Present the experimental procedure and expected conclusion as a team. (9.3.1)* 4. *Demonstrate the ability to work as a team. (9.1.1)*	**03**	**CO-4**
	Course Conclusion	**01**	
	Total	**15**	

Course Outcomes:

A learner will be able to

1. Apply the laws of electrochemistry and thermodynamics for performing the practicals.
2. Formulate a drug by applying the concepts of chemistry.
3. Analyse the quality of water for assessing the public health.
4. Demonstrate an ability to work effectively in a team for project based activity.

Performance Indicators:

P.I. No.	**P.I. Statement**
1.2.1	Apply laws of natural science to an engineering problem.
1.3.1	Apply fundamental engineering chemistry concepts to solve engineering problems.
2.1.3	Identify the engineering chemistry knowledge to analyze a given problem.
2.2.3	Identify existing processes/solution methods for solving the problems.
6.1.1	Identify and describe the role of engineering chemistry pertaining to the protection of the public and public interest at global regional and local level.
9.1.1	Recognize a variety of working and learning preferences; appreciate the value of diversity on a team.
9.3.1	Present result as a team with smooth integration of contributions from all individual efforts.

Text Books:

1. Practical book in Engineering Chemistry by Dr. Pijus Khatua and Debashree Singh, First edition, 2016, Platinum Publishers
2. Textbook of green chemistry by AK Ahluwalia, 2008, Ane Book India

Reference Books:

1. Engineering Chemistry by Jain and Jain, 17th edition, 2018, Dhanpatrai publications
2. Experiments in Engineering Chemistry by Payal Joshi, first edition, 2016, I.K. International Publishing House Pvt. Ltd.

Other Resources:

1. Online chemistry library for open access text books: https://chem.libretexts.org
2. Lab Simulation : https://vlab.amrita.edu/?sub=2&brch=190&sim=1546&cnt=1

CONTINUOUS INTERNAL EVALUATION (25 Marks)

1. Lab Performance: 10 Marks
2. Design experiment and presentation: 10 marks
3. Regularity and active participation: 5 marks

Course Type	Course Code	Course Name	Credits
ESC-LC	ESCLC101	ENGINEERING MECHANICS LABORATORY	01

Examination Scheme		
Continuous Assessment	**End Semester Exam**	**Total Marks**
25	--	25

Program Outcomes addressed:

1. PO1: Engineering knowledge
2. PO2: Problem analysis
3. PO9: Individual and team work

Course Objectives:

1. To demonstrate the equilibrium of coplanar forces
2. To demonstrate law of moments.
3. To determine coefficient of friction between two different surfaces in contact.
4. To analyse the motion of particle.

Module	Detailed Contents	Hrs	CO
00	**Course Introduction** The Engineering Mechanics Lab Course marks the transition from physics to engineering applications. This course develops the ability to apply and analyze, which are paramount in engineering profession.	**01**	
01.	***Learning Objective/s:*** *Learner will be able to apply fundamental engineering concepts to demonstrate the concept of equilibrium of coplanar forces.*	**07**	**CO- 1**
	Equilibrium of concurrent co-planer force system, general co-planer system, Reactions on the beam, Jib crane study. **Experiment 1:** To verify polygon law of forces (Concurrent force system) **Experiment 2:** To verify Lami's theorem using simple jib crane. **Experiment 3:** To determine the reactions of simply supported beam.		

	Learning Outcomes: *A learner will be able to* 1. *identify the type of force system in a team. (P.I.-1.3.1)* 2. *determine the whether the system is in equilibrium or not and present the results in a team. (2.2.3,9.3.1)* 3. *convert different mechanical systems into substems by using free body diagram. (2.2.1)* 4. *determine the reactions of the beam for various loading conditions as a team.(P.I.-1.4.1,9.2.1).*		
02.	***Learning Objective/s:*** *Learner will be able to apply mechanical engineering concepts to demonstrate the principle of Moments using the Bell Crank Lever apparatus.*	**07**	**CO- 2**
	To demonstrate law of moments. **Experiment 4:** To verify moment equilibrium condition using bell crank lever.		
	Learning Outcomes: *A learner will be able to* 1. *differentiate between moment and couple (P.I.-1.4.1).* 2. *verify moment equilibrium condition using bell crank lever and present the results as a team (P.I-1.3.1,9.3.1).* 3. *convert the bell crank lever diagram into subsystems by using free body diagram. (2.2.1)* 4. *Demonstrate effective communication while working as team for conducting the experiments (P.I-9.2.1).* 5. *Verify moment equilibrium condition using bell crank lever and present results as a team(P.I.-2.2.3,9.3.1).*		
03.	***Learning Objective/s:*** *Learner will be able to determine coefficient of friction between two different surfaces in contact.*	**07**	**CO- 3**
	Concept of Friction, coefficient of friction, angle of repose. **Experiment 5**: To determine coefficient of friction using friction plane. **Experiment 6:** To determine coefficient of friction using angle of repose method.		
	Learning Outcomes: *A learner will be able to* 1. *Identify the effects of friction on different surfaces. (P.I.-1.4.1,9.2.1).* 2. *Identify the parameters affecting the friction values. (P.I.-2.1.2).* 3. *determine the coefficient of friction and present the results as a team (P.I.-1.3.1,9.3.1)* 4. *compare and select the accurate method to determine coefficient of friction .(P.I.-2.2.3)*		

04	*Learning Objective/s:* *Learner will be able to analyze the motion of particle.*	**08**	**CO4**
	Study of translational motion and projectile motion **Experiment 7:** To study the motion of the projectile. **Experiment 8:** To measure and verify average speed of the vehicle.		
	Learning Outcomes: *A learner will be able to* 1. *Identify the variables associated with the projectile motion (P.I-1.2.1).* 2. *Determine the range and height of the particle during projectile motion and present the result as a team. (P.I.2.1.2,9.3.1)* 3. *Estimate velocities and distance travelled by the particle with a collaborative effort of a team. (P.I.-2.2.3,9.2.1).* 4. *Measure the speed of the particle. (P.I.-1.4.1).*		
	Total	**30**	

Course Outcomes:

1. Learner will be able to Demonstrate the Equilibrium of Coplanar Force System.
2. Learner will be able to demonstrate law of moments.
3. Learner will be able to determine coefficient of friction between two different surfaces in contact.
4. Learner will be able to analyse motion of a particle.

Performance Indicators:

P.I. No.	**P.I. Statement**
1.2.1	Apply laws of natural science to an engineering problem
1.3.1	Apply fundamental engineering concepts to solve engineering problems.
1.4.1	Apply Mechanical engineering concepts to solve engineering problem.
2.1.2	Identify engineering systems, variables, and parameters to solve the problems.
2.2.1	Reframe complex problems into interconnected subproblems.
2.2.3	Identify existing processes/solution methods for solving the problem, including forming justified approximations and assumptions.
9.2.1	Demonstrate effective communication, problem solving, conflict resolution and leadership skills.
9.3.1	Present results as a team, with smooth integration of contributions from all individual efforts.

Text Books:

1. Engineering Mechanics by A K Tayal, Fourteenth Edition, 2011 Umesh Publication.
2. Engineering Mechanics by Kumar, Fourth Edition, 2017 Tata McGraw Hill
3. Engineering Mechanics by F. L. Singer, Third Edition, 1975, Harper & Raw
4. Engineering Mechanics by R. C.Hibbeler , Fourth Edition, 2017, Pearson Education

Reference Books:

1. Engineering Mechanics by Beer &Johnston, Fourth Edition, 1987 ,Tata McGrawHill
2. Engineering Mechanics (Statics) by Meriam and Kraige, Fourth Edition, 1999 WileyBooks
3. Engineering Mechanics by Tmoshenkos Fifth Edition,2015, generic

CONTINUOUS INTERNAL EVALUATION (25 Marks)

1. Practical performance based on all the experiments mentioned in the syllabus with proper understanding : 10 Marks
2. Oral evaluation on experiments conducted on Statics :5 Marks
3. Oral evaluation on experiments conducted on Dynamics:5 Marks
4. Regularity and active participation: 5 Marks

Course Type	Course Code	Course Name	Credits
ESC-LC	ESCLC102	BASIC ELECTRICAL ENGINEERING LABORATORY	01

Examination Scheme		
Continuous Assessment	**End Semester Exam(ESE)**	**Total Marks**
25	25	50

Pre-requisite:

1. ESC102: Basic Electrical Engineering

Program Outcomes addressed:

1. PO2: Problem analysis
2. PO4: Conduct investigations of complex problems
3. PO6: The engineer and society
4. PO9: Individual and teamwork

Course Objectives:

1. To impart the knowledge on the analysis and applications of D.C. circuits and single-phase AC circuits.
2. To impart the knowledge on the elements of residential electrical system, appliances and electrical safety.
3. To impart the knowledge on the construction, working principle of transformer and motors and selection of motor for a specific application.

Module	Detailed Contents	Hrs	CO
00	**Course Introduction** The Basic Electrical Lab course is designed to introduce fundamental concepts in electrical engineering through hands-on laboratory experiments. Through a series of practical exercises, students will develop essential skills for working with basic electrical components and circuits.	**01**	
01.	***Learning Objective:*** *To impart knowledge on circuit mounting on breadboard, meters used and concept of theorems and laws required for analysis of DC circuits.*	**08**	**CO- 1** **CO- 2**
	Experiment: Verify network theorems and laws to interpret the current and voltage distribution in DC circuits.		
	Self-Learning Topics: *Concepts of Series and parallel circuits and Superposition Theorem.*		

	Learning Outcomes: *A learner will be able to* 1. *Assemble circuit on breadboard and use DC power supply, multimeter, ammeter and voltmeter for measuring current and voltage in DC circuits in a group. (P.I.-4.1.3, 9.3.1)* 2. *Measure current and voltage in electrical circuits and verify Ohm's law, Kirchhoff's laws, mesh analysis and nodal analysis practically and theoretically and submit a report. (P.I.- 4.1.4, 9.3.1)* 3. *Verify Thevenin's theorem, Norton's theorem and Maximum power transfer theorem in a DC circuit and summarize results in a report. (P.I.-4.1.4, 9.2.1)*		
02.	***Learning Objective/s:*** *To impart knowledge on circuit assembly on breadboard and analysis of Alternating Current (AC) circuits.*	**08**	**CO- 1** **CO- 2**
	Experiment: Analyse series and parallel connected AC circuits by determining circuit elements and resonant conditions.		
	Learning Outcomes: *A learner will be able to* 1. *Determine the inductance of a choke coil by measuring the voltage across and current through a series and parallel connected resistance and choke coil and summarize the results in a report. (4.1.3, 9.2.1)* 2. *Measure the resonance frequency in RLC series and parallel circuit and plot resonance curve. (4.1.4, 9.3.1)*		
03.	***Learning Objective/s:*** *To impart knowledge on household electrical wiring and safety devices, maintenance and up keeping of home appliances used in our day-to-day life.*	**08**	**CO- 1** **CO- 3**
	Experiment: Implementation of given residential electrical system incorporating safety devices and up-keeping of home appliances.		
	Learning Outcomes: *A learner will be able to* 1. *Assemble small electrical circuits similar to residential wiring system along with safety devices and submit a report. (4.1.3, 9.3.1)* 2. *Prepare test boards / extension boards and mount accessories like lamp holders, various switches, sockets, fuses, MCB, ELCB, MCCB etc. (6.1.1, 9.3.1)* 3. *Wire up PVC conduit wiring to control one lamp from two different places in a group. (Staircase wiring) (4.2.1, 9.3.1)* 4. *Maintenance and up-keeping of household electrical appliances and submit a report. (4.1.3, 9.2.1)*		
04	***Learning Objective/s:*** *To introduce concept of motor selection for given application, transformer connections and its testing.*	**05**	**CO- 4**
	Experiment: • Identify electrical motors for given application. • Analyse transformer by identifying name plate details, transformation ratio, polarity and regulation.		

	Learning Outcomes: 1. *Identify electrical motors for various electrical appliances like Fan, mixer, Vacuum cleaner, Washing machine, Water pump etc. and submit a report. (2.2.4, 9.2.1)* 2. *Verify terminals, study the name plate details and calculate transformation ratio of single-phase transformers. (4.1.3, 9.3.1)* 3. *Perform polarity test on transformers. (2.1.2, 9.3.1)* 4. *Determine voltage regulation of single-phase transformer by conducting direct load test and summarize results in a report. (4.2.1, 9.3.1)*		
	Total	**30**	

Course Outcomes:

Learner will be able to

1. Assemble the DC and AC circuits on breadboard and test the continuity.
2. Select the meters to measure the required variables and analyse the performance of DC and AC circuits.
3. Assemble simple residential electrical wiring incorporating safety devices.
4. Select motor for household applications and test the transformer.

Performance Indicators:

P.I. No.	P.I. Statement
2.1.2	Identify engineering systems, variables, and parameters to solve the problems.
2.2.4	Compare and contrast alternative solution processes to select the best process.
4.1.3	Apply appropriate instrumentation and/or software tools to make measurements of physical quantities.
4.1.4	Establish a relationship between measured data and underlying physical principles.
4.2.1	Design and develop experimental approach, specify appropriate equipment and procedures
6.1.1	Identify and describe various engineering roles; particularly as pertains to protection of the public and public interest at global, regional and local level
9.2.1	Demonstrate effective communication, problem solving, conflict resolution and leadership skills.
9.3.1	Present results as a team, with smooth integration of contributions from all individual efforts

Text Books:

1. Electrical Power Systems, S.L. Uppal and Prof. Sunil S. Rao 15th Edition, Khanna Publishers
2. Basic Electrical Engineering, B.R Patil, 2nd Edition Oxford Higher Education, 2019
3. Art & Science of Utilization of electrical Energy, H Partab, Dhanpat Rai & Co., 2004.
4. Electrical and Electronic Measurements and Measuring Instruments, A K Sawhney Dhanpat Rai and Sons
5. Special Electrical Machines, E G Janardanan PHI 2014
6. Electrical Power Systems, S.L. Uppal and Prof. Sunil S. Rao, 15th Edition, Khanna Publishers

Reference Books:

1. Power System Engineering, D P Kothari and I J Nagrath 3rd Edition, Mac Graw Hills,
2. Electrical Engineering Fundamentals, Vincent Del Toro, PHI Second edition, 2011
3. Utilization of Electric Power & Electric Traction, J B Gupta, 10th Edition, Dhanpat Rai and Sons 2012
4. Electrical Engineering, B.L.Theraja Vol-I and II
5. Basic Electrical Engineering, S.N.Singh PHI, 2011

Other Resources:

1. NPTEL course on Basic Electrical Technology, IISc Bangalore Prof. L. Umanand https://nptelvideos.com/course.php?id=460
2. Virtual Lab - https://asnm-iitkgp.vlabs.ac.in

CONTINUOUS ASSESSMENT (25 Marks)

1. Practical Exercises – 10 Marks

1. Readiness to perform experiment (2 Marks),
2. Performance (2 Marks),
3. Report writing (2 Marks),
4. Interpretation of result (2 Marks)
5. Regularity in submission (2 Marks).

2. Practical Test 1 (Based on first 50% of practical list) – 5 Marks

3. Practical Test 2 (Based on remaining 50% of practical list) – 5 Marks

4. Regularity and active participation – 5 Marks

END SEMESTER EXAMINATION (25 Marks)

Two examiners, one internal and one external will do the evaluation

1. Students will be randomly allocated and experiment from the list of laboratory exercises and will be asked to draw circuit diagram, observation table with relevant formulae. It will be checked by the examiners and evaluated out of 05 Marks.
2. Then the student will be allowed to start with the performance of the experiment.
3. Students will be given 1 hour to complete the circuit connection and take readings. The connections and output are verified by the examiners. The weightages 05 Marks.
4. Students will do sample calculations, draw relevant graphs and write conclusion of the experiment. It will be checked by the examiners and evaluated out of 05 Marks.
5. Students will be appearing for Oral test front of both Internal and External examiners. The weightage of Oral test will be of 10 marks.

Course Type	Course Code	Course Name	Credits
ESC-LC	ESCLC103	PROGRAMMING LABORATORY-I (C)	02

Examination Scheme		
Continuous Assessment	**End Semester Exam(ESE)**	**Total Marks**
50	50	100

Program Outcomes addressed:

1. PO1: Engineering knowledge
2. PO2: Problem analysis
3. PO5: Modern tool usage
4. PO12: Life-long learning

Course Objectives:

1. To provide exposure to problem-solving by developing an algorithm, flowchart and implement the logic using C programming language.
2. To familiarize basics of Conditional and Looping Control Structures in C.
3. To provide exposure about function definition, declaration and its usage and recursive functions.
4. To familiarize one and multi-dimensional arrays, structures and strings in C.
5. To provide exposure about pointers, operations on pointers and dynamic memory allocation in C programming language.

Module	Detailed Contents	Hrs	CO
00.	**Course Introduction** Knowledge of problem solving and programming concepts is essential for those who develop applications for users. This course imparts basic knowledge in C programming along with the concepts of design and development of programs using C.	**01**	
01.	**Introduction to Algorithm, Flowchart and C.** ***Learning Objective/s:*** *Learner is expected to recall basics of algorithm, flowchart and C. Also expected to understand problem-solving approach and apply the logic to implement program using C. Investigate the functioning of various components of the given control system as a team.*	**07**	**CO- 1**
	Contents:		
	Basic Concept of Problem solving, Introduction to Algorithm and Flowchart**.** Character Set, Identifiers and keywords, Data types, Constants, Variables. Operators-Arithmetic, Relational and logical, Assignment, Unary, Conditional, Bitwise, Comma, other operators. Expression, statements, Library Functions, Preprocessor. Data Input and Output – getchar( ), putchar( ), scanf( ), printf( ), gets( ), puts( ), Structure of C program .		
	Task 1: Algorithm and flowchart to find greatest of three numbers, sum of N natural numbers. **Task 2:** C program to calculate 40% da from basics, 20% hra from basics.		

	Also calculate the gross salary of an employee. (GS=BS+DA+HRA)		
	Learning Outcomes: *A learner will be able to* 1. *Apply algorithms on problem statements. (P.I.- 1.1.1)* 2. *Use symbols to draw flowcharts for problems. (P.I.- 1.3.1)* 3. *Identify data types, variables and operators to be used in C according to a problem. (P.I.- 2.1.2)* 4. *Solve the problem using nested control structure in C. (P.I.- 2.2.3)* 5. *Adapt modern tool VS code to solve problem using data input/output, operators. (P.I.- 5.1.2)* 6. *Use VS code to check if the result of the C program using operators is accurate(P.I.- 5.3.2)*		
02.	**Control Structures in C** ***Learning Objective/s:*** *Learner is expected to recall basics of Control Structures and understand Conditional structures. Also expected to apply it to solve problems in C.*	**16**	**CO- 2**
	Contents: Branching - If statement, If-else Statement, Multiway decision. Looping – while, do-while, for Nested control structure- Switch statement, Continue statement, Break statement, Goto statement. **Task 3:** C Program to compare two numbers and determine whether they are odd or even. **Task 4:** C Program to find percentage marks of four subjects. Then determine whether the student has secured distinction, first class, second class or fail. Percentage >=75 Distinction, Percentage >= 60 First class, Percentage >= 40 second class etc.(AF) **Task 5:** C Program to print numbers between 1 and 100 which are multiples of 5 by using do while loop.		
	Self-Learning Topics: *Differentiate between break and continue statements based on their usage in loops.* ***Learning Outcomes:*** *A learner will be able to* 1. *Apply if control statements in C. (P.I.- 1.1.1)* 2. *Use if else control statements in C. (P.I.- 1.3.1)* 3. *Identify data types, variables and loops to be used in C for a problem. (P.I.- 2.1.2)* 4. *Reframe the problem and use nested control structure to solve problems in C. (P.I.- 2.2.1)* 5. *Adapt modern tool VS code to solve problem using control structures (P.I.- 5.1.2)* 6. *Use VS code to check if the result of the C program using loops is accurate (P.I.- 5.3.2)*		
03.	**Functions in C** ***Learning Objective/s:*** *Learner is expected to recall function definition, declaration. and understand its usage. Also expected to apply it to solve problems in C.*	**12**	**CO- 3**

	Contents: Function -Introduction of Function, Function Main, Defining a Function, Accessing a Function, Function Prototype, Passing Arguments to a Function, Recursion. Storage Classes –Auto , Extern , Static, Register **Task 6:** C Program to create four types of user defined function for addition () of two numbers. **Task 7:** C Program to find Fibonacci series for given no of elements using recursive function.		
	Self-Learning Topics: *Write two programs using functions which have been written using loops.* ***Learning Outcomes:*** *A learner will be able to* 1. *Apply functions to write program in C. (P.I.- 1.1.1)* 2. *Use appropriate storage class in C. (P.I.- 1.3.1)* 3. *Identify data types, variables and type of user defined function to be used in C according to a problem. (P.I.- 2.1.2)* 4. *Reframe the problem and use recursive function to solve problems in C. (P.I.- 2.2.1)* 5. *Adapt modern tool VS code to solve problem using functions. (P.I.- 5.1.2)* 6. *Use VS code to check if the result of the C program using functions is accurate(P.I.- 5.3.2)*		
04.	**Arrays, Strings in C**	**12**	**CO- 4**
	Learning Objective/s: *Learner is expected to recall one dimensional arrays and understand its usage and apply it to solve problems in C.*		
	Contents: Array-Concepts, Declaration, Definition, Accessing array element, One-dimensional and Multidimensional array. String- Basic of String, Array of String, Functions in String.h **Task 8:** C Program to sort elements in ascending order in an array. **Task 9:** C Program to check if string is palindrome or not.		
	Self-Learning Topics: *Write two-dimensional array programs for matrix addition and multiplication.* ***Learning Outcomes:*** *A learner will be able to* 1. *Use 1D arrays to write program in C. (P.I.- 1.1.1)* 2. *Apply strings to write programs in C. (P.I.- 1.3.1)* 3. *Identify data types, variables and type of arrays to be used in C according to a problem. (P.I.- 2.1.2)* 4. *Reframe the problem and use arrays to solve problems in C. (P.I.- 2.2.1)* 5. *Adapt modern tool VS code to solve problem using arrays. (P.I.- 5.1.2)* 6. *Use VS code to check if the result of the C program using arrays is accurate(P.I.- 5.3.2)*		
05	**Structures and Pointers in C** ***Learning Objective/s:*** *Learner is expected to recall pointers, operations on pointers and its usage and apply it to solve problems in C.*	**12**	**CO-5**

	Contents: Structure- Declaration, Initialization, structure within structure, Operation on structures, Array of Structure. Pointer: Introduction, Definition and uses of Pointers, Address Operator, Pointer Variables, Pointer Arithmetic, Pointers to Pointers, Pointers and Array, Passing Arrays to Function, Pointers and Function, Pointers and two-dimensional Array, Array of Pointers, Dynamic Memory Allocation **Task 10:** C Program to create a structure to enter details for 5 students. The details are name, branch, roll no and marks of five different subjects. Also calculate the total marks and arrange them in ascending order. **Task 11:** C Program to create, initialize, assign and access a pointer variable. **Task 12:** C Program to Swap two numbers using call by value and call by reference functions.		
	A learner will be able to 1. *Apply structures to write program in C. (P.I.- 1.1.1)* 2. *Use pointers in C to write programs. (P.I.- 1.3.1)* 3. *Identify data types, variables and type of function for dynamic memory allocation to be used in C according to a given problem. (P.I.- 2.1.2)* 4. *Reframe the problem and use pointer arithmetic to solve problems in C. (P.I.- 2.2.1)* 5. *Adapt modern tool VS code to solve problem using pointers, structures. (P.I.- 5.1.2)* 6. *Use VS code to check if the result of the C program using pointers is accurate (P.I.- 5.3.2)* 7. *Learn new ways to use pointers and structures in professional work. (P.I.- 12.1.1)* 8. *Identify new updates like dynamic memory management in C programming so that they can use it for writing efficient programs in future. (P.I.- 12.2.1)*		
	Total	**60**	

Course Outcomes:

Learner will be able to

1. Illustrate the basic terminology used in computer programming concept of data types, variables and operators using C.
2. Use control structure concepts in C programming.
3. Develop functions and use it to solve problems in C using modern tools.
4. Apply arrays and strings to solve problems in C.
5. Demonstrate the use of structures, dynamic memory allocation and pointers in C.

Performance Indicators:

P.I. No.	**P.I. Statement**
1.1.1	Apply the knowledge of discrete structures, linear algebra, statistics and numerical techniques to solve problems.
1.3.1	Apply engineering fundamentals.
2.1.2	Identifies processes/modules/algorithms of a computer based system and parameters to solve a problem

2.2.1 Reframe the computer-based system into interconnected subsystems

2.2.3 Identify existing solution/methods to solve the problem, including forming justified approximations and assumptions

5.1.2 Create/adapt/modify/extend tools and techniques to solve engineering problems

5.3.2 Verify the credibility of results from tool use with reference to the accuracy and limitations, and the assumptions inherent in their use.

12.1.1 Describe the rationale for the requirement for continuing professional development

12.2.1 Identify historic points of technological advance in engineering that required practitioners to seek education in order to stay current

Text Books:

1. The C Programming Language, Brian W. Kernighan, Dennis M. Ritchie, Second Edition, 2015, Pearson Education India.
2. Programming with C, Byron S. Gottfried, Fourth Edition, 2018, Tata McGraw-Hill Publications.
3. Programming in ANSI C, E. Balaguruswamy, Eighth edition, 2019, Tata McGraw-Hill Publications.

Reference Books:

1. Programming in C, Pradeep Day and Manas Gosh, Second Edition, 2013, Oxford University Press.
2. Let Us C: Authentic Guide to C Programming Language, Yashwant Kanetkar, Nineteenth Edition, 2023, BPB Publication.

Other Resources:

1. NPTEL Course: Introduction to Programming in C By Prof. Satyadev Nandakumar, Department of Computer Science and Engineering, IIT Kanpur
   Web link- https://archive.nptel.ac.in/courses/106/104/106104128/

2. Problem Solving through Programming in C By Prof. Anupam Basu, Department of Computer Science and Engineering Engineering, IIT Kharagpur
   Web link- https://archive.nptel.ac.in/courses/106/105/106105171/

IN-SEMESTER ASSESSMENT (50 MARKS)

1. Task Execution (30 Marks)

Students will be given minimum 12 tasks.

Students are expected to

1. Identify variables, data types methods/approach required to write the code for the given task and apply the same.
2. Gain knowledge of Operators, data input and output concept

3. Recall basics control structures, understand conditional structures and apply it to solve problems in C.
4. Execute given task for different inputs and verify the result
5. Execute the function and integrate the functions for task completion.
6. Create a 1D, 2D array to solve problem.
7. Apply structure concept to solve the problem.
8. Apply concept of pointers to solve the problem.

Students will be evaluated based on following:

1. Logic building for the given task (10 marks)
2. Rectifying logical errors and syntax errors (06 marks)
3. Well-structured and organized program (06 marks)
4. Verification of experiment output for different inputs (08 marks)

Refer the sample task given below.

Example: Write a menu driven (use Switch, do --- while) C program to perform different calculations using function,
Students are expected to,

1. Identify variables, data types methods/approach required to create teacher class and add methods to display details of a given teacher
2. Execute given task for different inputs and verify the result
3. Follow the coding standards
4. Identify errors and rectify the errors.

Students are evaluated based on following:

1. Logic building for the given task (10 marks)
2. Rectifying logical errors and syntax errors (06 marks)
3. Well-structured and organized program (06 marks)
4. Verification of experiment output for different inputs (08 marks)

2. Regularity and active participation: (05 Marks)

3. Practical Test (15 Marks)

a) Task Execution: 10 Marks

1. Logic building for the given task (04marks)
2. Rectifying logical errors and syntax errors (02 marks)
2. Well-structured and organized program (02 marks)
3. Verification of experiment output for different inputs (02 marks)

b) Oral: 05 Marks

END SEMESTER EXAMINATION (Practical & Oral Exam) (50 Marks)

1. Task Execution: 30 Marks

   Students will be given task (different task for every student) to execute and will be evaluated as per the parameters mentioned in continuous evaluation
2. Presentation of Results and conclusion, Inferences drawn: 05 Marks
3. Oral based on entire syllabus: 15 Marks

Two examiners, one Internal and one External will do the evaluation.

Course Type	Course Code	Course Name	Credits
SEC	SEC101	BASIC WORKSHOP PRACTICE- I	01

Examination Scheme		
Continuous Assessment	**End Semester Exam(ESE)**	**Total Marks**
50	--	50

Pre-requisite:

There are no specific prerequisites for this course. However, students should have a willingness to learn and a commitment to safety.

Program Outcomes addressed:

1. PO5: Modern tool usage
2. PO6: The engineer and society
3. PO9: Individual and team work
4. PO12: Life-long learning

Course Objectives:

1. To impart training to help the students develop engineering skill sets.
2. To inculcate respect for physical work and hard labour.
3. To get exposure to interdisciplinary engineering domain.

Module	Detailed Contents	Hrs	CO
00	**Course Introduction** The Basic Workshop Practice I course is intended to give participants with the core information and abilities required for working safely and effectively in a workshop environment. This hands-on course introduces the fundamental principles, equipment, and techniques utilised in a variety of workshop scenarios, such as fitting, hardware and networking, and welding.	**01**	
01.	***Learning Objectives:*** *1. To familiarize participants with reading and interpreting technical drawings, and schematics related to fitting tasks.* *2. To enhance participants' proficiency in fitting various components or materials together accurately and securely using various fitting tools.* *3. To make participants learn to use precision measuring tools to verify part dimensions and ensure quality control.*	**09**	**CO- 1**
	Content: Fitting • 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, one simple male- female joint, drilling and tapping.		
	Learning Outcomes :		

	A learner will be able to 1. *Read and interpret technical drawings, or schematics related to fitting tasks, identifying dimensions, tolerances, and other specifications accurately. (P.I.- 12.3.1)* 2. *Demonstrate proficiency in fitting techniques. (P.I.- 5.3.1)* 3. *Competent in the effective use of precision measuring tools to examine work pieces, confirm dimensions, and ensure adherence to quality requirements and standards. (P.I.- 5.2.2, 12.3.1, 12.3.2)*		
02.	***Learning Objectives:*** *1. To gain a comprehensive understanding of computer hardware components and peripheral devices.* *2. To learn how to assemble a computer system, set up and configure network infrastructure components, including routers, switches, access points, and cables, to create a functional network environment.* *3. To develop the skills to diagnose and troubleshoot common hardware and network problems.*	**10**	**CO- 2** **CO- 3**
	Content: Hardware and Networking • 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 (Any one) 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.		
	Learning Outcomes : *A learner will be able to* 1. *Identify and understand the various hardware components of a computer system. (P.I.- 5.1.2, 12.1.1)* 2. *Assemble a computer system, set up and configure network infrastructure components to create a functional network environment. (P.I.- 5.2.2, 12.2.1)* 3. *Develop the skills to diagnose and troubleshoot common hardware and network problems. (P.I.- 6.1.1)*		
03.	***Learning Objectives:*** *1. To understand welding symbols and their meanings as per standard welding blueprints. Interpret welding drawings and specifications accurately.* *2. To become familiar with welding equipment, including welding machines, electrodes, torches, gas cylinders, filler metals, and other tools. Learn how to set up and operate welding equipment safely and efficiently.* *3. To develop proficiency in various welding techniques such as lap welding, butt welding, fillet welding, and groove welding. Practice achieving proper weld bead geometry, penetration and fusion.*	**08**	**CO- 4**

	Content: Welding Introduction to welding equipment. 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. One job on gas welding.		
	Learning Outcomes : *A learner will be able to* 1. *Interpret welding symbols and blueprints accurately, understanding weld joint designs, dimensions, and specifications as per industry standards. (P.I.- 9.3.1, 12.3.1)* 2. *Produce welds that meet industry standards and specifications, demonstrating the ability to achieve proper weld penetration, fusion, and surface finish while minimizing defects such as porosity, lack of fusion, and undercutting. (P.I.- 5.2.2, 5.3.1, 6.1.1, 9.1.1, 12.3.2)*		
04.	***Learning Objectives:*** *1. To gain knowledge of the different parts of a lathe machine, including the bed, headstock, tailstock, carriage, tool post, chuck, and various controls.* *2. To gain an understanding of lathe operations such as turning between centers, chucking, facing, taper turning, and threading. Understand the sequence of operations and the appropriate use of cutting tools and feeds for each operation.*	**02**	**--**
	Content: Machine Shop • Machine Shop (Demo of one simple lathe job) (Only for Mechanical Engineering students, other department students can utilized this time to complete the pending work, if any).		
	Learning Outcomes : *A learner will be able to* 1. *Identify different parts of a lathe machine and understand operations that can be carried out on it. (P.I.- 12.1.1, 12.3.1)*		
	Total	**30**	

Course Outcomes:

A learner will be able to

1. Develop the necessary skill required to handle/use different fitting tools.
2. Develop skill required for hardware maintenance and installation of operating system.
3. Identify the network components and perform basic networking and crimping.
4. Prepare the edges of jobs and do simple arc welding.

Performance Indicators:

P.I. No.	**P.I. Statement**
5.1.2	Create/adapt/modify/extend tools and techniques to solve engineering problems.
5.2.2	Demonstrate proficiency in using discipline-specific tools.
5.3.1	Discuss limitations and validate tools, techniques and resources.
6.1.1	Identify and describe various engineering roles; particularly as pertains to protection of the public and public interest at the global, regional and local level.
9.1.1	Recognize a variety of working and learning preferences; appreciate the value of diversity on a team.

9.3.1	Present results as a team, with smooth integration of contributions from all individual efforts.
12.1.1	Describe the rationale for the requirement for continuing professional development.
12.2.1	Identify historic points of technological advance in engineering that required practitioners to seek education in order to stay current.
12.3.1	Source and comprehend technical literature and other credible sources of information.
12.3.2	Analyse sourced technical and popular information for feasibility, viability, sustainability, etc.

CONTINUOUS INTERNAL EVALUATION (50 Marks)

1. Job Work with complete workshop book: 40 Marks
2. Regularity and active participation: 10 marks

Course Type	Course Code	Course Name	Credits
VEC	VEC101	UNIVERSAL HUMAN VALUES	02

Program Outcomes addressed:

1. PO6: The Engineer & society
2. PO7: Environment & sustainability
3. PO8: Ethics
4. PO12: Life-long learning

Course Objectives:

1. To help the student see the need for developing a holistic perspective of life.
2. To sensitize the student about the scope of life – individual, family (inter-personal relationship), society and nature/existence
3. To strengthen self-reflection.
4. To develop more confidence and commitment to understand, learn and act accordingly

Topic Title	**Aspirations and Issues**	**Basic Realities (underlying harmony)**
Welcome and Introductions	Getting to know each other	Self-exploration
Aspirations and Concerns	Individual academic, career… Expectations of family, peers, society, nation… Fixing one's goals	Basic human aspirations Need for a holistic perspective Role of UHV
Self-Management	Self-confidence, peer pressure, time management, anger, stress… Personality development, self-improvement…	Harmony in the human being
Health	Health issues, healthy diet, healthy lifestyle Hostel life	Harmony of the Self and Body Mental and physical health
Relationships	Home sickness, gratitude towards parents, teachers and others Ragging and interaction Competition and cooperation Peer pressure	Harmony in relationship Feelings of trust, respect… gratitude, glory, love
Society	Participation in society	Harmony in the society
Natural Environment	Participation in nature	Harmony in nature/existence
Total no. of hours: **30**		

Course Outcomes:

Learners will be able to

1. Analyze the significance of value inputs provided in formal education along with skills and develop a broader perspective about life and education
2. Formulate their aspirations and concerns at different levels of living, and the way to fulfill them in a sustainable manner.
3. Evaluate their current state of understanding and living, and model a healthy lifestyle
4. Examine the issues of home sickness, interactions with seniors on the campus, peer pressure with better understanding and feel grateful towards parents, teachers and others
5. Develop more confidence and commitment for value-based living in family, society and nature

Text Books:

1. Human values & Professional Ethics by R. R.Gaur, R Sangal, G. P.Bagaria, 2010, Excel Books , New Delhi

Reference Books:

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, Published by 2004 by New Age Intl. Publishers, New Delhi.
3. The Story of Stuff by Annie Leonard, published in 2010 by Free Press.
4. Small is Beautiful by E. F. Schumacher, published in 1973 by Harper & Row.
5. Slow is Beautiful by Cecile Andrews, published in 2006 by New Society Publishers

Other Resources:

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

Course Type	Course Code	Course Name	Credits
BSC	BSC204	ENGINEERING MATHEMATICS-II	03+01*

Examination Scheme					
Distribution of Marks			Exam Duration (Hrs.)		Total Marks
In-semester Assessment		End Semester Exam (ESE)			
Continuous Assessment	Mid-Semester Exam (MSE)		MSE	ESE	
20 + 25*	30	50	1.5	2	125

* For Tutorial

Program Outcomes addressed:

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

Course Objectives:

1. To provide the Basic knowledge of the concepts of Mathematics applicable to the field ofengineering.
2. To build a mathematical foundation of the methodology required for solving application basedproblems in the field of Engineering.

Module	Detailed Content	Hrs	CO
00.	**Course Introduction** Mathematics is the fundamental step which creates a solid foundation for all Applied fields of Engineering. Professional Engineering applications have Mathematics as an integral part of their evolution. For example: Formulation in Mathematics to various engineering field using case study. Introduction to differential equations from Electrical circuit. Introduction to Multiple Integration from real life application. Use the concept of vector integration into Fluid Mechanics**.** Hence, Formulation Based Mathematics is a fundamental requisite to all fields of Engineering for analyzing their performances.	**01**	
01.	**Differential Equations of First Order and First Degree** ***Learning Objective/s:*** *Learner will be able to* ***1.*** *Analyse and interpret the basic fundamentals of differential equations (D.E) of first order & first degree.* ***2.*** *Determine the solution of a first order D.E by applying the basic concepts of exact and linear DE.*	**6-8**	**CO-1**

	Contents: Definition, Formation of Differential equation, Exact differential Equations, Non Exact Differential Equation, Integrating Factors, Rules for finding the integrating factor, Linear Differential Equations, Equation reducible to Linear form , Bernoulli's equation. ***Self-Learning Topics:*** *Application of differential equations of First Order and First Degree in electrical circuits and thermodynamics.* ***Learning Outcomes:*** *A learner will be able to* 1. *Identify the exact differential equation and linear differential equations. (P.I.-2.1.3)* 2. *Identify the method of solving exact differential equation and linear differential equations. (P.I.-2.2.3)* 3. *Apply the fundamentals of differentiation and integrations to solve the problems related to exact and linear differential equations. (P.I.-1.1.1)* 4. *Apply the fundamental engineering concepts to model a first order DE and solve it.(P.I.-1.3.1)*		
02.	**Linear Differential Equations with Constant Coefficients and Variable Coefficients of Higher Order type f(D)y = X** ***Learning Objective/s:*** *Learner will be able to* 1. *Analyse and interpret the basic fundamentals of higher order differential equations (HODE).* 2. *Determine the solution of a HODE by applying the basic concepts of complementary function and particular integral.* **Contents:** Complementary Function, Particular Integral, Type 1. X = e^{ax} , Type 2 X = x^n ,Type 3 X = $cos(ax+b) or\ sin(ax+b)$,Type 4 X = $e^{ax}V$ Type 5 X= xV, General Type - Method of variation of parameters ***Self-Learning Topics:*** 1. *Differential equations with Variable Coefficients* 2. *(Cauchy's and Legendre's Linear Differential Equations)* 3. *Applications of Higher Order Linear Differential Equations to develop a mathematical model of linear differential equations.* ***Learning Outcomes:*** *A learner will be able to* 1. *Identify the nature of HODE. (P.I.-2.1.3)* 2. *Solve a higher order differential equation by applying the concept of complementary function and particular integral. (P.I.-2.2.3)* 3. *Apply the fundamentals of differentiation and integrations to solve the problems related HODE. (P.I.-1.1.1)* 4. *Develop a mathematical model of linear differential equations and to find the solution of designed model. (P.I.-2.3.1)* 5. *Apply the fundamental engineering concepts to model a higher order DE and solve it. (P.I.-1.3.1) (Tutorial)*	**7-9**	**CO- 2**

03.	**Beta and Gamma Functions** ***Learning Objective/s:*** ***1.*** *Analyse and interpret the basic definition of Beta and Gamma Functions and their properties.* ***2.*** *Apply the definition and properties of Beta and Gamma Functions to solve definite integrals.*	**5-7**	**CO- 3**
	Contents: Definitions, Gamma Function, Beta Function, Properties of Beta and Gamma Function, Relationship between Beta and Gamma Function, Duplication Formula		
	Learning Outcomes: *A learner will be able to* ***1.*** *Identify a definite integral. (P.I.-2.1.3)* ***2.*** *Apply the basic definition of beta and gamma function to solve the definite integral. (P.I.-1.1.1)* ***3.*** *Analyze the problem by identifying the appropriate substitution to solve it. (P.I.-2.2.3)* ***4.*** *Apply the properties of beta and gamma function to solve the definite integral. (P.I.-1.2.1)*		
04.	**Double Integration** ***Learning Objective/s:*** *1. Analyze the fundamentals of Double integration in different coordinate systems (Cartesian and polar) and apply it to solve problem.* *2. Apply the concepts of double integrations to evaluate area and mass of theLamina.*	**7-9**	**CO- 4**
	Contents: Definition, Evaluation of Double Integration in Cartesian Coordinates and Polar Coordinates, Evaluation of double integrals by changing the order of Integration, Evaluation of integrals over the given region, Evaluation of double integrals by changing to polar Co-ordinates, Application of double integrals to compute Area.		
	Self-Learning Topics: *Mass of a Lamina* ***Learning Outcomes:*** *A learner will be able to* *1. Identify the region of integration. (P.I.-2.1.3)* *2. Determine the Change of coordinate systems. (P.I.-2.2.1)* *3. Apply the fundamentals of integration of a function of single variable to solve problem in double integration. (P.I.-1.1.1)* *4. Apply the concept of double integration to find area of bounded regions. (P.I.-1.2.1)*		

05.	**Triple Integration** ***Learning Objective/s:*** 1. *Analyze the fundamentals of Triple integration in different coordinate systems and apply it to solve problem.* 2. *Apply the concepts of triple integrations to evaluate volume of a solid.* **Contents:** Definition, Evaluation of Triple Integral using Cartesian coordinates, Evaluation of Triple Integral using cylindrical coordinates, Evaluation of Triple Integral using Spherical coordinates. ***Self-Learning Topics:*** *Volume of a solid* ***Learning Outcomes:*** *A learner will be able to* 1. *Identify the region of integration. (P.I.-2.1.3)* 2. *Determine the Change of coordinate systems. (P.I.-2.2.1)* 3. *Apply the fundamentals of integration of a function of single variable to solve problem in double integration. (P.I.-1.1.1)* 4. *Apply the concept of triple integration to find the volume of a solid. (P.I.-1.2.1)*	**5-7**	**CO- 4**
06.	**Integration of vector function** ***Learning Objective/s:*** Analyze the fundamentals of Line integral, surface integral and volume integral and apply it to solve problems using Green's Theorem, Stoke's Theorem & Gauss Divergence Theorem. **Contents:** Integration of vector function, Line Integral, Green's Theorem (without proof), Surface Integral, Volume Integral, Stoke's Theorem & Gauss Divergence Theorem(without proof) ***Self-Learning Topics:*** *Work done by a force* ***Learning Outcomes:*** *A learner will be able to* 1. *Apply the concept of definite integral to evaluate Line integral, surface integral and volume integral. (P.I.-1.1.1)* 2. *Apply the concept of vector differentiation to evaluate Line integral, surface integral and volume integral. (P.I.-1.2.1)* 3. *Identify the concept of vector differentiation to evaluate Line integral, surface integral and volume integral. (P.I.-2.1.3)* 4. *Differentiate between the problems and solve using appropriate theorem (Green's Theorem, Stoke's Theorem & Gauss Divergence Theorem). (P.I.-2.2.4)*	**7-9**	**CO- 5**

	Course Conclusion.	**01**	
	Total	**45**	

Course Outcomes:

Learner will be able to

1. Analyse whether the first order Differential equation is exact or Linear and solve it by applying the appropriate method.

2. Analyse the procedure to find complementary function and particular integral of higher order differential equation solve it by applying the suitable method.

3. Implement the fundamentals of Beta and Gamma Function to evaluate the definite integral.
4. Apply the fundamentals of multiple integration to analyse and evaluate the area of a lamina and volume of a solid.

5. Apply the concepts of line integral, surface integral and volume integral in order to analyse and evaluate problems using Green's theorem, Stoke's theorem, Gauss-divergence theorem.

Performance Indicators:

P.I. No.	P.I. Statement
1.1.1	Apply mathematical techniques as calculus/algebra to solve problems.
1.2.1	Apply laws of natural science to an engineering problem.
1.3.1	Apply fundamental engineering concepts to solve engineering problem.
2.1.1	Articulate problem statements and identify objectives.
2.1.2	Identify engineering systems, variables, and parameters to solve the problems
2.1.3	Identify the mathematical knowledge that applies to a given problem.
2.2.3	Identify existing processes/solution methods for solving the Problems.
2.2.4	Compare and contrast alternative solution processes to select the best process.
2.3.1	Combine mathematical principles and engineering concepts to formulate models of a system or process that is appropriate in terms of applicability

Text Books:

1. Higher Engineering Mathematics, Dr. B. S. Grewal, Khanna Publication, forty fourth Edition, 2021

2. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley Eastern Limited, Tenth Edition, 2011.

Reference Books:

1. Engineering Mathematics by Srimanta Pal and Subodh, C. Bhunia, Oxford University Press, First Edition, 2015
2. Engineering Mathematics by P. Sivaramakrishna Das and C. Vijayakumari, Pearson, First Edition, 2017

IN-SEMESTER ASSESSMENT (75 Marks)

1. Continuous assessment (45 Marks)

Continuous Internal Evaluation of Theory (20 Marks)

1. Numerical Assignments (Minimum 20 problems): 5 marks
2. Class test based on above Numerical assignment: 5 marks
3. Team - Pair - Solo: 5 marks
4. Regularity and active participation: 5 marks

Continuous internal evaluation of Tutorial (25 Marks)

1. Tutorials: 20 Marks
2. Regularity and active participation: 5 marks
3. Students must be encouraged to write atleast 6 class tutorials. Atleast class tests will be conducted based on class tutorials on entire syllabus. Each class test carries 20 Marks. Average will be taken of all class tests.

2. Mid Semester Exam (30 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

END SEMESTER EXAMINATION (50 Marks)

End semester will be based on the syllabus coverage upto Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Type	Course Code	Course Name	Credits
BSC	BSC205	ENGINEERING PHYSICS-II	02

Examination Scheme					
Distribution of Marks			Exam Duration (Hrs.)		Total Marks
In-semester Assessment		End Semester Exam (ESE)			
Continuous Assessment	Mid-Semester Exam (MSE)		MSE	ESE	
15	20	40	1	1.5	75

Program Outcomes addressed:

1. PO1: Engineering knowledge
2. PO2: Problem analysis
3. PO6: The engineer and society
4. PO7: Environment and sustainability

Course Objectives:

1. To provide the Basic knowledge on the concepts of physics pertaining to the field of engineering.
2. To build a foundation to the methodology necessary for solving problems by applying theknowledge of physics in the field of engineering.

Module	Detailed Content	Hrs	CO
00.	**Course Introduction** Significances of Crystals and non–crystalline solid: Need of analysis of crystal: Applications of magnetic, dielectric and nanomaterials in Engineering.	01	
01.	**Crystal Structure** ***Learning Objective/s:*** *1. To introduce the fundamental knowledge of cubic crystal structures.* *2. To apply the knowledge of crystal parameters to identity the simple cubic structure.*	3-5	CO-1
	Contents: Crystals: Unit cell: Space lattice: Cubic Structures (SC, BCC and FCC): Unit cell characteristics for simple cubic: Unit cell volume, Number of atoms per unit cell, Coordination number, Atomic radius, Nearest neighbour distance, Packing fraction, Percentage of void space and Density.		

	Self-Learning Topics: *Crystals: Lattice parameters.* ***Learning Outcomes:*** *A learner will be able to* 1. *state various parameters of unit cell of a crystal. (P.I.- 1.2.1)* 2. *diagrammatically describe the structure of different cubic unit cell. (P.I.- 1.2.1)* 3. *solve the problems related to crystal structure. (P.I.- 1.2.2.)* 4. *identify cubic crystal structure knowing their various parameters. (P.I.- 2.1.2)* 5. *derive the unit cell parameters of cubic crystal structure. (P.I.- 2.1.3)*		
02.	**Analysis of Crystal Structure** ***Learning Objective/s:*** 1. *To interpret the use of X-ray diffraction in Bragg's law.* 2. *To apply the concept of Miller Indices and Bragg's law to identify the crystal planes.*	**4-6**	**CO-1**
	Contents: Crystal planes and Miller indices; Interplanar spacing: Relation between interplanar spacing and Miller indices for cubic unit cell. Diffraction of X-ray and Bragg's law; Bragg's spectrometer: Principle, Construction and working; Determination of crystal structure using Bragg's spectrometer.		
	Self-Learning Topics: *Diffraction of light through grating.* ***Learning Outcomes:*** *A learner will be able to* 1. *define crystal plane and miller indices of planes. (P.I.- 1.2.1)* 2. *draw the crystal planes from Miller indices. (P.I.- 1.2.1)* 3. *solve the problems related to miller indices and Bragg's law. (P.I.- 1.2.2)* 4. *derive interplanar distance in a simple cubic structure in terms of miller indices and lattice constant. (P.I.- 2.1.3)* 5. *diagrammatically describe Bragg's law and its application in crystal structure analysis. (P.I.- 2.2.3)* 6. *analyse the cubic crystal structure theoretically by using Bragg's spectrometer. (P.I.- 2.2.3)*		
03.	**Non-Crystalline Materials** ***Learning Objective/s:*** 1. *To gain the basic knowledge of non-crystalline solids.* 2. *To recognize the solids with amorphous structure and their importance in various applications*	**3-5**	**CO-1**
	Contents: Structure: order and disorder, importance of short range order, properties of non-crystalline solid; Classes: metals/metalloid glasses, alloys of transitions metals with rare earth atoms. Silica glasses and related alloys.		

	Self-Learning Topics: *Application of non-crystalline materials.* ***Learning Outcomes:*** *A learner will be able to* 1. *differentiate crystalline and non-crystalline materials. (P.I.- 1.2.1)* 2. *define non-crystalline material. (P.I.- 1.2.1)* 3. *list the properties of non-crystalline solid. (P.I.- 1.2.1)* 4. *identify the importance of short range order in non-crystalline materials. (P.I.- 2.1.2)* 5. *identify various non crystalline materials by knowing their properties. (P.I.- 2.2.3)*		
04.	**Magnetic and Dielectric Materials** ***Learning Objective/s:*** 1. *To identify the properties of magnetic and dielectric materials.* 2. *To apply magnetic and dielectric materials as solutions to enhance existing and future technology.*	**6-8**	**CO-2**
	Contents: Magnetic materials: Ferromagnetism: Magnetization of ferromagnetic materials, hysteresis loop: soft and hard magnetic materials, Magnetoresistive materials, Applications of magnetic materials. Dielectric materials: Dielectric materials: Dielectric constant; Dielecctric polarization; Dielectric susceptibility; Dipoles; Nonpolar and polar dielectric, Applications of dielectric materials.		
	Self-Learning Topics: *Magnetization of materials.* ***Learning Outcomes:*** *A learner will be able to* 1. *state various parameters related to magnetic and dielectric materials. (P.I.- 1.2.1)* 2. *solve the problems involving magnetic and dielectric materials using the concepts and basic formulae. (P.I.- 1.2.2)* 3. *identify the types of ferromagnetic materials. (P.I.- 2.1.2).* 4. *classify the dielectric materials as polar and non-polar dielectrics. (P.I.- 2.1.2)* 5. *Draw the hysteresis loop for ferromagnetic materials by knowing the concept of magnetization. (2.1.3)* 6. *use magnetic materials and dielectric materials in various applications. (P.I.- 6.1.1)* 7. *state the advantages, disadvantages of using magnetic and dielectric materials in various devices. (P.I.- 6.2.2)*		
05.	**Nanomaterials** ***Learning Objective/s:*** 1. *To explore the basics of nanomaterials.* 2. *To identify the applications of nanomaterials in current technology.*	**3-5**	**CO-3** **CO-4**

	Contents: Introduction; Properties (Optical, electrical, magnetic, mechanical); Surface to volume ratio; Two main approaches in nanotechnology to synthesize Nanomaterials (Bottom up technique and Top down technique); Synthesis methods: Ball milling; Chemical vapour deposition; Applications.		
	Self-Learning Topics: *Advantages and disadvantages of Ball milling and Chemical vapour deposition methods.* ***Learning Outcomes:*** *A learner will be able to* 1. *define nanomaterial (P.I.- 1.2.1)* 2. *differentiate between two approaches of synthesizing nanomaterials. (P.I.- 1.2.1)* 3. *solve the problems related to surface area to volume ratio. (P.I.- 1.2.2)* 4. *classify various synthesis methods of nanomaterials in terms of approaches. (2.1.2).* 5. *write about various synthesis methods and identify the suitable method for the preparation of a different nanomaterials. (P.I.- 2.2.3)* 6. *state the advantages, disadvantages and limitations of using various synthesis methods. (P.I.- 6.2.2)* 7. *analyse the properties of nanomaterials. (P.I.- 6.1.1)* 8. *identify the applications of nanomaterials in technical and environmental fields. (P.I.- 7.1.2)*		
06.	**Characterization Techniques of Nanomaterials** ***Learning Objective/s:*** *The learner will be able to predict the tools for specific characterization of nanomaterials.*	**3-5**	**CO-3** **CO-4**
	Contents: Tools for characterization of Nanomaterials: Scanning Electron Microscope (SEM), Transmission Electron Microscope (TEM), Atomic Force Microscope (AFM).		
	Self-Learning Topics: *Difference between optical and electron microscope.* ***Learning Outcomes:*** *A learner will be able to* 1. *state working principle of different tools (SEM, TEM and AFM). (P.I.- 1.2.1)* 2. *interpret the importance of electron microscope to characterize nanomaterials. (P.I.- 2.2.3)* 3. *analyse different characterization tools in terms of their principle, construction, working. (P.I.- 2.2.3)* 4. *identify different tools for specific characterization of nanoparticles. (P.I.- 6.1.1)* 5. *identify merits, demerits and challenges in using the characterization tools. (P.I.- 6.2.2)* 6. *apply the tools as a sustainable technique for the characterization of nanomaterials. (P.I.- 7.2.1)*		
	Course Conclusion	**01**	
	Total	**30**	

Course Outcomes:

Learner will be able to

1. Apply the fundamental knowledge of crystals and non-crystalline solids parameters to analyse therelevant basic engineering problems.
2. Apply the fundamental knowledge of magnetic and dielectric materials in various technical fieldsby analyzing their intrinsic behaviours.
3. Use the basic knowledge of nanomaterials and their characterization techniques to identify theirapplications in societal issues.
4. Apply the basic knowledge of nanomaterials and their characterization techniques to identify theirimpact and role as a sustainable solution.

Performance Indicators:

P.I. No.	P.I. Statement
1.2.1	Apply laws of physics to an engineering problem.
1.2.2	Apply the formulae derived from the concept to solve engineering problem.
2.1.2	Identify engineering systems, variables, and parameters to solve the problems
2.1.3	Identify the mathematical, engineering and other relevant knowledge that applies to a givenproblem
2.2.3	Identify existing processes/solution methods for solving the problem, including forming justifiedapproximations and assumptions.
6.1.1	Identify and describe various role of science particularly as pertains to protection of the public andpublic interest at global, regional and local level.
6.2.2	Interpret and explain the limitations in the usage of devices for protection of the public.
7.1.2	Understand the relationship between the technical, socio economic and environmental dimensionsof sustainability.
7.2.1	Describe devices and techniques for sustainable development.

Text Books:

1. A Textbook of Engineering physics, Dr. M. N. Avadhanulu and Dr. P. G. Kshirsagar RevisedEdition, 2014, S. Chand Publishing.
2. Engineering physics, R. K. Gaur and S. L. Gupta, Revised Edition, 2012, Dhanpat RaiPublications.

Reference Books:

1. Fundamentals of Physics, Halliday /Resnick/Walker, Twelve Edition, 2021, Wiley
2. Introduction to solid state physics, Charles Kittel, Eighth Edition, 2005, Wiley
3. Introduction to nanotechnology, Charles P Poole and Frank J Owens, 1st Edition, Wiley-Interscience.
4. Nano: The essentials: Understanding Nanoscience and Nanotechnology, T Pradeep, 1st Edition,2017, McGraw Hill.

Other Resources:

1. Online physics library, California State University:-Web link- https://phys.libretexts.org/
2. Physics website, The State University of New Jersey :-Web link- www.physics.rutgers.edu
3. NPTEL Course: Nano structured materials-synthesis, properties, self assembly and applications by Prof. A.K. Ganguli, IIT Delhi:- Web link- https://nptel.ac.in/courses/118102003

IN-SEMESTER ASSESSMENT (35 Marks)

1. Continuous Internal Evaluation (15 Marks)

1) MCQ test: 4 marks
2) Class test: 4 marks
3) Open book test/Open notes test: 4 marks
4) Regularity and active participation: 3 marks

2. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

END SEMESTER EXAMINATION (40 Marks)

End semester will be based on the syllabus coverage upto Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Type	Course Code	Course Name	Credits
BSC	BSC206	ENGINEERING CHEMISTRY- II	02

Examination Scheme					
Distribution of Marks			Exam Duration (Hrs.)		Total Marks
In-semester Assessment		End Semester Exam (ESE)			
Continuous Assessment	Mid-Semester Exam (MSE)		MSE	ESE	
15	20	40	1	1.5	75

Program Outcomes addressed:

1. PO1: Engineering knowledge
2. PO2: Problem analysis
3. PO6 -The engineer and society
4. PO7 - Environment and sustainability

Course Objectives:

1. To enable the students to apply the laws of chemistry to an engineering problem.
2. To enable the students to appreciate material properties and their engineering applications.
3. To enable the students to analyze and select the most appropriate engineering material
4. To acknowledge the current developments in the field of nanotechnology, energy storage systemsand green chemistry for sustainable development.

Module	Detailed Content	Hrs	CO
00	**Course Introduction** This course provides the insights into the properties, composition and behavior of materials and enables engineers to understand how different materials react under various conditions, allowing them to select appropriate materials for specific applications.	01	
01.	**Alloys**	4-6	CO-1 CO-2
	Learning Objective: *To classify the different types of alloys and interpret their properties and applications in industry.*		
	Contents: Introduction, Significance of alloying, Ferrous Alloys-Plain carbonsteels and special steels: - Nichrome and Stainless steel, Non-ferrous: - Duralumin, Alclad, Shape memory alloys: definition, properties and uses. Calculations on mass of eutectic in alloys.		

	Self-Learning Topics: *Applications of aluminum alloys in aeronautical engineering.* ***Learning Outcomes:*** *A learner will be able to* 1. *State the significance of making alloys (P.I.-1.3.1)* 2. *State the role of carbon in steels (P.I.-1.3.1)* 3. *Classify the plain carbon steels on the basis of their carbon content. (P.I.-2.1.3)* 4. *Distinguish between plain carbon steels and alloy steels (P.I.-2.1.3)* 5. *Identify the role of various alloying elements in alloy steel (P.I.-2.1.3)* 6. *Apply the knowledge of properties of SS and Heat resistant steel in engineering industries. (P.I.-1.3.1)* 7. *State the composition, properties and applications of duralumin. (P.I.-1.3.1)* 8. *State the applications of alclad in aircraft industries. (P.I.-1.3.1)* 9. *State the concept of shape memory alloys. (P.I.-1.3.1)* 10. *Apply the knowledge of shape memory alloys in industries (P.I.-1.3.1).* 11. *Calculate mass of eutectic in alloys (P.I.-1.2.2)*		
02.	**Polymers** ***Learning Objective:*** *To use the knowledge of synthesis, properties and uses of various polymers in industry. This will aid in identifying the impact of disposal of plastics on general health and the environment.* **Contents:** Preparation, properties and uses of Phenol formaldehyde, PMMA, Kevlar. Effect of heat on the polymers (Glass transition temperature). Molecular weight of polymer and numericals. Conducting polymers and their applications. Electroluminescent polymer, Biodegradable polymers. ***Self-Learning Topics:*** *Classification of polymers, Thermoplastic and Thermosetting plastics.* ***Learning Outcomes:*** *A learner will be able to* 1. *Apply the basic concepts of polymer chemistry (P.I.-1.3.1)* 2. *Synthesize thermoplastic and thermosetting polymers for industrial use. (P.I.-2.2.3)* 3. *Calculate the molecular weight of polymer by number average and weight average methods. (P.I.-1.2.2)* 4. *Apply the knowledge of high-performance polymeric materials for the protection of public. (P.I.-6.1.1)* 5. *Define glass transition temperature and melting temperature of polymers. (P.I.-1.3.1)*	**4-6**	**CO- 1** **CO- 2** **CO- 3** **CO- 4**

	6. *State the factors affecting glass transition temperature and melting temperature of polymers. (P.I.-1.3.1)* 7. *Identify the correct polymer for various applications on the basis of glass transition temperature. (P.I.-2.1.3)* 8. *Identify the types of conducting polymers, for various applications in industry. (P.I.-2.1.3)* 9. *State the concept of Electroluminescent polymer and biodegradable polymers. (P.I.-1.3.1)* 10. *Apply the knowledge of disposal of biodegradable polymers for protection of environment and sustainable development. (P.I.-7.2.1)*		
03.	**Advanced Functional materials** **Learning Objective:** *To familiarize with the composite materials, their properties and applications in various industries and for the protection and safety of society.* **Contents:** Introduction, Constitution- i) Matrix phase ii) Dispersed phase. Classification- (A) Particle - reinforced composites- i) Large – particle reinforced composites ii) Dispersion – strengthened composites. (B) Fiber – reinforced composites- i) Continuous – aligned ii) Discontinuous – aligned (short)- (a) aligned (b) randomly oriented (C) Structural Composites- i) Laminates (ii) Sandwich Panels. Their applications in aeronautical engineering and other industries. ***Learning Outcomes:*** *A learner will be able to* 1. *State the properties of composite materials (P.I.-1.3.1)* 2. *State the functions of matrix and dispersed phase (P.I.-1.3.1)* 3. *Classify the composite materials on the basis of types of reinforced materials used. (P.I.-2.3.1)* 4. *Analyze the structural and mechanical properties of composites for industrial use. (P.I.-2.3.1)* 5. *Analyze the properties of composite materials for the applications in aeronautical engineering. (P.I.-2.3.1).*	**4-6**	**CO- 1** **CO- 2** **CO- 3**
04.	**Carbon Nanomaterials** ***Learning Objective:*** *To use carbon nanomaterials on the basis of their mechanical and electrical properties in various industrial applications and modern devices.* **Contents:** Introduction to carbon nanomaterials, structure, electrical and mechanical properties of graphene, CNTs and Fullerenes. Application of Nanomaterials in various industries. ***Self-Learning Topics:*** *Inorganic nanomaterials like metals, metal oxides etc.* ***Learning Outcomes:***	**3-5**	**CO- 1** **CO- 2**

	A learner will be able to 1. *Define nanomaterials (P.I.-1.3.1)* 2. *Analyze the structures of graphene, CNTs and fullerene for their electrical and mechanical properties. (P.I.-2.3.1)* 3. *Apply the knowledge of carbon nanomaterials in industry. (P.I.-1.3.1)*		
05.	**Batteries** ***Learning Objective:*** *To relate the knowledge of different kinds of batteries and their applications which will aid in the e waste management for the protection of health and environmental safety.* **Contents:** Introduction and Characteristics of batteries. Construction, working and applications of Lithium-ion batteries, Hydrogen oxygen alkaline fuel cells. E-waste Management, Battery e-waste management. ***Self-Learning Topics:*** *Classification of batteries.* ***Learning Outcomes:*** *A learner will be able to* 1. *State the characteristic properties of batteries (1.3.1)* 2. *Write the construction and working of Li-ion and fuel cell batteries. (1.3.1)* 3. *Analyze the uses of batteries in various devices for solving the real-world problems. (2.1.3)* 4. *Identify the impact of disposal of batteries on the environment and society. (6.1.1)* 5. *Apply e-waste management of batteries for sustainable development and environment protection. (7.2.1)*	**4-6**	**CO- 1** **CO- 2** **CO- 3** **CO- 4**
06.	**Spectroscopic Techniques** ***Learning Objective:*** *To differentiate between the various ranges of electromagnetic spectrum used in the different types of spectroscopic techniques like absorption and emission spectroscopy.* **Contents:** Spectroscopy - Principle, atomic and molecular spectroscopy. Beer lambert's law and UV-Visible Spectroscopy, Selection rules. Introduction to florescence and phosphorescence, Jablonski diagram. Material Characterization using different Spectroscopic Techniques. ***Self-Learning Topics:*** *Electromagnetic radiation, characteristics of electromagnetic radiation, electromagnetic spectrum.* ***Learning Outcomes:*** *A learner will be able to* 1. *Analyze the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques. (P.I.-2.1.3)* 2. *Classify spectroscopic techniques on the basis of atomic or molecular level of study. (P.I.-2.1.3)* 3. *Identify various electronic and molecular transitions occurring in photo excited electrons. (P.I.-2.1.3)* 4. *State the fundamental selection rules in spectroscopic technique (P.I.-1.3.1)*	**3-5**	**CO- 1** **CO- 2**

	5. *State the Beer Lambert's law (P.I.-1.2.1)* 6. *Apply Beer Lambert's law to absorption spectroscopy (P.I.-1.2.1)* 7. *State the applications of UV visible spectroscopy. (P.I.-1.3.1)* 8. *To calculate absorbance, concentration and molar extinction coefficient of given compounds using Beer Lambert's law. (P.I.-1.2.2)* 9. *State the phenomena of fluorescence and phosphorescence. (P.I.-1.3.1)* 10. *Analyze the various radiative and non-radiative transitions occurring in a photo excited electron with the help of Jablonsky diagram. (P.I.-2.1.3)* 11. *Analyze the chemical substances using various spectroscopic techniques (P.I.-2.1.3)*		
	Course Conclusion	**01**	
	Total	**30**	

Course Outcomes:

Learners will be able to

1. Apply the concepts of engineering chemistry for solving the engineering problems.
2. Analyze the quality and properties of engineering materials for solving real world problems.
3. Identify the suitable engineering material for the protection of the environment and public health.
4. Apply the knowledge of e- waste management and biodegradable polymers for the sustainable development.

Performance Indicators:

P.I. No.	P.I. Statement
1.2.1	Apply laws of natural science to an engineering problem.
1.2.2	Apply the formulae based on the concepts of engineering chemistry for solving the numericalproblems.
1.3.1	Apply fundamental engineering chemistry concepts to solve engineering problems.
2.1.3	Identify the engineering chemistry concepts to analyze the given problem
2.2.3	Identify the existing processes/ solution methods for solving the problems.
6.1.1	Identify and describe the various roles of materials particularly as pertains to protection of thepublic and public interest at global, regional and local level
7.2.1	Describe management technique for sustainable development

Text books:

1. A textbook of engineering chemistry by S. Dara, 2014 edition, Chand Publication.
2. Engineering Chemistry by Jain and Jain, 17th edition, 2018, Dhanpatrai publications.

Reference Books:

1. Engineering Chemistry by Jain and Jain, 17th edition, 2018, Dhanpatrai publications
2. Elements of 2017 by Y. R. Sharma, Spectroscopy 29th edition, Pragati Prakashan
3. Nano forms of carbon and its Applications by Prof Maheshwar Sharon and Dr. Madhuri Sharon, First edition, 2007, Monad nanotech Pvt Ltd

Other Resources:

1. Online chemistry library for open access text books: https://chem.libretexts.org

IN-SEMESTER ASSESSMENT (35 Marks)

1. Continuous Internal Evaluation (15 Marks)

1. Assignment on live problems: 8 marks
2. Poster making: 4 marks
3. Regularity and active participation: 3 marks

2. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

END SEMESTER EXAMINATION (40 Marks)

End semester will be based on the syllabus coverage upto Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Type	Course Code	Course Name	Credits
AEC	AEC 201	PROFESSIONAL COMMUNICATION & ETHICS-I	02+01

Examination Scheme		
Continuous Assessment	**End Semester Exam(ESE)**	**Total Marks**
50	--	50

Program Outcomes addressed:

1. PO8: Ethics
2. PO9: Individual and teamwork
3. PO10: Communication
4. PO12: Life-long learning

Course Objectives:

1. To demonstrate the fundamental concepts of interpersonal and professional communication.
2. To encourage active listening with focus on content, purpose, ideas and tone.
3. To facilitate fluent speaking skills in social, academic and professional situations.
4. To train in reading strategies for comprehending academic and business correspondence.
5. To promote effective writing skills in business, technology and academic arenas.
6. To inculcate confident personality traits along with grooming and social etiquettes.

Module	Detailed Content	Hrs	CO
00	**Course Introduction** Every learning should lead toward the building of a holistic individual and a good citizen. Communication Skills and Ethics as a subject is the very fundamental requirement of a human being in any social and/or professional ecosystem. The syllabus has been compiled with the strategic idea of helping individual students to enhance, incorporate and implement the four pillars of Communication, Listening, Speaking, Reading and Writing (LSRW Skills), in all walks of life. There is an added emphasis on Ethical behavior and communication which is an integral value that every good human being, who also aims at being an impressive professional, should imbibe. The learner will also gain basic skills in professional writing and public speaking, exude confidence in presenting themselves and their work, with hands on training in real time.	**01**	
01.	**Fundamentals of Communication** ***Learning Objective/s:*** *To aid the learner in understanding the importance of communication in the spoken and written form so that they can express themselves effectively and ethically in any professional or social setting.* *To encourage active listening with focus on content, purpose and ideas which can be shared using ICT tools, ethical use of social media and appropriate professional etiquette as individuals and team members.*	**7-9**	**CO-1** **CO-4** **CO-6**

Contents:

1.1 Introduction to Theory of Communication
- a) Definition
- b) Objectives
- c) The Process of Communication

1.2 Methods of Communication
- i. Verbal (Written & Oral)
- ii. Non-verbal
  - a. Non-verbal cues perceived through the five senses: (Visual, Auditory, Tactile, Olfactory and Gustatory cues)
  - b. Non-verbal cues transmitted using: (Body, Voice, Space, Time and Silence)

1.3 Barriers to Communication
- a) Mechanical/External
- b) Physical/Internal
- c) Semantic & Linguistic
- d) Psychological
- e) Socio-Cultural

1.4 Communication at the Workplace
- a) Corporate Communication - Case Studies
- b) Short Group Presentations on Business Plans
- c) Selecting Effective Communication Channels

1.5 Professional Etiquette
- a) Formal Dress Code
- b) Cubicle Étiquette
- c) Formal Dining Étiquette
- d) Responsibility in Using Social Media
- e) Showing Empathy and Respect
- f) Learning Accountability and Accepting Criticism
- g) Demonstrating Flexibility and Cooperation

Self-Learning Topics: *Visit nearby Government office e.g. Passport/Post/Electricity/Telephone, as such, communicate with them and related information. Evaluate your communication with them & find out the flaws and/or barriers in the communication process that you faced. Document it for further discussion.*

Reading up on various case studies depicting barriers in communication which led to conflicts; finding alternative methods of resolving them

Learning Outcomes :

A learner will be able to

1. *Identify the various channels of communication in a business organization (10.2.1)*
2. *Differentiate between verbal and non-verbal communication. (9.2.3)*
3. *Apply verbal and non-verbal cues to communicate more effectively in a group (9.2.1)*
4. *Identify barriers in communication and overcome them efficiently (8.1.1)*
5. *Implement the correct method of listening, speaking, reading and writing keeping 'You-attitude' in perspective. (8.2.2)*
6. *Deliver a short speech for special occasions or an extempore with appropriate professional tools and social etiquette. (10.2.2, 10.3.2))*
7. *Introduce self with confidence and composure to the class. (9.2.4)*
8. *Differentiate between formal and casual clothing (12.1.1)*
9. *Implement appropriate grooming and ethical way of presenting oneself (12.1.1)*

	10. *Utilise the knowledge of responsible and ethical use of social media (8.1.1)* 11. *Exhibit flexibility and empathy in the professional space (9.2.2)* 12. *Identify conflict situations and attempt to come up with a resolution. (9.2.1)*		
02.	**Verbal Aptitude For Employment**	**2-4**	**CO-2** **CO-3**
	Learning Objective/s: *To facilitate clear comprehension, interpretation, and evaluation of verbal technical and non-technical data.* *To facilitate fluent and precise presentation skills, in social, academic, and professional situations, with correct syntax, lexicon and semantics.*		
	Contents: 2.1 Vocabulary Building a) Meaning of Words in Context b) Synonyms & Antonyms c) Avoiding redundancy d) Word Form Charts e) Prefixes & Suffixes f) Standard Abbreviations 2.2 Grammar a) Identifying Common Errors b) Subject - Verb Agreement c) Articles d) Preposition e) Pronunciation		
	Self-Learning Topics: *Maintain a journal of new vocabulary; add, learn and apply in conversation 3 new words daily.*		
	Learning Outcomes : *A learner will be able to* 1. *Identify the commonly found grammatical errors in the written and spoken format of communication. (10.1.1)* 2. *Apply appropriate words and parts of speech such as prefixes, suffixes, synonyms and antonyms in the written and oral form of communication. (10.2.2)* 3. *Eliminate the use of pleonasms, tautologies and redundancies during communication (10.1.3)* 4. *Employ proper idioms, proverbs and clichés in their written and spoken communication (10.1.3)* 5. *Listen to grammatically correct input, understand and analyse the same (12.3.1)*		
03.	**Developing Basic Language Skills-Lsrw** ***Learning Objective/s:*** *To listen, read, write, summarise and present concrete technical and non-technical data precisely with minimum errors keeping the audience in mind.* *To comprehend the need for ethical concepts such as Plagiarism checks and Copyright in professional writing.* *To generate and deliver a speech and/or presentation using both rational and out of the box thinking.*	**4-6**	**CO-1** **CO-2** **CO-3**

	Contents: 3.1 Listening Skill- Listening to recordings of Formal and Informal communication situations and Activity sheets (Listening Tasks with Recordings and Activity Sheets) 3.2 Speaking Skill- Developing and Delivering Short Speeches, Informative Speeches (that center on people, events, processes, places, or things), Persuasive Speeches (to persuade, motivate or take action) and Special Occasion Speeches- (anchoring, hosting, compering events in institute) a) Pair-work Conversational Activities / Role play b) Introducing Self and/or a Classmate 3.3 Reading Skill – Reading Short and long passages for comprehension. 3.4 Writing Skill- Summarization of non-technical passages, reports. Writing review of Short Stories- *Lamb to the slaughter- by Roald Dahl, The green Leaves* by Grace Ogot, Uncle *podger Hangs a picture* by Jerome K Jerome, R.K. Narayan (Malgudi Days), Ruskin Bond a) Graphic Organizers for Summaries i. Radial Diagrams like Mind Maps ○ Flow Charts ○ Tree Diagrams Cyclic Diagrams ii. Linear Diagrams like Timelines ○ Pyramids ○ Venn Diagrams b) Point-form Summaries c) One-sentence Summaries of Central Idea 3.5 Intellectual Property Rights - a) Paraphrasing b) Understanding Copyrights c) Running a Plagiarism Check on Paraphrased Passages		
	Self-Learning Topics: *Read either autobiography or biography of A.P.J. Kalam, Nelson Mandela, or any such revolutionary thinker and write its summary* ***Learning Outcomes :*** *A learner will be able to* 1. *Listen to team members, peers respectfully, without prejudice to understand ideas and opinions. (9.2.2, 9.2.3, 10.2.1)* 2. *Read and comprehend long/short, technical/non-technical passages. (10.1.1)* 3. *Comprehend and derive appropriate answers to the questions related to each passage. (10.2.1)* 4. *Analyse and derive significant information from a given passage (10.1.1)* 5. *Summarise passages in paragraph format and as graphical organisers (10.1.3)* 6. *Identify the utility and importance of Copyrights (8.2.2, 10.3.1, 12.1.1)* 7. *Generate plagiarism reports by running a plagiarism check (8.2.2, 10.3.2, 12.3.1)*		
04.	**Business Correspondence**	**6-8**	**CO- 4**

Learning Objective/s:

To train in writing strategies for comprehensive academic and business correspondence.

To promote competent writing skills in business, technology and academic areas using effective media.

To find and fill gaps in knowledge required for basic written business correspondence and continued professional growth.

Contents:

4.1. Seven Cs of Business Correspondence

1) Completeness
2) Conciseness
3) Consideration
4) Concreteness
5) Clarity
6) Courtesy
7) Correctness

4.2. Parts of a Formal Letter and Formats

1)Parts/Elements of a Formal Letter

i. Letterheads and/or Sender's Address
ii. Dateline
iii. Reference Number
iv. Inside Address
v. Attention Line (Optional)
vi. Salutation
vii. Subject Line / Caption Line / Reference Line
viii. Body of the Letter
ix. Complimentary Close
x. Signature Block
xi. Identification Marks
xii. Enclosures/Attachments
xiii. Carbon Copy Notation (courtesy copy)
xiv. Postscript

2)Complete/ Full Block Format

4.3. Emails

1)Format of Emails
2)Features of Effective Emails
3)Language and style of emails

4.4. Types of Letters in Both Formal Letter Format and Emails -

1)Enquiry letter (internship, placement, workshop)
2)Request/Permission Letters
(Leave letter, apology letter, seeking permission for facilities)

Self-Learning Topics:

Collect Official letters and evaluate them for language, tone, format and content.

Learning Outcomes :

A learner will be able to

1. *Apply the 7 C's of Business correspondence? Why is 'You attitude' important in business communication? (8.1.1, 8.2.2)*
2. *Write a Sales/Complaint/Adjustment/Request letter using the correct format. (10.3.2)*
3. *Generate a job application letter? State: How does it promote your growth? (12.1.1)*

05.	**Basic Technical Writing**	**4-6**	**CO- 5**
	Learning Objective/s:		
	To promote effective technical writing skills in business, technology and academic arenas. *To create easy to understand technical documents with logical flow of ideas keeping the end user in mind.* *To identify gaps in research papers and attempt to source information for the same.*		
	Contents:		
	5.1. Introduction 1)What is Technical Writing? 2)Importance and Principles of Technical Writing 3)Difference between Technical Writing & Literary Writing 4)Framing Definitions 5.2. Writing User Instructions 1)User Instructions 2)Hazard Notations /Special Instructions- (Note, Precaution Warning, Caution and Danger) 5.3 Basics of Research Methodology Importance of Research, Types of research, How to select topic? 1) Structure of a Technical Research Paper 2) Referencing styles (APA, IEEE)		
	Self-Learning Topics:		
	Collect User Manuals and study them for language and tone of instructions, hazard notations, and order of instructions.		
	Learning Outcomes : *A learner will be able to* 1. *Delineate the difference between technical writing, academic writing and literary writing. (10.1.1)* 2. *Frame clear definitions (10.1.3)* 3. *Write and present a clear set of instructions for the end user for a particular task (10.1.3, 10.2.2)* 4. *Critically choose a research topic and write a research paper (12.3.1)*		
06.	**Activities for Practical:**		
	1. Listening skill - Listening to audio and video content of various types like Monologues, dialogues, formal talk and discussion about the same.	**4**	**CO-1** **CO-2**
	2. Self-Introduction and introducing others - Learning formal self-introduction and introducing colleagues through practice activity.	**2**	**CO-3** **CO-4**
	3. Group Discussion on various relevant topics - Minimum three rounds to be conducted for facilitating enough practice.	**6**	**CO-5** **CO-6**
	4. Debates on several relevant issues- Two rounds to be conducted.	**4**	
	5. Selection of Ethical Case Study, Analysis, discussion and report documentation.	**2**	
	6. Reading of short stories, writing summaries and learning to critically evaluate the stories – Students will be given selected list of short stories and guided for writing summaries after critical evaluation of the same.	**2**	
	7. Selecting a socio-psychological or socio-technical or socio economic problem, creating a short paper in the relevant format – Detailed discussion about format for	**2**	

	technical paper will be held. Students will create a short paper as per the above areas using the template. *8. Team activity: Poster Presentation on a specific theme based on Awareness creation – Students will work as a team of four members to create the poster as per the given guidelines and the presentation session will be conducted with open evaluation.* *9. Assignment on business Correspondence – Practice for drafting various business letters.* *10. Assignment on writing accurate technical instructions for the users.*	**4** **2** **2**	
	Course Conclusion	**01**	
	Total	**60**	

Course Outcomes: The Lerner will be able to

1. Evaluate information they listen to and express their ideas ethically and with greater clarity.
2. Present convincingly before an audience using accurate and appropriate lexis and enhanced digital content
3. Read and analyze objectively, summarize graphically and paraphrase effectively.
4. Communicate effectively and ethically along the various channels of communication within a business organization and follow the general code of conduct and professional etiquette of the organization.
5. Write a set of effective and easy to understand academic articles and technical instructions and convey the same using global information technology and Netiquette.
6. Conduct ably and ethically within the social circles with empathy and confidence, thus exhibiting a well-groomed and balanced personality.

Performance Indicators:

P.I. No.	**P.I. Statement**
8.1.1	Identify situations of unethical professional conduct and propose ethical alternatives
8.2.2	Examine and apply moral & ethical principles to known case studies
9.2.1	Demonstrate effective communication, problem-solving, conflict resolution and leadership skills
9.2.2	Treat other team members respectfully
9.2.3	Listen to other members
9.2.4	Maintain composure in difficult situations
10.1.1	Read, understand and interpret technical and non-technical information
10.1.3	Create flow in a document or presentation - a logical progression of ideas so that the main point is clear
10.2.1	Listen to and comprehend information, instructions, and viewpoints of others

10.2.2	Deliver effective oral presentations to technical and non-technical audiences
10.3.2	Use a variety of media effectively to convey a message in a document or a presentation
12.1.1	Describe the rationale for the requirement for continuing professional development
12.3.1	Source and comprehend technical literature and other credible sources of information

Text Books:

1. Sanjay Kumar & Pushp Lata (2018). Communication Skills, New Delhi: Oxford University Press
2. Rizvi, A. M. (2010). Effective Technical Communication: A guide for Scientists and Engineers.
3. Dahl, R. (1953), "Lamb to the Slaughter". *Harper's Magazine*. Harpers.
4. *"The Green Leaves", Land without Thunder, Short Story* by Grace Ogot, East African Publishing House, Kenya, 1068
5. Sanjay Kumar & Pushp Lata (2018). Communication Skills, New Delhi: Oxford University Press

Reference Books:

1. Soft Skills, Dr. k. Alex, S. Chand Publication, 2009
2. English Grammar and Composition, S.C. Gupta, Arihant Publication, 2014
3. Oxford handbook of Commercial Correspondence, A. Ashley, Raman, M., & Sharma, S. (2016). Technical Communication: Principles and practice. New Delhi: Oxford University Press
4. Lewis, N. (2014). Word power made easy. Random House USA.

CONTINUOUS INTERNAL EVALUATION (50 Marks)

1. Speaking Listening
   GD/Debating Skills + group dynamics (10)
2. Ethical Case Study a project (10)
   (Continuous work as individual with set due date)
3. Critical Analysis of a SS or novella + report (Individual) (10)
   OR
   Short Technical Paper on any socio Technical problem, Presentation 7 minutes. (Individual) (10)
4. Poster Presentation on a given theme teams of 4
   Students can choose any 2 out of 3 (10 marks each)
5. Assignments until End Semester syllabus (05)
6. Regularity and active participation (05)

Course Type	Course Code	Course Name	Credits
ESC	ESC203	BASIC ELECTRONICS ENGINEERING	02

Examination Scheme					
Distribution of Marks			Exam Duration (Hrs.)		Total Marks
In-semester Assessment		End Semester Exam (ESE)			
Continuous Assessment	Mid-Semester Exam (MSE)		MSE	ESE	
15	20	40	1	1.5	75

Pre-requisite:

1. ESC102- Basics of Electrical Engineering
2. BSC102- Engineering Physics-I

Program Outcomes addressed:

1. PO1: Engineering knowledge
2. PO2: Problem analysis
3. PO3: Design/ Development of Solutions
4. PO12: Life-long learning

Course Objectives:

1. To impart the knowledge to demonstrate competence in comprehending the concepts ofsemiconductor diodes and solve the problems to analyse its applications.
2. To demonstrate the ability to execute a solution process and analyse results to design real lifeapplications such as an amplifier, switch, etc.
3. To introduce number system and use logic gates to analyse and design circuits for a givenexpression.
4. To recognize the utilisation of measuring devices and its working.
5. To introduce various transducers and sensors to adapt to the current technologies regarding newdevelopments in the relevant fields.

Module	Detailed Content	Hrs	CO
00.	**Course Introduction** Electronics is a branch of engineering that has grown exponentially in recent years, and now electronics has become a very important part of our lives. This is foundation course deals with fundamental concepts of semiconductors devices, transistors, number system, logic gates, measuring instruments, transducers and sensors. With the growing popularity and production of electric vehicles (EVs) in India, it is projected that semiconductor use in fields including safety, electrification, communication, and networking would rise.	**01**	
01.	**Introduction to Basic Electronic system** ***Learning Objective/s:***	**5-7**	**CO-1**

	1. *To demonstrate competence in engineering fundamentals and specialized engineering knowledge to comprehend the concepts of semiconductor diodes.* 2. *To identify the engineering systems, variables, and parameters to solve the problems for analyzing the applications of semiconductor diodes.*		
	Contents: Semiconductor Diode - Ideal versus Practical, Characteristics and Parameters, Diode Approximations, Diode Equivalent Circuits, Load Line Analysis; Diode as a Switch, Diode as a Rectifier, Half Wave and Full Wave Rectifiers with and without Filters; Diode as clipper and clampers; Zener diode- Operation and Applications; Opto-Electronic Devices – LEDs, Photo Diode and Applications.		
	Self-Learning Topics: *LASER diode* ***Learning Outcomes :*** *A learner will be able to* 1. *Apply fundamental engineering concepts to comprehend the characteristics and parameters of semiconductor diodes. (P.I.-1.3.1)* 2. *Apply concepts of electronics and communication engineering and allied disciplines to comprehend diode equivalent circuit and its load line analysis. (P.I.-1.4.1)* 3. *Identify engineering systems to analyze the applications of diode such as switch, rectifier, clipper, clampers etc. (P.I.-2.1.2)* 4. *Identify existing methods for analyzing voltage, currents of zener diode and opto –electronic devices. (P.I.-2.2.3)*		
02.	**Introduction to Transistor** ***Learning Objective/s:*** 1. *To demonstrate competence in engineering fundamentals and specialized engineering knowledge to comprehend the concepts of bipolar junction transistor.* 2. *To identify the engineering systems, variables, and parameters for analyzing the applications of bipolar junction transistor as an amplifier and also as a switch.*	**6-8**	**CO- 2**
	Contents: Bipolar Junction Transistor (BJT) – Construction, Operation, Amplifying Action, Common Base, Common Emitter and Common Collector Configurations, Operating Point, Potential Divider Bias circuit; DC load line analysis, Q point, comparison of characteristics of transistors in different configurations, Applications: Transistor as an amplifier, transistor as a switch.		

	Self-Learning Topics: *Self-biasing.* ***Learning Outcomes:*** *A learner will be able to* 1. *Apply fundamental engineering concepts to comprehend the concept of biasing with potential divider bias circuit. (P.I.-1.3.1)* 2. *Apply concepts of electronics and communication engineering and allied disciplines to comprehend the types and characteristics of bipolar junction transistor. (P.I.-1.4.1)* 3. *Identify engineering systems to find gain, operating point of bipolar junction transistor etc. (P.I.-2.1.2)* 4. *Identify solution methods to use bipolar junction transistor as an amplifier and switch. (P.I.-2.2.3)*		
03.	**Introduction to Number system and Logic gates** ***Learning Objective/s:*** 1. *To analyze the number systems, different types of numbers and Boolean algebra.* 2. *To Demonstrate the ability to generate alternative design solutions using logic gates.*	**5-7**	**CO- 3**
	Contents: Number System: Binary Numbers systems, Decimal to Binary and Binary to Decimal Conversion, BCD, Octal and Hexadecimal numbers, Negative numbers representation, 1's, 2's, Complements, BCD codes, Excess-3 code, Gray code. Boolean Algebra, Basic Theorems and properties of Boolean Algebra, Logic gates: Truth Tables and Functionality of Logic Gates – NOT, OR, AND, NOR, NAND, XOR and XNOR Integrated Circuits (ICs).		
	Self-Learning Topics:*Flip- flops* ***Learning Outcomes:*** *A learner will be able to* 1. *Integrate mathematical tools to perform conversion in number system. (P.I.-2.2.2)* 2. *Compare alternative solutions to select the best methodology to implement logic gates. (P.I.-2.2.4)* 3. *Determine design objectives to implement electronic circuits using logic gates. (P.I.-3.1.6)* 4. *Apply formal design principles to build simplified circuits using universal gates. (P.I.-3.3.3)*		
04.	**Electronic Instruments** ***Learning Objective/s:*** 1. *To comprehend the working of CRO, DSO, function generators, power supply and access sources to read technical datasheets of instruments.*	**1-3**	**CO- 4**
	Contents:		

	Introduction to Basic instruments: Components of generalized measurement system Concept of accuracy, precision, linearity, sensitivity, resolution, hysteresis, calibration.		
	Learning Outcomes: *A learner will be able to* 1. *Apply concepts of electronics and communication engineering and allied disciplines to comprehend the working principle of CRO and DSO. (P.I.-1.4.1)* 2. *Comprehend technical datasheets of instruments. (P.I.-12.3.1)*		
05.	**Introduction to Transducers** ***Learning Objective/s:*** *To demonstrate competence in engineering fundamentals to introduce the concept transducer for the desired application.*	**2-4**	**CO- 5**
	Contents: Transducers, classification of transducers, selection of transducers, Resistance- temperature detector (RTD), inductive transducers, Linear variable differential transformer (LVDT).		
	Learning Outcomes: *A learner will be able to* 1. *Apply fundamental engineering concepts to comprehend the concept of transducers and its working. (P.I.-1.3.1)* 2. *Apply concepts of electronics and communication engineering to comprehend various types of transducers used in electronics. (P.I.-1.4.1)*		
06.	**Introduction to Sensors** ***Learning Objective/s:*** *To demonstrate competence in engineering fundamentals to comprehend the concepts of sensor as per the application.*	**3-5**	**CO- 5**
	Contents: Definition, Classification & selection of sensors, Proximity sensors: Inductive & Capacitive, Use of proximity sensor as accelerometer and vibration sensor, Flow Sensors: Ultrasonic & Laser, Level Sensors: Ultrasonic & Capacitive.		
	Self-Learning Topics: *Sensors used in IOT.* ***Learning Outcomes:*** *A learner will be able to* 1. *Apply laws of natural science to an engineering problem to understand the concept of sensors. (P.I.-1.2.1)* 2. *Apply concepts of electronics and communication engineering and allied disciplines to comprehend the types of sensors. (P.I.-1.4.1)*		

	Course Conclusion	**01**	
	Total	**30**	

Course Outcomes:

1. Apply the fundamentals of engineering to demonstrate the concepts of semiconductor diodes andanalyse its applications.
2. Apply the fundamentals of engineering to design transistor-based applications such as anamplifier, switch, etc
3. Formulate mathematical models to introduce number system and use logic gates to design circuitsfor a given expression.
4. Recognize the utilisation of measuring devices and its working.
5. Apply the fundamentals of engineering to introduce various transducers and sensors to adapt tothe current technologies regarding new developments in the relevant fields.

Performance Indicators:

P.I. No.	P.I. Statement
1.2.1	Apply laws of natural science to an engineering problem.
1.3.1	Apply fundamental engineering concepts to solve engineering problems.
1.4.1	Apply concepts of electronics and communication engineering and allied disciplines to solveengineering problems.
2.1.2	Identify engineering systems, variables, and parameters to solve the problems.
2.2.2	Identify/ assemble/integrate mathematical tools to information and resources.
2.2.3	Identify existing processes/solution methods for solving the problem, including forming justifiedapproximations and assumptions.
2.2.4	Compare and contrast alternative solutions to select the best methodology.
3.1.6	Determine design objectives, functional requirements and arrive at specifications.
3.3.3	Identify relevant data from the given resources and arrive at an optimal design solution forparticular specifications.
12.3.1	Source and comprehend technical literature and other credible sources of information.

Text Books:

1. Basic Electronics- Devices, Circuits and IT Fundamentals, Prentice Hall, India, 3rd edition, 2019.
2. Electronics A Systems Approach, Neil Storey, 2011, 4th edition, Pearson Education PublishingCompany Pvt Ltd,.
3. Electronic Devices and Circuits, Salivahanan, N Suresh Kumar, 2013, 3rd edition, McGraw HillPublications.
4. Basic Electronics & Linear Circuits, Bhargava N. N., D C Kulshreshtha and S C Gupta, 2013,2nd edition, Tata McGraw Hill.

Reference Books:

1. Electronic Devices and Circuits, David A Bell, 2016, 5th Edition, Oxford.
2. The Art of Electronics 3rd Edition by Horowitz and Hill, 3rd edition, 2015.
3. Digital Logic and Computer Design, M. Morris Mano, 2008 ISBN-978-81-203-0417-8, PHILearning.

4. Electronic Instrumentation and Measurements (3rd Edition) – David A. Bell, 2013, OxfordUniversity Press.
5. Electronic Communication Systems, George Kennedy, 4th Edition, TMH, 2009.

Other Resources:

1. NPTEL Course: Introduction to Basic Electronics By Prof. T.S. Natarajan, Basic Electronics andLab, IIT Madras :-Web link- https://nptel.ac.in/courses/122106025
2. NPTEL Course: Digital Electronic Circuits By Prof. Goutam Saha, NOC:Digital ElectronicCircuits, IIT Kharagpur :-Web link- https://nptel.ac.in/courses/108105132
3. NPTEL Course: Introduction to Microcontrollers & Microprocessors By Prof. Dr. S.P. DasMicrocontrollers and Applications, IIT Kanpur :- Web link- https://nptel.ac.in/courses/107/106/10710608

IN-SEMESTER ASSESSMENT (35 MARKS)

1. Continuous Assessment (15 Marks)

1. Numerical Assignment/s (min 20 problems) – 04 Marks
2. Class test based on above numerical assignment – 04 Marks
3. Open book test/ Open notes test: 04 Marks
4. Regularity and active participation:05 Marks

2. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40% to 50% syllabus.

END SEMESTER EXAMINATION (40 MARKS)

End Semester Examination will be based on syllabus coverage up to the Mid Semester Examination(MSE) carrying 30% weightage, and the syllabus covered from MSE to ESE carrying 70% weightage.

Course Type	Course Code	Course Name	Credits
BSC-LC	BSCLC203	ENGINEERING PHYSICS-II LABORATORY	0.5

Examination Scheme		
Continuous Assessment	**End Semester Exam(ESE)**	**Total Marks**
25	-	25

Program Outcomes addressed:

1. PO1: Engineering Knowledge
2. PO4: Conduct investigations of complex problems
3. PO9: Individual and team work
4. PO10: Communication

Course Objectives:

1. To demonstrate the fundamental concepts of physics and evaluate the process of an experiment/project quantitatively and qualitatively.
2. To improve the knowledge gained in the theory course.
3. To develop the abilities of modelling, measurements, observations and analysing data.
4. To develop the experimental skill in assembling and handling laboratory instruments.

Module	Detailed Contents	Hrs	CO
00.	**Course Introduction** Introduction to various instruments and components used in physics lab; Rules and regulations to be followed; The fundamental concepts for all experiments, Explanation for performing the experiments.	**01**	
01.	***Learning Objective/s:*** • *To apply the concept of miller indices to identify principal crystal planes.* • *To determine the interplanar distance in simple cubic structure..*	**02**	**CO- 1**
	Experiment 1: Miller Indices: Study of miller indices for planes in simple cubic structure.		
	Learning Outcomes: *A learner will be able to* *1. apply the hall effect phenomena for execution of experiment. (P.I.- 1.2.1)* *2. write the required theory and procedure for the experiment. (P.I.- 4.3.1)* *3. draw the principal planes of simple cubic structure. (P.I.- 4.3.3)* *4. identify the principal planes of simple cubic structure from the given models. (P.I.- 1.2.1)* *5. determine the miller indices for the same and interplanar distance and write the result. (P.I.- 1.2.2, P.I.- 4.3.3)*		

02.	***Learning Objective/s:*** *To simulate XRD pattern for a given crystal system* **Experiment 2:** X-ray Diffraction: Simulation of X-ray Diffraction (XRD) pattern of a material. ***Learning Outcomes:*** *A learner will be able to* 1. *apply the knowledge of x-ray diffraction for execution of experiment. (P.I.-1.2.1)* 2. *write the required theory and procedure for the experiment. (P.I.- 4.3.1)* 3. *use the software to simulate XRD pattern for various materials. (P.I.- 4.1.3)* 4. *visualize the crystal structure of the materials and write the result. (P.I.- 1.2.2, P.I.- 4.3.3)*	**02**	**CO- 1**
03.	***Learning Objective/s:*** • *To apply the knowledge magnetic materials in order to study the phenomena of magnetic hysteresis.* • *To gain the knowledge of importance of hysteresis loop.* **Experiment 3:** Magnetization: Drawing hysteresis curve (B-H curve) of a magnetic material. ***Learning Outcomes:*** *A learner will be able to* 1. *apply basic concepts of magnetization for execution of experiment. (P.I.- 1.2.1)* 2. *write the required theory and procedure for the experiment. (P.I.- 4.3.1)* 3. *familiarize the apparatus included in hysteresis curve set up. (P.I.- 4.3.1)* 4. *draw the circuit diagram and connect the components accordingly. (P.I.- 4.2.1)* 5. *assemble the set up for Hysteresis loop experiment. (P.I.- 4.2.1)* 6. *draw the B-H curve of a ferromagnetic material. (P.I.- 4.3.3)* 7. *determine the loss of energy per unit volume to magnetize the material and write the result. (P.I.- 1.2.2, 4.3.3)*	**02**	**CO- 1**
04.	***Learning Objective/s:*** • *To apply the knowledge of dielectric materials.* • *To determine the dielectric constant of a given material.* **Experiment 4:** Dielectrics: Determination of dielectric constant of a given material.	**02**	**CO- 1**

	Learning Outcomes: *A learner will be able to* 1. *apply the knowledge of dielectrics for execution of experiment. (P.I.- 1.2.1)* 2. *write the required theory and procedure for the experiment. (P.I.- 4.3.1)* 3. *draw the circuit diagram and connect the components accordingly. (P.I.- 4.2.1)* 4. *assemble the set up for the experiment. (P.I.- 4.2.1)* 5. *determine the dielectric constant of the given material and write the result. (P.I.- 1.2.2, 4.3.3)*		
05.	***Learning Objective/s:*** *To simulate and visualize nanostructures.* **Experiment 5:** Nanomaterials: Simulation experiment for structure of nanomaterials. ***Type your self-learning topics here*** *Learning Outcomes:* *A learner will be able to* 1. *apply the knowledge of nanomaterials for execution of experiment. (P.I.- 1.2.1)* 2. *write the required theory and procedure for the experiment. (P.I.- 4.3.1)* 3. *use the software to simulate the structure of a nanomaterial using (P.I.- 4.1.3)* 4. *visualize the structure of the nanomaterials and write the result. (P.I.- 1.2.2, 4.3.3)*	**02**	**CO- 1**
06.	***Learning Objective/s:*** • *To apply various concepts of physics in a project.* • *To execute the chosen project through practical demonstration.* **Project:** Report writing and Demonstration of the project. ***Type your self-learning topics here*** *Learning Outcomes:* *A learner will be able to* 1. *use the concepts and principles of physical science for execution of project. (P.I.- 1.2.1, 1.2.2)* 2. *collect and assemble the components as per the requirement. (P.I.- 4.2.1)* 3. *design and develop the set up as well as the procedure for execution of the project (P.I.- 4.2.1)* 4. *execute the project with the help of proper demonstration. (P.I.- 4.3.1)* 5. *communicate and present effectively project related activities. (P.I.- 10.2.2)* 6. *work as an individual and as a team in development of the project in a chosen area. (P.I.- 9.3.1)* 7. *identify, discuss and justify the results found in a systematic approach. (P.I.- 9.1.2)* 8. *conclude the results and submit final report work as an individual and in a team for successful completion of the project. (P.I.- 10.1.2)*	**03**	**CO- 1** **CO- 2** **CO- 3**
	Course Conclusion	**01**	
	Total	**15**	

Course Outcomes:

Learners will be able to

1. Apply the fundamental knowledge of different materials to determine various parameters throughrelevant experiments/simulations.
2. Use fundamental knowledge of physics for the effective preparation and execution of the chosenproject to draw the result and conclusion as a team.
3. Apply the knowledge gained from the project to present the project work, write effective reports,and communicate effectively.

Performance Indicators:

P.I. No.	P.I. Statement
1.2.1	Apply laws of natural science to an engineering problem.
1.2.2	Apply the formulae derived from the concept to solve engineering problem.
4.1.3	Apply appropriate instrumentation and/or software tools to make measurements of physicalquantities.
4.2.1	Design and develop experimental approach, specify appropriate equipment and procedures.
4.3.1	Use appropriate procedures, tools and techniques to conduct experiments and collect data.
4.3.3	Represent data (in tabular and/or graphical forms) so as to facilitate analysis and explanation of the data, and drawing of conclusions.
9.1.2.	Implement the norms of practice (e.g. rules, roles, charters, agendas, etc.) of effective teamwork,to accomplish a goal.
9.3.1	Present results as a team, with smooth integration of contributions from all individual efforts.
10.1.1	Produce clear, well-constructed, and well- supported written engineering documents.
10.2.2	Deliver effective oral presentations to technical and non- technical audiences.

Text Books:

1. A Textbook of Engineering physics, Dr. M. N. Avadhanulu and Dr. P. G. Kshirsagar RevisedEdition, 2014, S. Chand Publishing.
2. Engineering physics, R. K. Gaur and S. L. Gupta, Revised Edition, 2012, Dhanpat RaiPublications.

Reference Books:

1. Fundamentals of Physics, Halliday /Resnick/Walker, Twelve Edition, 2021, Wiley
2. Introduction to solid state physics, Charles Kittel, Eighth Edition, 2005, Wiley
3. Introduction to nanotechnology, Charles P Poole and Frank J Owens, 1st Edition, Wiley-Interscience.

Other Resources:

1. Online physics library, California State University:-Web link- https://phys.libretexts.org/
2. Physics website, The State University of New Jersey :-Web link- www.physics.rutgers.edu

CONTINUOUS INTERNAL EVALUATION (25 Marks)

1. Lab Performance: 10 Marks
2. Project (Final Report and Demonstration): 10 marks
3. Regularity and active participation: 5 marks

Course Type	Course Code	Course Name	Credits
BSC-LC	BSCLC204	ENGINEERING CHEMISTRY II LABORATORY	0.5

Examination Scheme		
Continuous Assessment	**End Semester Exam (ESE)**	**Total Marks**
25	-	25

Program Outcomes addressed:

1. PO1: Engineering Knowledge:
2. PO2: Problem Analysis:
3. PO6: The engineer and society
4. PO9: Individual and teamwork

Course Objectives:

1. To enable the students to apply the laws of chemistry to an engineering problem.
2. To acquaint the students with practical knowledge of the basic concepts of chemistry to gainexperimental skill.
3. To enable the students to utilize the fundamental laboratory techniques for analysis.

Module	Detailed Contents	Hrs	CO
00	**Course Introduction** 1. Code of conduct in chemistry laboratory 2. Safety and precautions to be observed in chemistry laboratory 3. Orientation on evaluation of laboratory performance	**01**	
01.	***Learning Objective/s:*** *To calculate percentage of iron in plain carbon steel and relate it with the classification of plain carbon steel.*	**02**	**CO- 2**
	Experiment 1 : To determine the percentage of iron present in a plain carbon steel		
	Learning Outcomes :		
	A learner will be able to *1. Use the basics of titrimetric experiments. (P.I.-1.2.1)* *2. Use of redox titration method. (P.I.-1.3.1)* *3. Calculate the amount and composition of iron present in a given sample of steel. (P.I.-2.2.3)*		

02.	***Learning Objective/s:*** *To apply the knowledge of condensation polymerization for the synthesis of urea formaldehyde.*	**02**	**CO- 3**
	Experiment 2: Synthesis of Urea formaldehyde.		
	Learning Outcomes: *A learner will be able to* 1. *Apply the condensation polymerization reaction for the synthesis of thermosetting resin (P.I.-1.2.1)* 2. *Use of catalyst in the polymerization process. (P.I.-1.3.1)* 3. *Calculate the yield of synthesized polymers. (P.I.-2.2.3)* 4. *Use of urea formaldehyde in everyday life (P.I.-6.1.1)*		
03.	***Learning Objective/s:*** *To compare the viscosity of pure solvent and the solution of polymer for calculating the molecular weight of polymer.*	**02**	**CO- 2**
	Experiment 3 : To Determine molecular weight of a polymer using Ostwald's viscometer.		
	Learning Outcomes: 1. *A learner will be able to* 2. *Use the concept of viscosity coefficient. (1.2.1)* 3. *Use Ostwald Viscometer. (1.3.1)* 4. *Calculate the viscosity of pure solvent and polymer (2.2.3)* 5. *Calculate specific viscosity and molecular weight of polymer (2.2.3)*		
04.	***Learning Objective/s:*** *To construct the Daniel cell and calculate its E^0 using Nernst equation.*	**02**	**CO- 1**
	Experiment 4 : To determine the emf of galvanic cell-Daniel cell.		
	A learner will be able to 1. *Use of salt bridge and electrodes for the construction of Daniel cell (1.2.1)* 2. *Represent Daniel cell with electrode reactions. (1.3.1)* 3. *Calculate E^0 of Daniel cell (2.2.3)* 4. *Compare theoretical voltage and measured voltage of cell. (2.2.3)* 5. *Conclude whether Daniel cell is working or not. (1.3.1)*		
05.	***Learning Objective/s:*** *To determine the concentration of iron and verify Beer Lambert's law.*	**02**	**CO- 1** **CO- 2**
	Experiment 5 : To determine iron from the given sample using UV-Visiblespectrophotometer.		

	A learner will be able to 1. *Use UV-Visible spectrophotometer(P.I.-1.2.1)* 2. *Distinguish single beam spectrophotometer and double beamspectrophotometer (P.I.-1.2.1)* 3. *State and explain Beer Lambert's Law (P.I.-1.3.1)* 4. *Determine the λmax and measure absorbance of standard and unknownconcentrations of given analyte. (P.I.-2.2.3)* 5. *Plot a calibration curve of concentration Vs absorbance (P.I.-2.2.3)* 6. *Verify Beer Lambert's law (P.I.-1.3.1)* 7. *Calculate the concentrations of given samples (P.I.-1.3.1)*		
06.	***Learning Objective:*** *To develop the basic knowledge of analytical chemistry using titrimetric experiment.* **Demonstration:** Demonstration of titrimetric experiment and conclusion. ***Learning Outcomes: -*** The learner will be able to 1. *Apply fundamental laws of engineering chemistry (1.2.1)* 2. *Apply the basic concepts of engineering chemistry. (1.3.1)* 3. *Analyze the proposed substances* in an *experiment in the laboratory. (2.1.3)* 4. *Calculate the results of the proposed experiments (1.2.2)* 5. *Demonstrate the ability to work as a team. (9.1.1)* 6. *Present the results as a team (9.3.1)*	**04**	**CO-4**
	Total	**15**	

Course Outcomes:

Learner will be able to

1. Apply the laws of electrochemistry and spectroscopy for performing the practicals.
2. Analyze the materials for engineering applications.
3. Synthesize the polymer and use it for societal benefits.
4. Demonstrate an ability to work effectively in a team for the project

Performance Indicators:

P.I. No.	**P.I. Statement**
1.2.1	Apply laws of natural science to an engineering Problem.
1.2.2	Apply the formula based on the concepts of engineering chemistry for solving the numerical problems.
1.3.1	Apply fundamental engineering concepts to solve engineering problems
2.1.3	Identify the engineering chemistry knowledge to analyse a given problem.

2.2.3 Identify the existing processes/ solution methods for solving the problems.

6.1.1 Identify and describe the various roles of materials particularly as pertains to protection of the public and public interest at global, regional and local level.

9.1.1 Recognize a variety of working and learning preferences; appreciate the value of diversity on a team.

9.3.1 Present result as a team with smooth integration of contributions from all individual efforts

Text Books:

1. Practical book in Engineering Chemistry by Dr. Pijus Khatua and Debashree Singh, First edition, 2016, Platinum Publishers
2. Textbook of green chemistry by AK Ahluwalia, 2008, Ane Book India

Reference Books:

1. Experiments in Engineering Chemistry by Payal Joshi, first edition, 2016, I.K. International Publishing House Pvt. Ltd.

Other Resources:

1. Online chemistry library for open access text books: https://chem.libretexts.org
2. https://vlab.amrita.edu/?sub=2&brch=190&sim=1546&cnt=1

CONTINUOUS INTERNAL EVALUATION (25 Marks)

1. Lab Performance: 10 Marks
2. Demonstration of the experiment: 10 marks
3. Regularity and active participation: 5 marks

Course Type	Course Code	Course Name	Credits
ESC-LC	ESCLC204	ENGINEERING GRAPHICS LABORATORY	02

Examination Scheme		
Continuous Assessment	**End Semester Exam (ESE)**	**Total Marks**
50	50	100

Program Outcomes addressed:

1. PO1: Engineering knowledge
2. PO2: Problem Analysis
3. PO5: Modern tool usage
4. PO10: Communication

Course Objectives:

1. To inculcate proper understanding of the theory of projection.
2. To enable students to understand and represent three-dimensional objects on a two-dimensional surface in a way that accurately conveys their shape, size, and orientation.
3. To acquaint students with representing internal features of a three-dimensional object by way of section that accurately conveys their internal orientation.
4. To communicate proper ideas by representing the two-dimensional views into a three dimensional object.
5. To enable students to read and interpret a given orthographic projection to draw the missing view.

Module	Detailed Contents	Hrs	CO
00.	**Course Introduction** This is foundation course which deals with fundamental concepts of technical drawing and modern tools associated with it. This course will empower the imagination and visualization which will help in communicating the technicality of the product.	**01**	
01.	***Learning Objective/s:*** *To identify different types of lines and dimensioning standards as per IS system.*	**08**	**CO- 1**
	Content: **Introduction to Engineering Graphics:** Principles of Engineering Graphics and their significance, Types of Lines, Dimensioning Systems as per IS conventions Introduction to CAD tool (AutoCAD): An overview of AutoCAD software to make simple drawings.		

	Experiment: To demonstrate the basic commands in AutoCAD software. ***Learning Outcomes:*** *A learner will be able to* 1. *represent the fundamental drawing essentials such as line types, line weights, dimensioning systems, tolerance, etc. (P.I.-2.2.3)* 2. *identify standard procedures according to IS conventions. (P.I.-2.2.2)* 3. *demonstrate the use of basic AutoCAD commands. (P.I.-5.1.1)* 4. *draw simple drawings with the use of basic AutoCAD commands.(P.I.-5.2.2)*		
02.	***Learning Objective/s:*** *To develop the imagination in creating the orthogonal and sectional orthographic views for communicating the features in the product.* **Content:** 2.1 Projection of Points and Lines: Projection of points in different quadrants. Projection of lines keeping the ends in different quadrants. 2.2 Orthographic Projections: Concept of First Angle and Third Angle Projection. Fundamentals of Orthographic Projections. Different views of a simple machine part as per the first angle projection method recommended by I.S. Multi view drawing from pictorial views using CAD Software (AutoCAD) 2.3 Sectional Orthographic Projections: Full or Half Sectional views of the Simple Machine parts. Sectional view using CAD Software (AutoCAD). **Experiment:** To demonstrate the ability to convert the isometric drawings into orthogonal and sectional orthographic drawings. ***Learning Outcomes:*** *A learner will be able to* 1. *differentiate between the apparent length and true length of the lines by projecting the lines in a two-dimensional space from different quadrants and represent the procedure in the form of drawing or report. (P.I.-1.3.1,10.3.1)* 2. *develop the ability to create orthographic projections of objects in different views, including front, top, and side views. (P.I.-1.4.1,10.1.1)* 3. *create sectional orthographic projections of objects including half and full sections. (P.I.-2.1.3, 10.1.1)* 4. *demonstrate the application of orthographic and sectional orthographic projections in different fields, including engineering, architecture, and manufacturing by representing them in a report. (P.I.-2.2.3,10.3.1)* 5. *demonstrate the use of basic AutoCAD commands. (P.I.- 5.1.1)* 6. *apply the basics of AutoCAD to create the simple orthographic drawings(P.I.-5.2.2,10.3.1)*	**20**	**CO- 2**
03	***Learning Objective/s:*** *To develop the ability in visualization of the two-dimensional views of the object to produce the isometric drawing.*	**12**	**CO- 3**

	Content: Isometric Drawing: Principles of Isometric Projection, Isometric Views, Conversion of Orthographic Views to Isometric Views. (Excluding Sphere). Construction of Isometric View from Orthographic views with CAD Software (Auto CAD) **Experiment:** To demonstrate the ability to convert the orthographic views into isometric drawings.		
	Learning Outcomes: *A learner will be able to* 1. *identify the nature of simple geometries when plotted on isometric plane (P.I.-1.3.1)* 2. *apply the fundamental geometrical procedures from mathematics to draw the given isometric views. (P.I.-1.2.1)* 3. *develop their ability to visualize three-dimensional objects and represent them on a two-dimensional surface. (P.I.-2.1.3,10.3.1)* 4. *draw the isometric drawings from the two-dimensional views. (P.I.-2.2.3)* 5. *create isometric drawings of objects in AutoCAD. (P.I.-5.1.1,10.1.1)* 6. *develop proficiency in the orientation and scale of the object while drawing the AutoCAD (P.I.-5.2.2,10.1.1)*		
04.	***Learning Objective/s:*** *To develop the ability of the students to read the orthographic and sectional orthographic projections to draw the missing views.*	**05**	**CO-5**
	Content: Orthographic Reading: The identification of missing views from the given views. Creation of the third view from the two available views so that all the details of the object are obtained using CAD Software (AutoCAD). **Experiment:** To demonstrate the ability to visualize and interpret the missing views of Orthographic projections.		
	Learning Outcomes: *A learner will be able to* 1. *Read and interpret technical drawings that use orthographic and sectional orthographic projections. (P.I.-,2.2.3,10.1.1)* 2. *identify the missing view by visualizing the two views in combined manner. (P.I.-1.3.1)* 3. *redraw the simple orthographic view into sectional orthographic view (P.I.-1.2.1)* 4. *identify the position and orientation of the missing view.(P.I.-2.2.1)*		

	5. *Demonstrate the use of basic AutoCAD commands to produce the missing view by reading the orthographic projections on a tw-dimensional space. (P.I.-5.1.1,10.3.1)* 6. *use the theory of projection efficiently to create the missing view in AutoCAD (P.I.-5.2.2)*		
05.	***Learning Objective/s:*** *To develop the ability to imagine the solid geometries and represent the views in a two dimensional space.*	**14**	**CO-4**
	Content: 5.1 Projection of Planes: Projection of Triangular, Square, Rectangular, Pentagonal, Hexagonal or Circular planes inclined to either HP or VP only. 5.2 Projection of Solids: Solid projection (of Prism, Pyramid, Cylinder, Cone only) with the axis inclined to HP or VP. (Exclude Spheres, Composite, Hollow solids and frustum of solids). Use change of position or Auxiliary plane method. 5.3 Section of Solids: Section of Prism, Pyramid, Cylinder and Cone cut by plane perpendicular to at least one reference plane and incline to otherin simple positions of the solid. (Section in initial position only)		
	Learning Outcomes: *A learner will be able to* 1. *create orthographic projections of planes and different types of solids. (P.I.-1.3.1)* 2. *create different views of solid geometries. (P.I.-1.2.1)* 3. *develop the ability to create auxiliary views, which are used to show the true shape and size of features that are not parallel to the principal planes of projection (P.I.-2.2.4,10.1.1)* 4. *create section views of solids using different cutting planes in different orientations and represent them in the form of two-dimensional drawings. (P.I.-2.2.3,10.3.1)*		
	Total	**60**	
	MINIMUM 2 experiments should be conducted from each module.		

Course Outcomes:

A learner will be able to

1. Apply the basic concepts and standards in accordance with IS conventions.
2. Apply the basic principles of projections in converting pictorial views into orthographic Views.
3. Apply the basic principles of projections in converting orthographic Views into isometric drawing.
4. Represent the internal features of the objects by providing the sectional views of the object.
5. Apply the basic principles of projections to draw the missing views.

Performance Indicators:

P.I. No.	P.I. Statement
1.2.1	Apply laws of natural science to an engineering problem
1.3.1	Apply fundamental engineering concepts to solve engineering problems.
1.4.1	Apply mechanical engineering concepts to solve engineering problems.
2.1.3	Identify the mathematical, engineering and other relevant knowledge that applies to a givenproblem
2.2.2	Identify, assemble and evaluate information and resources.
2.2.3	Identify existing processes/solution methods for solving the problem, including formingjustified approximations and assumptions.
2.2.4	Compare and contrast alternative solution processes to select the best process.
5.1.1	Identify modern engineering tools such as computer aided drafting, modelling and analysis;techniques and resources for engineering activities
5.2.2	Demonstrate proficiency in using discipline specific tools.
10.1.1	Read, understand and interpret technical and non-technical information.
10.3.1	Create engineering-standard figures, reports and drawings to complement writing andpresentations.

Text Books:

1. Engineering Drawing (Plane and solid geometry), N.D. Bhatt, 54th Edition, 2023, CharotarPublishing House Pvt. Ltd.
2. Engineering Drawing, N.H.Dubey, 16th Edition, 2015, Nandu Publications
3. Machine Drawing, N.D. Bhatt & V.M. Panchal, 49th Edition, 2014, Charotar Publishing HousePvt. Ltd.

Reference Books:

1. Engineering Drawing, Narayana, K.L. & P Kannaiah ,3rd Edition, 2012, Scitech Publisher
2. AutoCAD 2024: A Problem-Solving Approach, Basic and Intermediate, , Prof. Sham Tickoo,30th Edition, 2023, CADCIM Technologies

Other Resources:

1. NPTEL Course: Engineering Drawing by Prof. P.S. Robi, Department of Mechanical Engineering, IIT Guwahati:-Web link- https://nptel.ac.in/courses/112103019.
2. NPTEL Course: Engineering Graphics and Design by Prof. S.R.Kale, Department of MechanicalEngineering, IIT Delhi :-Web link- https://onlinecourses.nptel.ac.in/noc21_me128

IN-SEMESTER ASSESSMENT (50 Marks)

1. **AutoCAD Assignments (10 Marks):** AutoCAD assignments will be evaluated as a part of continuous laboratory experiments which will be done in AutoCAD software. The Assignments will be based on the following topics:
    i. Redraw the given views using basic AutoCAD Commands. (2 Problems)
    ii. Orthographic Projections (2 Problems)
    iii. Sectional Orthographic Projections (2 Problems)
    iv. Isometric Projections (3 Problems)
    v. Reading of Orthographic Drawings (1 Problems)

2. **Sketchbook Assignments (10 Marks)*:*** Regular Assignments will be given based on the topic covered in the class and will be evaluated at regular intervals as a part of continuous assessment. The Assignments will be based on the following topics:
    1) Projection of Lines (2 Problems)
    2) Orthographic Projections (2 Problems)
    3) Sectional Orthographic Projections (2 Problems)
    4) Reading of Orthographic Projections (1 Problems)
    5) Isometric Projections (2 Problems)
    6) Projection of Planes (2 Problems)
    7) Projections of Solids (2 Problems)
    8) Section of Solids (2 Problems)

3. **Regularity and active participation: 5 marks**

4. **Class Tests (25 Marks) :**

    1. **AutoCAD (15 Marks):** The test will be based on Orthographic Projections on AutoCAD software.

    Evaluation Criterion:

    1. Completion and accuracy of the drawing.
    2. Presentation of labels, dimensions, title block on the sheet.

    2. **Manual Drawing Exam (10 Marks):** The test will be based on projections of lines and projections of Solids.

    Evaluation Criterion:

    1. Completion and accuracy of the drawing.
    2. Neatness of the drawing.
    3. Proper space management of the sheet.

END SEMESTER EXAMINATION (Practical Exam) (50 Marks)

Topic for the End Semester Practical Examination (Auto CAD) (2.5 hours)

1. **Isometric drawing. (1 problem) (20 Marks) (Excluding the curves on an inclined plane):**

   The two-dimensional views will be provided such as Front view, Top View and Side view of the object. The task will be to convert the given views in to an isometric drawing (three-dimensional model)

2. **Sectional Orthographic Projection (1 problem). (15 Marks):**

   An isometric figure will be given and the task will be to convert the isometric figure in a sectional 2D view which will include the sectional Front view, Top View and Side view of the three-dimensional figure.

3. **Reading of Orthographic Projections (1 problem) (15 Marks):**

   The two views of the model will be given as an AutoCAD file and the task will be to generate the missing view of the drawing.

Note:

1. Printout of the answers have to be taken preferably in A4 size sheets and should be assessed by External Examiner only.

2. Knowledge of Auto CAD software, concepts of Engineering Graphics related to specified problem and accuracy of drawing should be considered during evaluation.

Two examiners, one Internal and one External will do the evaluation

Course Type	Course Code	Course Name	Credits
ESC-LC	ESCLC205	PROGRAMMING LABORATORY-II (JAVA)	02

Examination Scheme		
Continuous Assessment	**End Semester Exam (ESE)**	**Total Marks**
50	50	100

Pre-requisite:

1. ESCLC103: Programming Laboratory-I (C)

Program Outcomes addressed:

1. PO1: Engineering knowledge
2. PO2: Problem analysis
3. PO3: Design/development of solutions
4. PO5: Modern tool usage
5. PO12: Life-long learning

Course Objectives:

1. To impart the knowledge in object-oriented paradigm in the Java programming language.
2. To inculcate the importance of Classes & objects along with constructors,
3. To impart skills of inheritance, interface and packages and demonstrate the concept of reusabilityfor faster development.
4. To introduce usage of Exception Handling, Multithreading, Input Output streams in variousapplications.
5. To impart the knowledge of designing, implementing, testing, and debugging graphical userinterfaces in Java using Swings and AWT components that can react to different user events.

Module	Detailed Contents	Hrs	CO
00.	**Course Introduction** Java is platform independent, open-source object oriented programming language enriched with free and open source libraries. In current industrial scenario Java has the broad industry support and is prerequisite with many allied technologies like Advanced Java, Java Server Pages, and Android Application Development. Thus, current industrial trends necessitate acquiring Java knowledge for graduates.	**01**	
01.	**Introduction to Java** ***Learning Objective:*** *Learner is expected to gain proficiency in concept like programming tokens like variables, data types, operators, control structures, function. Also expected to apply the concepts for writing program*	**11**	**CO-1**
	Contents: OOP concepts: Objects, class, Encapsulation, Abstraction, Inheritance,		

	Polymorphism, message passing. Java development kit, Java Virtual Machine, Garbage collection in java Basic programming constructs: variables, data types operators,expressions, branching and looping. Setup a Java Programming development environment by using: a) Command prompt. (Classpath and path setup) b) Any IDE (Eclipse, Netbeans etc.) **Demonstration** 1. How to Install Java? 2. Setting environment Variables to Run Java Programs. 3. Editing a Java Program and its Compilation and Execution. 4. About main () Method 5. Few Simple Java Programs 6. Writing and running simple Java programs 7. Explain control structures in java **Task 1:** Write simple java program 1. To show basic syntax, variables, and data types 2. Implement basic arithmetic operations using Java. 3. Write a program using if statement (eg. to check if a number is even or odd.) 4. Implement a simple calculator using methods for arithmetic operations. Use switch control to write menu driven program. **Task 2:** Practice method overloading by creating multiplemethods with different parameters. ***Learning Outcomes:*** *A learner will be able to* 1. *Illustrate the concept of keywords, data types, variables, operators, and expressions (PI-1.1.1)* 2. *Apply the fundamental control structures to solve problem (PI-1.3.1)* 3. *Identify mathematical expression or formula to write and execute a program (PI-2.1.3)* 4. *Write java code using keywords, data types, variables, operators, and expressions in notepad, then compile and execute the program. Implement a java program using control structure (PI-2.2.3)* 5. *Use modern JAVA IDE like eclipse, NetBeans (PI-5.1.1).* 6. *Install JDK and adapt JAVA IDE like eclipse and Set path in command prompt for executing java program (PI-5.1.2)*		

02.	**Class and object** ***Learning Objective/s:*** 1. *To investigate the functioning of various components of the given control system as a team.* 2. *To grasp the fundamental concept of input output. Also expected to write program using different input output constructs.*	**08**	**CO- 2**
	Contents: Classes, objects, data members, member functions, Constructors, method overloading. Input and output functions in Java, scanner class **Demonstration** 1. Encapsulation: creating a class. 2. Creating objects in a program. 3. Defining more method in a class. 4. Constructor in a class and its use 5. Demonstration of constructor overloading. 6. Use of this keyword: to avoid name space collision. **Task 3:** Create a simple Java class representing an entity(e.g., Person, Car) with attributes and methods. • Instantiate objects of the class and demonstrate basic operations. **Task 4:** Practice encapsulation by defining privatevariables with public accessors /mutators. **Demonstration** 1. Use of print (), println () and printf (). 2. Command Line Input in Java 3. Take Input using Scanner Class 4. Read Input with DataInputStream **Task 5:** Write a Java program that prints out informationabout any entity (eg. Student, Animal etc.) **Task 6:** Write a Java program that takes input from userwith following ways 1. Command line arguments. 2. Use the Scanner class to prompt the user for the required input Read information with DataInputStream		

	Learning Outcomes: *A learner will be able to* 1. *Use print statement (PI-1.1.1)* 2. *Implement a program by taking input from user (PI-1.3.1)* 3. *Identify classes and objects for problem statement (2.1.1)* 4. *Apply concept of constructors overloading to write java program (2.3.1)* 5. *Explore the concept and write recursive function (3.2.1)* 6. *Write static, non-static and recursive method in java program (3.4.2)*		
03.	**Inheritance, Interfaces, Packages** ***Learning Objective/s:*** 1. *Learner is expected to gain knowledge of code reusability. Also expected to write program using inheritance.* 2. *Learner is expected to grasp the concept of total abstraction and multiple inheritance Also expected to apply interface concept to achieve multiple inheritance.* 3. *Learner is expected to gain the knowledge in concept of grouping related classes, interfaces, and sub-packages. Also expected to apply the concept of packages to write well-structured application.*	**16**	**CO- 3**
	Contents: Types of inheritance, Method overriding, super, Abstract class and abstract method, final, Interface Define package, types of package, naming and creating packages. accessing package. **Demonstration** 1. Simple Inheritance 2. Multilevel Inheritance 3. Use of super Keyword 4. Method Overriding in Inheritance 5. Abstract Class 6. Create a base class (e.g., Shape) with common properties and methods, and derived classes (e.g., Circle, Rectangle) inheriting from it. 7. Method overriding and dynamic method dispatch 8. Override methods in the derived classes to demonstrate dynamic method dispatch. **Task 7:** Write a program using inheritance for given problem statement		

	Demonstration 1. Some properties of Interface 2. Define Interface 3. Interface and single Inheritance 4. Interface and multiple Inheritance **Task 8:** Develop a program with the interface for given problem statement. **Demonstration** 1. Importing a Java Built-in API package. 2. Creating a User's Own Package 3. Package with Default Access Specifier for its Classes 4. Utilization of a Package in a Java Program 5. Inheritance with a Class in a Package 6. Access Protection of Classes in Package **Task 9:** Write a program to import built-in packages **Task 10:** Create user defined package for the given problem. 1. Write a class and interface to the package. ***Learning Outcomes:*** *A learner will be able to* *1. Summarize the concept of polymorphism using inheritance, concept of abstraction using interfaces, and packages in java (PI-2.4.1)* *2. Show polymorphism by inheriting the features of one class to other class (PI-2.4.4)* *3. Explore the single inheritance and multilevel inheritance (PI-3.2.1)* *4. Implement the program using inheritance and interfaces to achieve reusability. Also implement the packages to group classes and interfaces in the package (PI-3.4.2)*		
04.	**Exception Handling and Multi-threading** ***Learning Objective/s:*** *1. To impart skills that can enable students to check and handle the proper functioning of applications. Also expected to apply the exception handling for proper functioning of applications* *2. Learner is expected to know the concept of multithreading. Also expected to apply it for multitasking*	**08**	CO- 4
	Contents: 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 extends and implements keyword. **Demonstration** 1. Exception handling using try, catch, finally, throw and throws, 2. Exception handling Multiple try and catch blocks, 3. Exception handling user defined exception		

	Task 11: Write a program for handling the given exceptionusing try, catch, finally, throw and throws. **Demonstration** 1. Creating Threads using the Thread Class. 2. Creating Threads Implementing the Runnable Interface. 3. Life cycle of thread: Thread Methods: wait(). sleep(), notify(), resume(), suspend(). stop(). **Task 12:** Create threads to run the given multiple processesin the given program. ***Learning Outcomes:*** *A learner will be able to* *1. Illustrate the concept the exception handling and threads in java (PI-1.1.1)* *2. Apply the fundamentals of exception handling to handle error (PI-1.3.1)* *3. Write a program to show exception handling in java (PI-2.1.3)* *4. Create user-defined exception handling (PI-2.2.3)* *5. Explore the multiple task handling with threads (PI-3.2.1).* *6. Implement threads to achieve multi-tasking(PI-3.4.2)*		
05	**Graphical User Interface** ***Learning Objective/s:*** *1. Learner will gain the knowledge of handling events through GUI. Also expected to apply it for creating small applications.* *2. Learner is expected to develop proficiency in the concept of swing. Also expected to apply it for developing GUI with good look and feel* *3. Learner will learn the concept of connecting database with business logic. Also expected to apply it for retrieving and saving data.* **Contents:** Applet and applet life cycle, creating applets, graphics class functions, parameter passing to applet, Font and color class. Event handling using event class GUI design with Swing class in JAVA Introduction to JDBC, JDBC-ODBC connectivity **Demonstration** 1. Java Programming for Applet 2. Structure of an Applet 3. A Simple Java Applet Program 4. An Applet using Methods 5. An HTML File Hosting Applet Programs 6. GUIs with AWT Component Frame, Panel, Button, TextField, TextArea, List, Choice, ChoiceBox, Label, Scrollbar, etc. **Task 13:** Develop a program using applet (Applet tag. Adding Applet to HTM file, passing parameter to applet, embedding <applet> tags in java code, adding controls to applets.) **Task 14:** Develop a program for GUI using appletExample	**16**	**CO-5**

Demonstration:

1. Create a JFrame container
2. Create a JPanel container
3. Create a Swing button
4. Creating JFrame, JButton and method call inside the java constructor
5. Inherit the JFrame class
6. Button with ActionListner
7. Button with image

Task 15: Develop a GUI using layouts and components of swing

Learning Outcomes:

A learner will be able to

1. *List all data and techniques to solve problem (PI-1.1.1)*
2. *Determine different layout manager to develop software (PI-1.4.1)*
3. *Examine layout managers for flexible window layouts while creating GUI (PI-3.1.6)*
4. *Write modules to handle events through components of GUI using applets and Abstract Window Toolkit (AWT) (PI-3.4.2)*
5. *Extend study on eclipse to solve problem (PI-5.1.1)*
6. *Adapt eclipse and HTML to create GUI using applet and AWT (PI-5.1.2)*
7. *Illustrate the path from CLI to GUI (PI-12.2.1)*
8. *Summarize the advantages of GUI of problem (PI-12.2.2)*

	Total	**60**	

Self-Learning Topics

MySQL

1. Installation of MySQL
2. DBMS related Tasks with MySQL
3. Steps to connect to the Database,
4. Connectivity with MySQL using JDBC

Micro-projects

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

1. Mini Banking System for handling deposits and withdrawal.
2. Medical Store Stock Management System.
3. Bus Reservation System.
4. Student Information System
5. Library Management System
6. Attendance Management System.
7. Develop a small animation using applet, graphics and multithreading

Guidelines for developing micro projects:

1. Declare four to five classes and may include Interfaces if required.
2. Must use Most of the Object Oriented Concepts.

3. Must implement concepts of Inheritance and Exception Handling.
4. Must Create Own Package.
5. May use the constructor overloading and overriding.
6. May Use Multithreading if required.

Course Outcomes:
Learner will be able to

1. Install java environment and write a java program using fundamental concepts.
2. Apply concepts of classes, objects, members of a class and the relationships among them needed for a finding the solution to specific problem.
3. Achieve reusability in programming by using concept of Inheritance, Interface and Packages.
4. Implement concept of Multithreading, and exceptions to obtain robust and faster programmed solutions to problems.
5. Design and develop application using Abstract Window Toolkit, Swings with database connectivity

Performance Indicators:

P.I. No.	P.I. Statement
1.1.1	Apply the knowledge of discrete structures, linear algebra, statistics and numericaltechniques to solve problems
1.3.1	Apply fundamental engineering concepts to solve engineering problems.
1.4.1	Apply theory and principles of computer science engineering to solve an engineeringproblem
2.1.1	Identifies processes/modules of a computer based system and parameters to solve a problem
2.1.3	Identifies mathematical algorithmic knowledge that applies to a given problem
2.2.3	Identify existing solution/methods to solve the problem, including forming justifiedapproximations and assumptions.
2.3.1	Able to apply computer engineering principles to formulate modules of a system withrequired applicability and performance
2.4.1	Applies engineering mathematics to implement the solution.
2.4.4	Arrive at conclusions with respect to the objectives.
3.1.6	Ability to develop software requirement specifications
3.2.1	Ability to explore design alternatives.
3.4.2	Ability to implement and integrate the modules.
5.1.1	Identify modern engineering tools, techniques and resources for engineering activities
5.1.2	Create/adapt/modify/extend tools and techniques to solve engineering problems.
12.2.1	Identify historic points of technological advance in engineering that required practitioners toseek education in order to stay current

12.2.2 Recognize the need and be able to clearly explain why it is vitally important to keep currentregarding new developments in your field

Text Books:

1. Java: The Complete Reference, Herbert Schildt, Ninth Edition, 2017, McGraw Hill Education.
2. Programming with Java, E. Balagurusamy, Seventh Edition, 2019, McGraw Hill Education.

Reference Books:

1. Beginning JAVA, Ivor Horton, Seventh Edition, 2011, Wrox.
2. JAVA Programming Black Book, by D.T. Editorial Services, 2015, Dreamtech Press.
3. Java One Step Ahead, Anita Seth, B.L.Juneja, First Edition, 2017, oxford university press.

Other Resources:

1. NPTEL Course: Programming in Java, By Debasis Samanta, Computer Science and Engineering,Indian Institute of Technology Kharagpur.:-
   Web link-https://onlinecourses.nptel.ac.in/noc23_cs74/co
2. Web link-www.w3schools.com
3. Web link-www.tutorialspoint.com
4. Web link-https://starcertification.org/Certifications/Certificate/securejava

IN-SEMESTER ASSESSMENT (TERM WORK) (50 MARKS)

1. Task Execution (30 Marks)

Students will be given minimum 15 experiments.
Students are expected to

1. Identify variables, data types methods/approach required to write the code for the given task and apply the same.
2. Execute given task for different inputs and verify the result
3. Create a simple Java class representing an entity (e.g., Person, Car) with attributes and methods. Instantiate objects of the class and demonstrate basic operations.
4. Apply simple inheritance and multilevel inheritance.
5. Import a Java Built-in API package and also create user's own package
6. Handle the proper functioning of applications by applying the exception handling.
7. Develop proficiency in the concept of swing and apply it for creating small applications (GUI)

Students are evaluated based on following:

1. Logic building for the given task (10 marks)
2. Rectifying logical errors and syntax errors (06 marks)
3. Well-structured and organized program (06 marks)
4. Verification of experiment output for different inputs (08 marks)

Refer the sample task given below.
Example:
Create a Persona class to add details of the person, inherit features of person class into Employee class and display details using method.
Students are expected to.

1. Identify Variables, data types methods/approach required to create teacher class and add methods to display details of a given teacher
2. Execute given task for different inputs and verify the result
3. Follow the coding standards
4. Identify errors and rectify the errors.

Students are evaluated based on following:

1. Logic building for the given task (10 marks)
2. Rectifying logical errors and syntax errors (06 marks)
3. Well-structured and organized program (06 marks)
4. Verification of experiment output for different inputs (08 marks)

2. Regularity and active Participation (05 Marks)

3. Mid Semester Examination (15 Marks)

a) Task Execution: 10 Marks

Students are evaluated based on following:

1. Logic building for the given task (04 marks)
2. Rectifying logical errors and syntax errors (02 marks)
3. Well-structured and organized program (02 marks)
4. Verification of experiment output for different inputs (02 marks)

b) Oral: 05 Marks

END SEMESTER EXAMINATION (Practical & Oral Exam) (50 Marks)

1. Task Execution: 30 Marks
   Students will be given task (different task for every student) to execute and will be evaluated as per the parameters mentioned in continuous evaluation
2. Presentation of Results and conclusion, Inferences drawn: 05 Marks
3. Oral: 15 Marks

Two examiners, one Internal and one External will do the evaluation.

Course Type	Course Code	Course Name	Credits
ESC-LC	ESCLC 206	BASIC ELECTRONICS ENGINEERING LABORATORY	01

Examination Scheme		
Continuous Assessment	**End Semester Exam(ESE)**	**Total Marks**
25	25	50

Pre-requisite:

1. ESC102- Basic Electrical Engineering
2. BSC102- Engineering Physics I

Program Outcomes addressed:

1 PO2: Problem Analysis
2 PO3: Design / Development of Solutions
3 PO4: Conduct investigations of complex problems
4 PO5: Modern tool usage
5 PO6: The engineer and society
6 PO9: Individual and Team work
7 P10: Communication
8 P12: Life-long learning

Course Objectives:

1. To familiarize with electronics components, measuring devices, source devices for building andanalyzing analog as well as digital circuits.
2. To provide practical exposure to sensors and transducers and build a basic data acquisition system
3. To provide hands-on experience in designing real time application circuits.

Module	Detailed Contents	Hrs	CO
00.	**Course Introduction** Electronics is pervasive in the modern era which provides a platform to comprehend the basics of components, ICs devices with some practical application. This provides a roadmap to venture in the field of electronics. The electronic circuits form the integral part for almost all used in industrial machinery, computers, microprocessors, household appliances, medical equipment, internet and e-commerce.	**01**	
01.	***Learning Objective/s:*** *Analyze experimental results to validate theoretical concepts and understand practical implications. Evaluate circuit parameters to achieve desired performance characteristics.*	**10**	**CO-1** **CO-2**

	Experiments: **Electronic Devices** 1. Study of CRO & Measurement of Voltage Amplitude & Frequency. 2. Testing of Components using Instruments and fault detection. 3. V. I. Characteristics of Si & Ge diode. 4. Zener Diode Characteristics 5. Applications of Diode: a. Clipper – positive, negative, combinational, biased and combinational b. Clamper – positive and negative c. Rectifier – Half Wave / Full wave with/without filter. 6. Characteristics of BJT in Common Emitter Configuration.		**CO-3**
	Self-Learning Topics: *Advanced Component Testing using LCR Meters* ***Learning Outcomes:*** *A learner will be able to* *1. Analyze an electronic device model by observing and plotting the response with various inputs and make a document in the form of report. (P.I.- 2.4.1, P.I.- 10.3.1).* *2. Use a systematic approach to measure data and analyze the system's performance across various parametric variation in a team. (P.I.- 4.3.1, P.I.- 9.3.1).*		
02.	***Learning Objective/s:*** *Explore digital circuit fundamentals by understanding logic gates, Boolean expressions, universal gates, and their practical applications.* **Suggested List of Experiments: (Any Two)** **Digital Circuits** 1. Introduction to Logic Gates – NOT, AND, OR, NAND NOR and XOR 2. For a given Boolean expression, design and verify the circuit using Universal Gates. 3. Basics of AND gate and its application in car wiper control ***4.*** Basics of NOT gate and its application in fuel level Indicator ***Self-Learning Topics:*** *Simulation based exploration for all the hardware based digital circuits.* ***Learning Outcomes:*** *A learner will be able to* *1. Identify and analyze various IC's required for a digital system, use systematic techniques to test and verify with the help of truth table as a team. (P.I.-2.4.1, P.I.- 9.3.1)* *2. Devise an optimal design, verify a given Boolean expression and make a document in form of report. (P.I.- 3.3.3, P.I.- 10.3.1)*	**8**	**CO-1** **CO-2** **CO-3**

03.	***Learning Objective/s:*** *To teach the fundamentals of sensor/transducer and model the basic data acquisition system.*	**4**	**CO-1** **CO-2** **CO-3** **CO-4**
	Suggested List of Experiments: (Any One) **Sensor/ Transducer Applications** 1. Intruder detection using IR sensor 2. Collision avoidance using ultrasonic sensor 3. Fire alarm system using temperature sensor 4. Movement detection using flex sensor 5. Light detection using LDR 6. Interactive doorbell system using Proximity sensor 7. Gas detection using gas sensors		
	Self-Learning Topics: *Explore and compare software simulations to carry out basic real-life projects in the field of data acquisition system.* ***Learning Outcomes:*** *A learner will be able to* *1. Identify and analyze various sensors/transducers required for a dataacquisition system, use systematic techniques to test and verify same as a team.(P.I.- 2.4.1, P.I.-.9.3.1)* *2. Design, a prototype of a simple Data Acquisition system, test and convey a document in report form. (P.I.- 3.3.3, P.I.- 10.3.1)*		
04	***Learning Objective/s:*** *Develop practical electronic skills through designing and implementing real-life applications.* **Suggested List of Experiments: (Any One)** **Real life Applications** 1. Regulated Power Supply using transistor and zener diode 2. Electronic lock using basic logic gates 3. Cockpit warning light control using basic logic gates. 4. Universal NOR gate and its application in automobile alarm system 5. Universal NAND gate and its application in level monitoring in chemical plant 6. Mosquito Trap bat. 7. Electronic safety lock using vibration sensor 8. Water Level Indicator 9. Smoke Detector 10. Smart Trash Bin 11. Virtual Piano 12. Voltage Doubler Circuit	**6**	**CO-1** **CO-2** **CO-3** **CO-4**

	Self-Learning Topics: *Smart sensors in the field of IoT* ***Learning Outcomes:*** *A learner will be able to* *1. To demonstrate the analysis with clear, well-constructed presentations to a group of technical and non-technical group with concrete well written documents (P.I.- 2.4.1, P.I.- 10.3.1)* *2. To design for real life scenarios and check for the sustainability and feasibility of the application (P.I.- 3.3.3, P.I.- 12.3.1)* *3. To demonstrate proficiency by recognizing the sources of error in measurements, modelling or simulations and verify credibility of results as a team. (P.I.- 5.3.3, P.I.- 9.3.1)* *4. Measure the impact of technological development on society considering factors like environment, user needs, safety and protection (P.I.-6.2.2)*		
	Course Conclusion	**01**	
	Minimum Ten Experiments		
	Total	**30**	

Course Outcomes:

Learners will be able to

1. Apply knowledge about the electronic equipment such as oscilloscopes, function generators, multimeter, timers etc. for analog testing, measuring the parameters electronics devices such as diode, Zener diode, Transistor etc.
2. Demonstrate and analyze the use of basic gates and apply it in various applications in digital domain.
3. Analyze sensors/transducers and assemble a prototype for a basic data acquisition system.
4. Design analyze, test, and ensure functionality of real-life electronic applications using acquired skills and electronic test instruments.

Performance Indicators:

P.I. No.	**P.I. Statement**
2.4.1	Extract desired understanding and conclusions consistent with objectives and limitations of the analysis
3.3.3	Identify relevant data from the given resources and arrive at an optimal design solution for particular specifications.
4.3.1	Use appropriate procedures, tools, and techniques to conduct experiments and collect data
5.3.3	Recognize sources of error in measurements, modelling or simulations and verify credibility of results.
6.2.2	Comprehend legal requirements relevant to engineering design with reference to standards/regulations.

9.3.1 Present results as a team, with smooth integration of contributions from all individual efforts

10.3.1 Create engineering-standard figures, reports and drawings to complement writing and presentations

12.3.1 Source and comprehend technical literature and other credible sources of information

Text Books:

1. Basic Electronics By B.L.Theraja,S Chand Publications.
2. Basic Electronics Engineering. Satya Sai Srikant, Prakash Kumar Chaturvedi, Springer, Year:2020
3. A Textbook of Basic Electronics, Dr. Barun RayChaudhuri Chhaya Prakashan Pvt. Ltd.

Reference Books:

1. Learning Art of Electronics: A Hands-on Lab Course By. Paul Horowitz and Thomas C. Hayes, 2020.
2. Basic Electronics--theory and practice J. A. Sam Wilson, Publisher, Gregg Division,McGraw-Hill, 1977.
3. Practical Electronics for Inventors, 4th Edition by Paul Scherz, Simon Monk, 2016
4. Getting started in Electronics – Forest M. Mims Publisher. Fort Worth: Radio Shack,12th edition, 1994.
5. Self-teaching guide: All new electronics – Harry Kybett and Earl Boysen, 3rd edition 2008.

Other Resources:

1. Basic Electronics Course – NPTEL By Dr. M.B. Patil, IIT Bombay.
2. Virtual Lab of Basic Electronics. Basic Electronics (iitkgp.ac.in).

CONTINUOUS INTERNAL EVALUATION (25 Marks)

1. Lab Experiments: 10 Marks
2. Internal Assessment –

i) Practical Test 1 (Based on 50% of the Practical list): 5Marks

ii) Practical Test 2 (Based on remaining 50% of the Practical list):5 Marks

3. Regularity and active participation: 5 marks

END SEMESTER EXAMINATION (Pract. /Oral Exam) (25 Marks)

Performance of experiments based on the course content.

Students will have to:

1. Draw the circuit diagram.: 03 Marks
2. Identify the components.: 01Marks
3. Make proper connections on breadboard.:03Marks
4. Take accurate readings from instruments.:03 Marks
5. Tabulate the readings and plot graphs if required.:05 Marks
6. Orals:10 Marks

Two examiners, one Internal and one External will do the evaluation

Course Type	Course Code	Course Name	Credits
SEC	SEC202	BASIC WORKSHOP PRACTICE - II	01

Examination Scheme		
Continuous Assessment	**End Semester Exam(ESE)**	**Total Marks**
50	--	50

Pre-requisite:

1. SEC101- Basic Workshop Practice I

Program Outcomes addressed:

1. PO5: Modern tool usage
2. PO6: The engineer and society
3. PO7: Environment and sustainability
4. PO9: Individual and team work
5. PO11: Project management and finance
6. PO12: Life-long learning

Course Objectives:

1. To impart training to help the students develop engineering skill sets.
2. To inculcate respect for physical work and hard labour.
3. To get exposure to interdisciplinary engineering domain.

Module	Detailed Contents	Hrs	CO
00.	**Course Introduction** The Basic Workshop Practice II course is intended to give students with the coreinformation and abilities required for developing engineering skill sets andgetting an exposure to work in an interdisciplinary engineering domain including basic electronic work shop. This hands-on course introduces the fundamental principles, equipment, and techniques utilised in workshop scenarios, such as carpentry, sheet metal working, brazing and forging.	**01**	
01.	***Learning Objectives:*** *1. To gain proficiency in accurate measuring, marking, and layout techniques, including the use of squares, levels, and other layout tools.* *2. To develop proficiency in the use of basic carpentry hand tools such as hammers, saws, chisels, planes, and measuring devices.*	**09**	**CO- 1**
	Content: Carpentry • Use and setting of hand tools like hacksaws, jack planes, chisels and gauges for construction of various joints, wood turning 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.		

	Learning Outcomes: *A learner will be able to* 1. *Accurately measure and layout components of carpentry projects using appropriate tools and techniques, ensuring precision and alignment. (5.2.1, 12.3.1)* 2. *Exhibit proficiency in the use of common carpentry hand tools and power tools, including accurate handling, operation, and maintenance. (5.2.2, 12.3.2)*		
02.	***Learning Objectives:*** *1. To provide hands-on experience in measuring instruments, electronic components, PCB circuit design and to familiarize students with PCB fabrication process.* *2. To provide hands-on experience in assembly and testing of electronics circuit.*	**10**	**CO- 2**
	Content: Basic Electronic work shop • Introduction to measuring instruments and electronic components like resistors, capacitors, inductors, diodes, transistors, etc. • Demonstration of PCB simulation software for making the layout, layout transfer to PCB, etching, drilling and soldering technique. • Assembling and testing the circuit for correct functionality.		
	Learning Outcomes: *A learner will be able to* 1. *Select appropriate electronic components based on design requirements and place them effectively on the PCB layout. (5.2.1, 5.2.2, 12.3.1)* 2. *Demonstrate a clear understanding of what PCBs are, how they function, and their importance in electronic devices and systems. (9.2.1, 9.3.1, 11.3.1)* 3. *Comprehend the basic principles of PCB design, including component placement, routing, signal integrity, and manufacturability. (6.1.1, 7.2.2, 9.2.1, 9.3.1, 11.3.1, 12.3.2)*		
03.	***Learning Objectives:*** *1. To become proficient in the use of various sheet metal working tools and equipment, such as shears, brakes, punches, rollers, and spot welders.* *2. To grasp the fundamental principles and techniques involved in forging, which includes heating, shaping, and cooling metal through the application of force.*	**10**	**CO- 3** **CO- 4**
	Content: Sheet metal working, Brazing and Forging (Smithy) • Use of sheet metal, working hand tools, cutting, bending, spot welding. One job covering maximum operation with soldering or brazing. • At least one forging job to be demonstrated and a simple job to be made for Term Work in a group of 4 students.		
	Learning Outcomes: *A learner will be able to* 1. *Use various sheet metal working tools and equipment proficiently. (5.2.2, 5.3.2, 12.1.1, 12.3.2)* 2. *Demonstrate competence in operating forging equipment and tools, including heating furnaces, power hammers, presses, and hand tools, to manipulate metal effectively. (5.2.2, 7.2.2, 9.1.1, 9.3.1, 12.1.1, 12.3.2)*		
	Total	**30**	

Course Outcomes:

A learner will be able to

1. Develop the necessary skill required to handle/use different carpentry tools.
2. Identify different electronic components to design, fabricate and assemble PCB.
3. Develop the necessary skill required to use different sheet metal and brazing tools.
4. Demonstrate the forging operation with the help of a simple job.

Performance Indicators:

P.I. No.	P.I.Statement
5.2.1	Identify the strengths and limitations of tools for creating engineering designs.
5.2.2	Demonstrate proficiency in using discipline-specific tools.
5.3.2	Verify the credibility of results from tool use with reference to the accuracy and limitations,and the assumptions inherent in their use.
6.1.1	Identify and describe various engineering roles; particularly as pertains to protection ofthe public and public interest at the global, regional and local level.
7.2.2	Apply principles of preventive engineering and sustainable development to an engineeringactivity or product relevant to the discipline.
9.1.1	Recognize a variety of working and learning preferences; appreciate the value of diversityon a team.
9.2.1	Demonstrate effective communication, problem-solving, conflict resolution and leadershipskills.
9.3.1	Present results as a team, with smooth integration of contributions from all individual efforts.
11.3.1	Identify the tasks required to complete an engineering activity, and the resources required tocomplete the tasks.
12.1.1	Describe the rationale for the requirement for continuing professional development.
12.3.1	Source and comprehend technical literature and other credible sources of information.
12.3.2	Analyse sourced technical and popular information for feasibility, viability, sustainability,etc.

CONTINUOUS INTERNAL EVALUATION (50 Marks)

1. Job Work with complete workshop book: 40 Marks
2. Regularity and active participation: 10 marks.

Course Type	Course Code	Course Name	Credits
IKS	IKS201	INDIAN KNOWLEDGE SYSTEM	02

Program Outcomes addressed:

1. PO1 : Engineering knowledge
2. PO6 : The engineer & society
3. PO7 : Environment & sustainability
4. PO8 : Ethics
5. PO12: Life-long learning

Course Objectives:

1. To introduce fundamentals of Ancient Indian Educations to understand the pattern and purpose ofstudying vedas, vedangas, upangas, upveda, purana & Itihasa
2. To help students to trace, identify and develop the ancient knowledge systems.
3. To help to understand the apparently rational, verifiable and universal solution from ancient Indianknowledge system for the holistic development of physical, mental and spiritual wellbeing
4. To build in the learners a deep rooted pride in Indian knowledge, committed to universal humanright, well-being and sustainable development.

Module	Detailed Content
01.	**Indian Knowledge System** Caturdaśa Vidyāsthānam, 64 Kalas, Shilpa Śāstra, Four Vedas, Vedāṅga, Indian Philosophical Systems, Vedic Schools of Philosophy (Sāṃkhya and Yoga, Nyaya and Vaiśeṣika, Pūrva-Mīmāṃsā and Vedānta), Non-Vedic schools of Philosophical Systems (Cārvāka, Buddhist, Jain), Puranas (Maha-puranas, Upa-Puranas and Sthala-Puranas), Itihasa (Ramayana, Mahabharata), Niti Sastras, Subhasitas
02.	**Foundation concept for Science & Technology** Linguistics & Phonetics in Sanskrit (panini's), Computational concepts in Astadhyayi Importance of Verbs, Role of Sanskrit in Natural Language Processing, Number System and Units of Measurement, concept of zero and its importance, Large numbers & their representation, Place Value of Numerals, Decimal System, Measurements for time, distance and weight, Unique approaches to represent numbers (Bhūta Saṃkhya System, Kaṭapayādi System), Pingala and the Binary system, Knowledge Pyramid, Prameya – A Vaiśeṣikan approach to physical reality, constituents of the physical reality, Pramāṇa, Saṃśaya

03.	**Indian Mathematics & Astronomy in IKS** Indian Mathematics, Great Mathematicians and their contributions, Arithmetic Operations, Geometry (Sulba Sutras, Aryabhatiya-bhasya), value of π, Trigonometry, Algebra, Chandah Sastra of Pingala, Indian Astronomy, celestial coordinate system, Elements of the Indian Calendar Aryabhatiya and the Siddhantic Tradition Pancanga – The Indian Calendar System Astronomical Instruments (Yantras) Jantar Mantar or Raja Jai Singh Sawal.
04.	**Indian Science & Technology in IKS** Indian S & T Heritage, sixty-four art forms and occupational skills (64 Kalas) Metals and Metalworking technology (Copper, Gold, Zinc, Mercury, Lead and Silver), Iron & Steel, Dyes and Painting Technology), Town & Planning Architecture in India, Temple Architecture, Vastu Sastra
05.	**Humanities & Social Sciences in IKS** Health, Wellness & Psychology, Ayurveda Sleep and Food, Role of water in wellbeing Yoga way of life Indian approach to Psychology, the Triguṇa System Body-Mind-IntellectConsciousness Complex. Governance, Public Administration & Management reference to ramayana, Artha Sastra, Kauṭilyan State
Total no. of hours: **30**	

Course Outcomes:

1. Explore the diverse realms of the Indian Knowledge System, spanning philosophy, literature, andethics, to appreciate its holistic approach to education.
2. Understand foundational concepts in Science and Technology from ancient Indian perspectives,including linguistics, mathematics, and astronomy.
3. Discover the rich heritage of Indian Mathematics, Astronomy, and Science, exploring theircontributions to global knowledge and technological advancement.
4. Engage with interdisciplinary perspectives in Humanities and Social Sciences rooted in ancientIndian wisdom, fostering critical thinking and holistic development.
5. Apply insights from ancient Indian knowledge systems to contemporary challenges, promotinginnovation and sustainable solutions.
6. Cultivate a deeper appreciation for Indian heritage while developing analytical skills andinterdisciplinary insights for real-world application.

Text Books:

1. Exploring the Indian Knowledge System: Insights from Prof. B Mahadevan, Prof. B Mahadevan,
IIM Bengaluru Press

Kapur K and Singh A. K (Eds) 2005). Indian Knowledge Systems, Vol. 1. Indian Institute of

2. Advanced Study, Shimla. Tatvabodh of sankaracharya, Central chinmay mission trust,Bombay,1995.

3. Nair, Shantha N. Echoes of Ancient Indian Wisdom. New Delhi: Hindology Books, 2008

Reference Books:

1. Reshmi ramdhoni, Ancient Indian Culture and Civilisation, star publication ,2018

2. Supriya Lakshmi Mishra, Culture and History of Ancient India (With Special Reference of Sudras), 2020.

3. DK Chakkrabarty, Makkhan Lal, History of Ancient India (Set of 5 Volumes), Aryan book Internation publication, 2014

Other Resources:

1. NPTEL Course: Indian Knowledge System(IKS): Concepts and Applications in Engineering, By By Prof. B. Mahadevan, Dr. Vinayak Rajat Bhat, Dr. R Venkata Raghava, Indian Institute of Management Bangalore (IIMB), Chanakya University, Bangalore :-Web link- https://onlinecourses.swayam2.ac.in/imb23_mg53/preview

2. NPTEL Course: Indian Knowledge System(IKS): Humanities and Social Sciences, By Prof. B. Mahadevan, Dr. Vinayak Rajat Bhat, Dr. R Venkata Raghavan, Indian Institute of Management Bangalore (IIMB), Chanakya University, Bangalore :-Web link- https://onlinecourses.swayam2.ac.in/imb23_mg55/preview

F. Second Year Syllabi

Course Type	Course Code	Course Name	Credits
PCC	ITPCC301	ENGINEERING MATHEMATICS - III	03+01*

Examination Scheme					
Distribution of Marks			Exam Duration (Hrs.)		Total Marks
In-semester Assessment		End Semester Exam (ESE)			
Continuous Assessment	Mid-Semester Exam (MSE)		MSE	ESE	
20+ 25*	30	50	1.5	2	125

*For Tutorial

Pre-requisite :

1. BSC101- Engineering Mathematics-I
2. BSC204- Engineering Mathematics-II

Program Outcomes addressed :

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

Course Objectives :

1. To provide the basic knowledge on the concepts of Mathematics in the field of Engineering.
2. To build a foundation to the methodology necessary for solving problems by applying the knowledge of Mathematics to the field of Engineering.

Module	Detailed Contents	Hrs	CO
00.	**Course Introduction** Engineering Mathematics III is often a foundational course designed to provide students with the mathematical tools and concepts essential for various engineering disciplines. Engineering Mathematics III has many applications in Information Technology such as 1) Application of Vector space in Deep Learning, dimension reduction and Neural Networks. 2) Application of Linear Mapping in Deep learning and Machine Learning. 3) Application of in Number theory in Cryptography.	**01**	
01.	**Vector Space** ***Learning Objective/s:*** *To analyse the definition of basis and apply it to determine the basis of a Vector Space.* **Contents:** Vector Spaces, Examples of vector spaces, Subspace, Linear combinations, Spanning Set, Linear Independence and Dependence. Linear spans, Row Space of a matrix , Basis and Dimensions	**07-09**	CO- 1

	Learning Outcomes : *A learner will be able to* 1. *Apply the axioms of closure, addition and scalar multiplication and prove that the given set of vectors is a Vector Space (P.I.- 1.1.1)* 2. *Identify the conditions of closure and prove that the given space is a Subspace. (P.I.= 2.1.3)* 3. *Applying the condition for linear independency and the span of a Vector Space determine the basis of a vector space. (P.I.- 1.1.2)* 4. *Identifying Vector space its operations to determine the Basis of a Vector Space.(P.I.-2.1.2)*		
02.	**Linear Mappings** ***Learning Objective/s:*** *To apply the concepts of kernel and image of a linear map to compute and analyse the rank and nullity.* **Contents:** Mappings, Function, Linear mapping (Linear transformations), Kernel and Image of a linear mapping, Rank and Nullity, Singular and non-singular mapping, Isomorphism. ***Self-Learning Topics:*** *Operations with linear mapping.* ***Learning Outcomes:*** *A learner will be able to* 1. *Apply the properties of vector addition and scalar multiplication to examine whether the mapping is a Linear mapping. (P.I.- 1.1.1)* 2. *Determine the rank and nullity of the given linear mapping using the matrix method (P.I.- 1.1.2)* 3. *Examine whether a mapping is a linear mapping and find its kernel and image.(P.I.- 2.1.2)* 4. *Analyse the property of homomorphism and one-one mapping isomorphism between the vector space to prove that the mapping an isomorphism. (P.I.- 2.1.3)*	**06-08**	CO- 2
03.	**Linear Mappings and Matrices** ***Learning Objective/s:*** *To analyze and compute the change of basis matrix for linear map.* **Contents:** Introduction, Matrix Representations of a linear operator, Change of Basis, Similarity, Matrices and general linear mapping ***Learning Outcomes:*** *A learner will be able to* 1. *Express the linear mapping in the matrix form. (P.I.- 1.1.1)* 2. *Apply matrix method to prove that the two linear mappings are similar (P.I. - 1.1.2)*	**06-08**	CO- 2

	3. *Analyze the procedure and determine the change of Basis Matrix from one coordinate system to the alternate coordinate system (P.I.- 2.1.3)* 4. *Apply the concept of linear mapping and the change of basis to solve mathematical models (P.I.- 2.4.1)*		
04.	**Inner Product spaces, Orthogonality** ***Learning Objective/s:*** *To analyse and apply Gram-Schmidt Technique to determine an Orthonormal Basis.* **Contents:** Introduction, Inner product spaces, Examples of Inner product spaces, Cauchy-Schwartz Inequality, Orthogonality, orthogonal sets and Basis Gram-Schmidt orthogonalizations process ***Learning Outcomes :*** *A learner will be able to* *1 Prove Cauchy's Schwartz inequality for the set of all matrices (P.I. -1.1.1)* *2 Identify the inner product space to prove that the set of vectors is an orthogonal basis. (P.I. - 2.1.2)* *3 Identify the inner product space to prove that the set of vectors is an orthonormal basis. (P.I. -2.1.3)* *4 Apply Gram Schmidt Technique to determine the orthonormal basis.(P.I. - 1.1.2)*	**06-08**	CO- 3
05.	**Number Theory** ***Learning Objective/s:*** *To identify and apply the appropriate theorem of Number Theory to solve the simultaneous system of congruences.* **Contents:** Modular Arithmetic, Divisibility and Euclid Algorithm, Primes and Sieve of Eratosthenes, Euler's and Fermat Little Theorem, Congruences, Computing Inverse in Congruences, Legendre and Jacobi Symbol, Chinese Remainder Theorem ***Self-Learning Topics:*** *Testing for Primes, Prime Number Theorem* ***Learning Outcomes :*** *A learner will be able to* 1. *Apply Euler's or Fermat little theorem to solve congruent modulo equation.(P.I. - 1.1.1)* 2. *Formulate and solve the linear congruent equation for the given problem. (P.I.- 2.2.2)* 3. *Identify appropriate theorem and solve the linear congruent equation.(P.I.- 2.1.3)* 4. *Apply Chinese Remainder theorem to solve the given simultaneous linear congruence.(P.I.- 1.1.2)*	**06-08**	CO- 4

06.	**Numerical Methods** ***Learning Objective/s:*** *To analyse and apply the appropriate numerical method to solve transcendental equation and system of simultaneous equations.*	**06-08**	CO- 5
	Contents:		
	Solution of Transcendental Equations: Newton Raphson method , Regula –Falsi Method, Solution of system of linear algebraic equations Gauss Jacobi Iteration Method, Gauss Seidel Iteration Method.		
	Self-Learning Topics: *Bisection Method, Gauss Elimination Method.* ***Learning Outcomes :*** *A learner will be able to* 1. *Apply Newton Raphson method and Regula Falsi method to solve the transcendental equation.(P.I. - 1.1.1)* 2. *Apply Gauss Jordan or Gauss Siedel Iterative method to solve the system of equations.(P.I -1.1.2)* 3. *Identify the appropriate numerical method to solve the system of equation.(P.I -2.1.3)* 4. *Examine the limitation for the convergent solution of system of equation is using iterative method.(P.I -2.4.3)*		
	Course Conclusion	**01**	
	Total	**45**	

Course Outcomes:
Learner will be able to

1. Apply the fundamentals of Vector Space to analyse the Basis of the Vector Space.
2. Apply the fundamentals of Linear Mapping to identify the Kernel and Image of the Linear Mapping.
3. Analyse the Inner Product Space and apply the properties to determine the orthogonal basis.
4. Identify and apply the appropriate theorem of Number Theory to solve the congruent equation and the simultaneous congruent equations.
5. Identify and apply appropriate numerical methods to solve System of equations.

Performance Indicators:

P.I. No.	**P.I. Statement**
1.1.1	Apply mathematical techniques such as calculus, linear algebra, and statistics to solve problems
1.1.2	Apply advanced mathematical techniques to model and solve mechanical engineering problems

2.1.2 Identify engineering systems, variables, and parameters to solve the problems

2.1.3 Identify the mathematical, engineering and other relevant knowledge that applies to a given problem

2.2.2 Identify, assemble and evaluate information and resources

2.4.1 Apply engineering mathematics and computations to solve mathematical models.

2.4.3 Identify sources of error in the solution process and limitations of the solution.

Text Books :

1. Elements of Discrete Mathematics, C. L. Liu ,2nd edition, 1985,TMH
2. Cryptograph and Network Security ,B. A. Forouzan & D. Mukhopadhyay, 11th edition, 2008 McGraw Hill Publication

Reference Books :

1. Elementary Number Theory and its applications, Kenneth H. Rosen, 5th edition, 1986, Addison Wesley Publication
2. Advanced Engg. Mathematics ,C. Ray Wylie & Louis Barrett, 6 th edition , 1995,TMH International Edition
3. Beginning Linear Algebra Schaum's outline series, Seymour Lipschutz, 1st edition ,2020,Mc-Graw Hill Publication

Other Resources :

1. NPTEL Course: Applied Linear Algebra IIT Madras by Dr Andrew Thangaraj Web link- https://nptel.ac.in/courses/108106171
2. NPTEL Course: Computational Number Theory and Cryptography IIT Guwahati by Dr Pinaki Mishra , Web link- https://nptel.ac.in/courses/106103015
3. NPTEL Course :NOC: Numerical Methods, IIT Roorkee by Prof. Ameeya Kumar Nayak, Prof. Sanjeev Kumar , Web link- https://nptel.ac.in/courses/111107105

A. IN-SEMESTER ASSESSMENT (75 MARKS)

1. Continuous Assessment-Theory (20 Marks)

Suggested breakup of distribution

a) One MCQ test as per GATE exam pattern / level: 05 Marks

b) One Class test:05 Marks

c) One Team-Pair-Solo activity: 05 Marks

d) Regularity and active participation: 05 Marks

2. Continuous Assessment - Tutorial (25 Marks)

Suggested breakup of distribution

a) Tutorial Assignments and Class tests: 20 Marks

*Students must be encouraged to write at least 6 class tutorials based on entire syllabus. At least 6 Class tests will be conducted based on class tutorials. Each class tests carries 20 Marks. Average will be taken of all class tests***.**

b) Regularity and active participation: 05 Marks

3. Mid Semester Examination (30 Marks)

Mid semester examination will be based on 40% to 50% syllabus.

B. END SEMESTER EXAMINATION (50 MARKS)

End Semester Examination will be based on syllabus coverage up to the Mid Semester Examination (MSE) carrying 20% to 30% weightage, and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Type	Course Code	Course Name	Credits
PCC	ITPCC302	COMPUTER ORGANIZATION & ARCHITECTURE	03+01*

Examination Scheme					
Distribution of Marks			Exam Duration (Hrs.)		Total Marks
In-semester Assessment		End Semester Exam (ESE)			
Continuous Assessment	Mid-Semester Exam (MSE)		MSE	ESE	
20+25*	30	50	1.5	2	125

*For Tutorial

Pre-requisite :

1. ESCLC103: C Programming Laboratory

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 team work

Course Objectives :

1. To familiarize learners with organizational and architectural aspects of a computer system.
2. To make the learners comprehend Instruction Set of 8086 microprocessor and use it to develop Assembly Language Programs for a given task.
3. To make the learners study and apply algorithms to perform computer arithmetic operations.
4. To make the learners aware of the hierarchical organization of computer memory and various data transfer techniques in digital computer.
5. To acquaint learners with processor performance improvement using instruction level parallelism and advanced computer architectures.

Module	Detailed Contents	Hrs	CO
00.	**Course Introduction** This is a foundation course which deals with fundamentals of design and functions of different components of a computer system that will enable hardware engineers to develop high performance hardware designs and system programmers to design better system software's aiming at optimizing resource usage.	01	

01.	**Introduction to Computer Organization and Architecture** ***Learning Objective:*** *Learner is expected to identify and summarize the operational units of a computer system and their interconnections that realize the design specifications.*	**04-06**	CO- 1
	Contents: Introduction to Computer Organization and Architecture. Basic functional blocks of a computer: CPU, memory, input-output subsystems, control unit. Fetch-Decode-Execute Cycle, Von Neumann model. Performance measure of Computer Architecture, Amdahl's Law.		
	Self-Learning Topics: *Evolution of Computers.* ***Learning Outcomes :*** *A learner will be able to* 1. *Differentiate between organizational and architectural aspects of a computer system. (P.I.-1.4.1)* 2. *Restate Amdahl's Law and apply it to compute the speedup achieved using given number of processors. (P.I.-1.3.1)* 3. *Summarize the functions of different operational units of a computer (P.I.-2.2.2)* 4. *Identify the parameters that affect the performance of the computer architecture (P.I.-2.1.2)*		
02.	**Architecture, Instruction set and programming of 8086 microprocessor** ***Learning Objective/s:*** *Learner is expected to familiarize with the different components of a processor architecture, comprehend and apply the instruction set of 8086 microprocessor to write programs that run on the microprocessor.*	**08-09**	CO- 2
	Contents: Architecture of 8086 Family, Instruction formats, Instruction Set, Addressing Modes, Assembler Directives, Assembly Language Programming, Stack, Procedure, Macro.		
	Self-Learning Topics: *8086 Hardware Design, Minimum and Maximum Mode of operation.* ***Learning Outcomes :*** *A learner will be able to* 1. *Paraphrase the architecture of 8086 microprocessors. (P.I.-1.3.1)* 2. *Identify the Addressing Modes of 8086 microprocessor instructions(P.I.-1.4.1)* 3. *Interpret the use of different assembler directives of 8086 microprocessors. (P.I.-2.2.2)* 4. *Summarize different types of instructions of 8086 microprocessors. (P.I.-2.2.3)*		

	5. *Differentiate between procedure and Macros (P.I.-3.2.1)* 6. *Apply the instruction set of 8086 microprocessors to develop Assembly Language Programs for given task. (P.I.-3.2.2)* 7. *Identify different tools used for developing Assembly Language Programs. (P.I.-5.1.1)* 8. *Use TASM tool for writing and debugging Assembly Language Programs. (P.I.-5.2.2)* 9. *Show their problem solving skills through effective presentations of the solution of a given problem. (P.I.-9.2.1)* 10. *Solve given problem individually or in a team and illustrate the solution. (P.I.-9.3.1)*		
03.	**Processor Organization and Architecture** ***Learning Objective:*** *Learner is expected to analyze different approaches to the design of control unit of processor*	**05-07**	CO- 1
	Contents: CPU Architecture, basic instruction cycle with Interrupt processing. Instruction interpretation and sequencing. Control Unit: Soft wired (Microprogrammed) and hardwired control unit design methods. Microinstruction sequencing and execution. Micro operations, concepts of Nano programming.		
	Self-Learning Topics: *Architecture of Pentium IV processor.* ***Learning Outcomes :*** *A learner will be able to* 1. *Summarize the concept and advantages of nano- programming. (P.I.-1.3.1)* 2. *Paraphrase different steps taken by the processor in the execution of an instruction. (P.I.-1.4.1)* 3. *Outline hardwired and Microprogrammed control unit design approaches. (P.I.-2.2.2)* 4. *Compare and contrast different control unit design approaches. (P.I.-2.2.4)*		
04.	**Data Representation and Arithmetic Algorithms** ***Learning Objective:*** *Learner is expected to familiarize with standard floating point data representation formats and apply Algorithms for performing multiplication and division of integers.*	**05-07**	CO- 3
	Contents: Operations on integers: Negation, Addition, subtraction, Multiplication using Booth's algorithm. Division of integers: Restoring and non-restoring division. Floating-point number representation: IEEE 754 (Single & double precision) floating point number representation.		

	Self-Learning Topics: *Implement Booth's Algorithm and Division methods.* ***Learning Outcomes :*** *A learner will be able to* 1. *Summarize Normalized significand and Biased exponent with suitable example. (P.I.-1.3.1)* 2. *Restate IEEE 754 floating point number representation formats. (P.I.-1.4.1)* 3. *Paraphrase how multiplication of signed integers is performed using Booth's algorithm. (P.I.-2.2.2)* 4. *Apply Booth's algorithm for performing multiplication of signed integers. (P.I.-2.2.3)* 5. *Explore different algorithms for performing division of unsigned integers. (P.I.-3.2.1)* 6. *Use Restoring and non-restoring division algorithms to perform division of integers. (P.I.-3.2.2)* 7. *Show their problem solving skills through effective presentations of the solution of a given problem. (P.I.-9.2.1)* 8. *Solve given problem individually or in a team and illustrate the solution. (P.I.-9.3.1)*		
05.	**Memory and I/O Organization** ***Learning Objective/s:*** *Learner is expected to be aware of the different levels of computer memory to make effective utilization of hierarchical organization of computer memory for faster processing. Also comprehend different data transfer techniques.*	**10-11**	CO- 4
	Contents: Memory Organization: Memory parameters, Classifications of memories, Types of RAM and ROM, Memory hierarchy. Cache memory: Concept and Organization, Elements of a cache design, mapping techniques, Cache write policies, Cache Coherency, High speed memories: Interleaved and Associative memory. I/O Organization: Input/output systems, Structure of peripheral devices, data buffering, I/O module- need, functions and structure, Types of data transfer techniques: Programmed I/O, Interrupt driven I/O and DMA .		
	Self-Learning Topics: *Case study on Memory Organization, Address mapping, Comparison of all I/O methods.* ***Learning Outcomes :*** *A learner will be able to* 1. *Restate the need of an Input Output module. (P.I.-1.3.1)* 2. *Summarize the hierarchical organization of computer memory. (P.I.-1.4.1)* 3. *Paraphrase the function of a DMA module. (P.I.-2.2.2)* 4. *Differentiate between different data transfer techniques. (P.I.-2.2.4)*		

06.	**Fundamentals of Advanced Computer Architecture** ***Learning Objective/s:*** *Learner is expected to be aware of the advancements in computer hardware design and techniques used for enhancing the performance of a processor.*	**05-07**	CO- 5
	Contents: Parallel Architecture: Introduction to parallel processing concepts, Flynn's classifications, instruction pipelining, pipeline hazards. Introduction to Array Processors, Clusters, and NUMA Computers. Introduction to Multiprocessor, Multi-Core and Many-Core Systems.		
	Self-Learning Topics: *Advance accelerators such as GPGPUs.* ***Learning Outcomes :*** *A learner will be able to* 1. *Analyze the use of instruction pipelining to improve the performance of a processor. (P.I.- 1.3.1)* 2. *Paraphrase Flynn's classification of parallel computers. (P.I.- 1.4.1)* 3. *Interpret different pipeline hazards and methods to overcome them. (P.I.- 2.2.2)* 4. *Summarize processor performance improvement using different advanced parallel computer architectures. (P.I.- 2.2.3)*		
	Course Conclusion	**01**	
	Total	**45**	

Course Outcomes :

Learner will be able to

1. Restate the basic organization and architecture of a computer.
2. Develop assembly language programs for given task for 8086 microprocessor by using the instruction set of 8086 architecture.
3. Apply the algorithms to perform computer arithmetic operations
4. Analyse the organization of computer memory and different techniques for I/O data transfer.
5. Summarize advanced computer architectures including performance enhancement using instruction level parallelism.

Performance Indicators:

P.I. No.	**P.I. Statement**
1.3.1	Apply engineering fundamentals.
1.4.1	Apply theory and principles of computer science engineering to solve an engineering problem.
2.2.2	Identifies functionalities and computing resources.
2.2.3	Identify existing solution/methods to solve the problem, including forming justified approximations and assumptions

2.2.4 Compare and contrast alternative solution/methods to select the best methods

2.4.1 Applies engineering mathematics to implement the solution.

3.2.1 Ability to explore design alternatives.

3.2.2 Ability to produce a variety of potential design solutions suited to meet functional requirements.

5.1.1 Identify modern engineering tools, techniques and resources for engineering activities.

5.2.2 Demonstrate proficiency in using discipline specific tools.

9.2.1 Demonstrate effective communication, problem solving, conflict resolution and leadership skills

9.3.1 Present results as a team, with smooth integration of contributions from all individual efforts

Text Books :

1. Computer Organization, Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Fifth Edition, 2002, Tata McGraw-Hill.
2. Computer Organization and Architecture: Designing for Performance, William Stallings, Eleventh Edition, 2022, Pearson.
3. 8086/8088 family: Design Programming and Interfacing, John Uffenbeck, First Edition, 1986, Pearson.
4. Advanced Computer Architecture, Smruti R. Sarangi, First Edition, 2021, McGraw Hill.

Reference Books :

1. Computer Architecture and Organization, John P. Hayes, Third Edition, 2017, McGraw-Hill Education.
2. Computer Architecture and Organization: Design Principles and Applications, B. Govindarajulu, Second Edition, 2017, McGraw-Hill Education.
3. Advanced Microprocessors & Peripherals, K Bhurchandi, Third Edition, 2017, McGraw-Hill Education.
4. Advanced Computer Architecture: Parallelism, Scalability, Programmability, Kai Hwang, Naresh Jotwani, Third Edition, 2017, McGraw Hill Education.

Other Resources :

1. NPTEL Course: Computer architecture and organization By Prof. Indranil Sengupta, Prof. Kamalika Datta, Department of Computer Science and Engineering, IIT Kharagpur
   Web link- https://nptel.ac.in/courses/106105163
2. NPTEL Course: Computer Architecture By Prof. Smruti Ranjan Sarangi, Department of Computer Science and Engineering, IIT Delhi
   Web link-https://onlinecourses.nptel.ac.in/noc23_cs67/
3. NPTEL Course: Advanced Computer Architecture By Prof. Smruti Ranjan Sarangi, Department of Computer Science and Engineering, IIT Delhi
   Web link- https://onlinecourses.nptel.ac.in/noc23_cs07/

A. IN-SEMESTER ASSESSMENT (75 MARKS)

1. Continuous Assessment-Theory (20 Marks)

Suggested breakup of distribution

a) One MCQ test as per GATE exam pattern / level: 05 Marks

b) One Class test: 05 Marks

c) One Think Pair Share (TPS) activity: 05 Marks

d) Regularity and active participation: 05 Marks

2. Continuous Assessment - Tutorial (25 Marks)

Suggested breakup of distribution

a) Tutorial Assignments: 20 Marks

*Students must be encouraged to write at least 8 class tutorials on entire syllabus in the form of Numerical Assignment, Case Study, Theory Assignment, Programming assignment. Each tutorial assignment carries 20 Marks. Average will be taken of all tutorial assignments***.**

b) Regularity and active participation: 05 Marks

3. Mid Semester Examination (30 Marks)

Mid semester examination will be based on 40% to 50% syllabus.

B. END SEMESTER EXAMINATION (50 MARKS)

End Semester Examination will be based on syllabus coverage up to the Mid Semester Examination (MSE) carrying 20% to 30% weightage, and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Type	Course Code	Course Name	Credits
PCC	ITPCC303	DATA STRUCTURES AND ANALYSIS	03

Examination Scheme					
Distribution of Marks			Exam Duration (Hrs.)		Total Marks
In-semester Assessment		End Semester Exam (ESE)			
Continuous Assessment	Mid-Semester Exam (MSE)		MSE	ESE	
20	30	50	1.5	2	100

Pre-requisite:

1. ESCLC103: Programming Laboratory-I(C)

Program Outcomes addressed:

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

Course Objectives:

1. Facilitate the way students, comprehend computer automation in addressing engineering difficulties through the use of data structures.
2. Intended to guide learners through developing complex data structures through the application of fundamental programming concepts.
3. Aid learners to learn the basics of basic data structures including linked lists, stacks, and queues.
4. Assist learners in acquiring a strong comprehension of the fundamental concepts of different types of trees and graphs.
5. Asist learners with understanding the concepts of searching, hashing, and sorting.
6. Assist learners in applying linked lists, stacks, queues, trees, and graphs to solve complicated issues.

Module	Detailed Contents	Hrs	CO
00.	**Course Introduction** This course deals with basics of data types and variables, revision of concept of array, structures and pointers. Data is simplified by data structures. Data structures organize information for machines and humans to understand, most importantly. Understanding DSA helps to solve real-world problems quickly. Data structures and algorithms support logical problem-solving.	**01**	
01.	**Introduction of Data Structures and Algorithms Analysis** ***Learning Objective:*** *Learner is expected to recall and interpret data structures and algorithms to solve real time-complex issues and maximize results.*	**07-08**	CO- 1

	Contents: Introduction of Data Structures: Concept of computation, algorithms, elementary data types, abstract data types and data structures. RAM model of computation. Data Management concepts, Data types – primitive and non-primitive, Types of Data Structures- Linear & Non-Linear Data Structure. Introduction of Algorithm Analysis: Algorithm, pseudo code for expressing algorithms, performance analysis-space complexity, time complexity, asymptotic notation- big (O) notation, omega notation, theta notation and little (o) notation, recurrences, probabilistic analysis, disjoint set operations, union and find algorithms. applications-analysis of binary search. ***Self-Learning Topics:*** *Asymptotic Notations, advanced data structures.* ***Learning Outcomes:*** *A learner will be able to* 1. *Study the asymptotic notations for algorithm performance analysis. (P.I.-1.3.1)* 2. *Correlate data structure with software and hardware mechanism. (P.I.-1.4.1)* 3. *Compare various data structures and know the limit of each type. (P.I.-2.3.2)* 4. *Compare complexity of various searching methods. (P.I.-2.4.3)*		
02.	**Linear Data Structure-Stack, Queue, Linked List** ***Learning Objective:*** *Learner is expected to know linear data structures and interpret all linear data and functions.* **Contents:** Array: Representation of arrays, Applications of arrays, sparse matrix and its representation, Stack: Stack-Definitions & Concepts, Operations on Stacks, Applications of Stacks, Polish Expression, Reverse Polish Expression and Their Compilation, Recursion, Tower of Hanoi, Queue: Representation Of Queue, Operations on Queue, Circular Queue, Priority Queue, Array representation of Priority Queue, Double Ended Queue, Applications of Queue. Linked List: Singly Linked List, Doubly Linked list, Circular linked list, Linked implementation of Stack, Linked implementation of Queue, Applications of linked list. ***Self-Learning Topics:*** *Linked List Implementation of Stack, Linked List implementation of Queue, Circular Queue, Double Ended Queue, Priority Queue.* ***Learning Outcomes:*** *A learner will be able to* 1. *Discover the various applications of queues, linked lists, and stacks. (P.I.-1.3.1)* 2. *Apply theory of data structure functions on various application. (P.I.-1.4.1)* 3. *Design various functions of basic data structures. (P.I.-2.3.2)*	**09-10**	CO- 2

	4. *Identify real-life problem to apply data structure mechanism. (P.I.-2.4.3)*		
03.	**Nonlinear Data Structure-Tree, Graph** ***Learning Objective:*** *Learner is expected to know and interpret non-linear data structures, utilize them, and analyse its many functions.* **Contents:** Tree-Definitions and Concepts, Representation of binary tree, Binary tree traversal (In-order, Post-order, Preorder), Threaded binary tree, Binary search trees, Conversion of General Trees to Binary Trees, AVL trees, Height Balanced, Weight Balance. Insertion and deletion cases of tree. Graph-Types of Graphs, Matrix Representation of Graphs, Elementary Graph operations, (Breadth First Search, Depth First Search, Spanning Trees, Shortest path, Minimal spanning tree). ***Self-Learning Topics:*** *Implementation of AVL and B+ Tree.* ***Learning Outcomes :*** *A learner will be able to* 1. *Design MST. Learn MST designing using Prim's and Kruskal's algorithm. (P.I.-1.3.1)* 2. *Learn the Dijkstra's algorithm and find MST for directed graph. (P.I.-1.4.1)* 3. *Apply Kruskal and Calculate Total cost. (P.I.-2.3.2)* 4. *Identify the limitations of BST and use of AVL tree. (P.I.-2.4.3)*	**10-11**	CO- 2
04.	**Sorting and searching** ***Learning Objective:*** *Learner is expected to recall searching and sorting algorithm. Also expected to apply it to order the data with list and arrays.* **Contents:** Insertion Sort, Quick Sort, Merge Sort, Heap Sort, Sorting on Several Keys, List and Table Sort, Linear Search, Binary Search and complexity comparison. ***Self-Learning Topics:*** *Implementation of different sorting techniques and searching.* ***Learning Outcomes :*** *A learner will be able to* 1. *Compare searching methods. (P.I.-1.4.1)* 2. *Explore sorting methods on given data values. (P.I.-1.3.1)* 3. *Compare between sorting techniques and its time complexities. (P.I.-2.3.2)* 4. *Apply sorting and compare result with another method. (P.I.-2.4.3)*	**03-04**	CO- 3

05.	**Hashing and File Structures** ***Learning Objective:*** *Learner is expected to recall and summarize understand hashing and file structures to simplify the process of finding or using the original string.*	**05-06**	CO- 4
	Contents: Hashing: The symbol table, Hashing Functions, Collision-Resolution Techniques, File Structure: Concepts of fields, records and files, Sequential, Indexed and Relative/Random File. Organization, indexing structure for index files, hashing for direct files, multi-key file organization and access methods.		
	Self-Learning Topics: *Implementation of applications of hashing methods and collision techniques.* ***Learning Outcomes :*** *A learner will be able to* 1. *Summarize collision handling methods in hashing. (P.I.-1.3.1)* 2. *Explore hashing in file organization. (P.I.-1.4.1)* 3. *Apply and compare FCFS and SSTF and compare results. (P.I.-2.3.2)* 4. *Identify limitations of searching and benefit of hashing. (P.I.-2.4.3)*		
06.	**Data Structures for Complex Problems of computations** ***Learning Objective/s:*** *Learner is expected to know and recall the use of data structure for solving and analysing complex problems.*	**03-04**	CO- 5
	Contents: Single-source shortest path computation, topological sorting of a partially ordered set. Convex- hull computation, string matching algorithms, median computation, distributed algorithms.		
	Self-Learning Topics: *Implementation of applications for Stack, Queues, Linked List, Trees and Graph.* ***Learning Outcomes:*** *A learner will be able to* 1. *Choose data structure to solve topology sort of partially ordered set. (P.I.-1.3.1)* 2. *Decide best suitable data structure for convex hull computation. (P.I.-1.4.1)* 3. *Apply various data structure solutions for given problem statement. (P.I.-2.3.2)* 4. *Analyze topology sorting by using different data structures. (P.I.-2.4.3)*		
	Course Conclusion	**01**	
	Total	**45**	

Course Outcomes:
Learner will be able to

1. Determine the principles of algorithms and data structures.
2. Apply theory of linear data structure to solve the real-life problems.
3. Apply the methods of non-linear data structures in real life problem solving.
4. Analyse the concepts of sorting, searching and hashing techniques in real life problem solving.
5. Apply and compare functions of linear and non-linear data structure for complex problem solution.

Performance Indicators:

P.I. No.	P.I. Statement
1.3.1	Apply engineering fundamentals.
1.4.1	Apply theory and principles of computer science engineering to solve an engineering problem.
2.3.2	Identify design constraints for required performance criteria.
2.4.3	Identify the limitations of the solution and sources/causes.

Text Books:

1. Data Structures through C in Depth, S. K Srivastava, Deepali Srivastava, 5th Edition, 2011, BPB Publications.
2. Data Structures Using C by Aaron M Tenenbaum, 1st Edition ,2018, Pearson India.
3. Data Structures using C, Reema Thareja, 2nd Edition, 2011, Oxford.

Reference Books:

1. Fundamentals of Data Structures, Ellis Horowitz, Sartaj Sahni, 5th Edition, 2010, Galgotia Publications.
2. An introduction to data structures with applications, Jean Paul Tremblay, Paul G. Sorenson; 3rd Edition, 1984, Tata McGraw-Hill.
3. Data Structures using C and C++, Rajesh K. Shukla, 2nd Edition, 2009, Wiley India.

Other Resources:

1. NPTEL: Data Structures and Algorithms offered by IIT Delhi
   Web Link- https://archive.nptel.ac.in/courses/106/102/106102064/
2. NPTEL: Data Structures and program methodology by Dr. S.V.Rao offered by IIT Guwahati
   Web Link- https:/nptel.ac.in/courses/106103069

A. IN-SEMESTER ASSESSMENT (50 MARKS)

1. Continuous Assessment (20 Marks)

Suggested breakup of distribution

a) Numerical Assignment/s (Minimum 20 problems) : 05 Marks

b) Class Test based on above numerical assignment: 05 Marks

c) One Flip classroom activity: 05 Marks

d) Regularity and active participation :05 Marks

2. Mid Semester Examination (30 Marks)

Mid semester examination will be based on 40% to 50% syllabus.

B. END SEMESTER EXAMINATION (50 MARKS)

End Semester Examination will be based on syllabus coverage up to the Mid Semester Examination (MSE) carrying 20% to 30% weightage, and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Type	Course Code	Course Name	Credits
PCC	ITPCC304	DATABASE MANAGEMENT SYSTEM	03

Examination Scheme					
Distribution of Marks			Exam Duration (Hrs.)		Total Marks
In-semester Assessment		End Semester Exam (ESE)			
Continuous Assessment	Mid-Semester Exam (MSE)		MSE	ESE	
20	30	50	1.5	2	100

Pre-requisite:

1. ESCLC103: Programming Laboratory-I (C)

Program Outcomes addressed :

1. PO1: Engineering knowledge
2. PO2: Problem analysis
3. PO3: Design/development of solutions

Course Objectives:

Learner is expected to

1. Learn, the basics and the need of database management system.
2. Construct conceptual data model for real world applications
3. Build Relational Model from ER/EER
4. Learn introduce the concept of SQL to store and retrieve data efficiently
5. Demonstrate notions of normalization for database design and Learn with the concepts of transaction processing- concurrency control & recovery

Module	Detailed Contents	Hrs	CO
00.	**Course Introduction** This is foundation course which deals with concepts of Data base management system, which is used in all real time applications for data storage.	**01**	
01.	**Introduction to DBMS** ***Learning Objective/s:*** *Learner is expected to recall the concept of database system architecture and interpret the process of data management.*	**04-05**	CO- 1
	Contents: Introduction, Difference between data and information, Characteristics of Databases, File system v/s Database system, Data abstraction and Physical Data Independence, DBMS system architecture, Database Administrator (DBA), Role of DBA, significance of Relational Database.		
	Self-Learning Topics:		

	Identify the types of Databases.		
	Learning Outcomes : *A learner will be able to* 1. *Summarize the characteristics of database with advantages over file system. (P.I.-1.3.1)* 2. *Classify Level of abstraction. (P.I.- 2.1.1)* 3. *Draw Database system structure. (P.I.- 1.4.1)* 4. *Apply concept of physical data independence (P.I.- 2.1.2)*		
02.	**E-R model** ***Learning Objective/s:*** *Learner is expected to recall and demonstrate the concept of ER model. Also expected to apply the concept of ER model for conceptual design of database.*	**05-07**	CO- 2
	Contents: Conceptual Modeling of a database, The Entity-Relationship (ER) Model, Entity Type, Entity Sets, Attributes and Keys, Relationship Types, Relationship Sets, Weak entity Types. Extended Entity-Relationship (EER) Model: Generalization, Specialization and Aggregation. Design an ER model for real time case study. (e.g. Hospital management system)		
	Self-Learning Topics: *Design an ER model for any real time case study.* ***Learning Outcomes:*** *A learner will be able to* 1. *Identify entity set, relationship set (P.I.- 2.1.1)* 2. *Apply constraints with mapping cardinality. (P.I.- 2.1.2)* 3. *Design ER diagram for real time problem. (P.I.- 3.1.1)* 4. *Design EER diagram for real time problem.(P.I.- 3.1.2)*		
03.	**Introduction to Relational Model** ***Learning Objective/s:*** *Learner is expected to recall and demonstrate the process of conversion of ER into relational model. Also expected apply the process to create a database.*	**05-07**	CO- 2, CO- 3
	Contents: Relational Model Constraints and Relational Database Schemas, Concept of Keys: Primary Kay, Secondary key, Foreign Key, Introduction to Relational Algebra, Relational Algebra expressions for Unary Relational Operations, • Set Theory operations, • Binary Relational operation Relational Algebra Queries, Conversion of ER model in to relational schema by using rules. (e.g. Hospital management system)		
	Self-Learning Topics: *Convert the ER model designed to relational schema by using rules* ***Learning Outcomes :***		

	A learner will be able to 1. *Identify primary key and foreign key. (P.I.-2.1.1)* 2. *Solve relational algebra basic operations. (P.I.-2.1.2)* 3. *Convert ER of a given problem statement into Relational Model (P.I.- 3.1.1)* 4. *Design Relational schema diagram by identifying the requirements of application (P.I.- 3.1.2)*		
04.	**Overview of SQL** ***Learning Objective/s:*** *Learner is expected to recall and illustrate SQL and also expected to build Queries*. **Contents:** Overview of SQL, Data Definition Commands, set operations, aggregate function, null values Data Definition language(DDL), Data Manipulation commands(DML), Data Control commands(DCL), Complex Retrieval Queries using Group by, Recursive Queries, nested Queries, Integrity constraints in SQL, Security and authorization: Grant & Revoke in SQL. Indexing: Basic Concepts, Ordered Indices, Index Definition in SQL Physical design of database for the relational model designed (e.g. Hospital management system) ***Self-Learning Topics:*** *Physical design of database for the relational model designed*. ***Learning Outcomes :*** *A learner will be able to* 1. *Use DDL, DML and DCL commands. (P.I.- 2.1.1)* 2. *Apply integrity constraints (P.I.- 2.1.2)* 3. *Apply integrity and security constraint to a given problem statement. (P.I.- 3.1.1)* 4. *Apply complex queries for retrieval of information as per the requirement of user. (P.I.-3 1.2)*	**11-12**	CO- 4
05.	**Normalization** ***Learning Objective/s:*** *Learner is expected to define and interpret the concept of normalization and also expected to convert the given relation in different normalization forms to remove redundancy.* **Contents:** Design guidelines for relational Schema, Functional Dependencies, Database tables and normalization, the need for normalization, the normalization process, Improving the design, Definition of Normal Forms- 1NF, 2NF, 3NF & The Boyce-Codd Normal Form (BCNF). ***Self-Learning Topics:*** *Consider any real time application and apply normalization up to 3NF/BCNF to remove anomalies.*	**06-08**	CO- 5

	Learning Outcomes: *A learner will be able to* 1. *Identify anomalies of given relation. (P.I.-2.1.1)* 2. *Identify conditions of 1NF,2NF (P.I.-2.1.2)* 3. *Determine conditions of 3NF and BCNF of a given problem statement. (P.I.-3.1.1)* 4. *Convert given relation in different normalization form. (P.I.- 3.1.2)*		
06.	**Transaction** ***Learning Objective/s:*** *Learner is expected to define and illustrate transaction concept, Concurrency Control and Recovery. Also expected to apply the concept to ensure database consistency.* **Contents:** Transaction concept, State Diagram, ACID Properties, Transaction Control Commands(TCL), Concurrent Executions, Serializability – Conflict and View, Concurrency Control: Lock-based-protocols, Deadlock handling Timestamp-based protocols, Recovery System: Shadow Paging Recovery Concepts, Log based recovery. ***Self-Learning Topics:*** *Study the various deadlock situation which may occur for a database designed in module 5* ***Learning Outcomes:*** *A learner will be able to* 1. *Define transaction and its properties (P.I.- 1.3.1)* 2. *Use Identify transaction state diagram. (P.I.-1.4.1)* 3. *Identify problem of concurrency control (P.I.-2.1.1)* 4. *Identify problem of recovery (P.I.-2.1.2)*	**06-08**	CO- 5
	Course Conclusion	**01**	
	Total	**45**	

Course Outcomes :

Learner will be able to

1. Identify the need of Database Management System.
2. Design conceptual model and for real life applications.
3. Create Relational Model for real life applications.
4. Formulate query using SQL commands.
5. Apply the concept of normalization to relational database design and to demonstrate the concept of transaction, concurrency and recover.

Performance Indicators:

P.I. No.	**P.I. Statement**
1.3.1	Apply fundamental engineering concepts to solve engineering problems.
1.4.1	Apply electrical engineering concepts to solve engineering problems.

2.1.1	Evaluate problem statements and identifies objectives
2.3.2	Identify design constraints for required performance criteria.
3.2.1	Ability to explore design alternatives.
3.2.2	Ability to produce a variety of potential design solutions suited to meet functional requirements

Text Books :

1. Database System Concepts, Korth, Slberchatz, Sudarshan , Sixth Edition, 2011, McGraw Hill Education
2. Fundamentals of Database Systems, Elmasri and Navathe, Sixth Edition, 2010, Pearson
3. Database Management Systems, Raghu Ramkrishnan and Johannes Gehrke, ISE Editions, 1997 ,McGraw-Hill Education

Reference Books :

1. Database Systems Design, Implementation and Management , Peter Rob and Carlos Coronel, 9th Edition, 2009, Thomson Learning
2. SQL & PL / SQL for Oracle 11g Black Book, Dr. P. S. Deshpande, ISE Edition, 2011,Dreamtech Press
3. Database Management Systems , G. K. Gupta , 1st edition,2011,McGraw – Hill

Other Resources:

1. NPTEL Course on Database Management system by Prof.P.P.Das, Department of Computer Science and Engineering, IIT Khargpur
   Web link- https://archive.nptel.ac.in/courses/106/105/106105175/
2. Coursera course on Introduction to Relational Databases
   Web link- https://www.coursera.org/learn/introduction-to-relational-databases#modules

A. IN-SEMESTER ASSESSMENT (50 MARKS)

1. Continuous Assessment (20 Marks)

Suggested breakup of distribution

a) One Assignment on live problems/ case studies: 10 Marks

Students should be assigned a real life problem statement (different for each student). Students are expected to research and collect required resources to create a backend for the selected problem. Students should prepare a presentation of 10-15 minutes. This assignment should be graded for 10 marks depending on the parameters as analysis, design, conversion to relational schema and database creation for selected problem statement.

b) One Think Pair Share (TPS) activity: 05 Marks

c) Regularity and active participation :05 Marks

2. Mid Semester Examination (30 Marks)

Mid semester examination will be based on 40% to 50% syllabus.

B. END SEMESTER EXAMINATION (50 MARKS)

End Semester Examination will be based on syllabus coverage up to the Mid Semester Examination (MSE) carrying 20% to 30% weightage, and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Type	Course Code	Course Name	Credits
MDM	ITMDM301	DIGITAL LOGIC DESIGN AND ANALYSIS	03

Examination Scheme					
Distribution of Marks			Exam Duration (Hrs.)		Total Marks
In-semester Assessment		End Semester Exam (ESE)			
Continuous Assessment	Mid-Semester Exam (MSE)		MSE	ESE	
20	30	50	1.5	2	100

Pre-requisite :

1. BSC101 : Engineering Mathematics- I
2. BSC204 : Engineering Mathematics- II

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

Course Objectives :

1. To make learner recall the basic philosophy underlying various number systems, including negative number representation and binary.
2. Guide learner to analyse representation of switching functions using Boolean algebra.
3. To make learner evaluate the effectiveness of different minimization techniques in logic design.
4. To assist learner to create complex logic circuits using combinational and sequential logic design principles.
5. To assist learner to design Logic and switching devices to Construction various digital circuits
6. To equip students with the knowledge and skills required to navigate and contribute to the rapidly evolving landscape of digital logic and its applications in contemporary technology.

Module	Detailed Contents	Hrs	CO
00.	**Course Introduction** Digital logic design and Analysis uses Boolean algebra for creating circuits with diverse implementations, enabling arithmetic and memory elements. Its applications span computing, telecommunications, automation, sensing, and data processing, driving modern technological advancements.	**01**	
01.	**Introduction to Digital System** ***Learning Objective/s:*** *Learner is expected to solve and interpret the basic philosophy of number systems. Also expected to apply the concept of data representation in computer and communication systems for processing, storing and transferring. .*	**08-09**	CO- 1

	Contents: Number representation (Binary, Octa, Dec, Hex numbers and Conversions), synthesis of combinational and sequential logic Numbers Systems. Binary, weighted codes binary coded decimal, non-weighted codes Excess – 3 code, Gray code, Alphanumeric codes – ASCII Code, EBCDIC, ISCII Code, Error detection and correction, Universal Product Code, Code conversion. Binary Arithmetic: Binary addition, Binary subtraction, Negative number representation, Subtraction using 1's complement and 2's complement, Binary multiplication and division, Arithmetic in octal number system, Arithmetic in hexadecimal number system, BCD and Excess – 3 arithmetic ***Self-Learning Topics:*** *Hollerith Code, Morse Code, Teletypewriter (TTY)* ***Learning Outcomes:*** *A learner will be able to* 1. *Apply Conversion between different number systems for given numerical values. (P.I.-1.1.1)* 2. *Apply binary addition and subtraction to solve simple problems. (P.I.-1.3.1)* 3. *Identify the processes involved in code conversion and arithmetic operations in different number systems. (P.I.-2.1.2)* 4. *Interpret mathematical concepts to design an error detection and correction mechanisms. (P.I.-2.4.1)* 5. *Show multiple design solutions for arithmetic circuits in different number systems. (P.I.-3.2.2)* 6. *Determine the correctness and efficiency of code conversion processes through validation. (P.I.-3.4.3)*		
02.	**Boolean algebra and Logic Gates** ***Learning Objective/s:*** *Learner is expected to derive and demonstrate the representation of switching functions using Boolean algebra. Also expected to apply the concept of Boolean algebra to simplify digital circuits used in microprocessors.* **Contents:** Basic and Axiomatic definitions of Boolean algebra, Basic Theorems and properties of Boolean Algebra, Boolean Functions, Logic Operations, Logic Gates, Integrated Circuits. ***Self-Learning Topics:*** *Canonical and Standard Forms.* ***Learning Outcomes :*** *A learner will be able to* 1. *Apply Boolean algebraic operations and theorems to simplify logical expressions. (P.I.-1.1.1)* 2. *Illustrate Boolean algebraic concepts to optimize the performance of digital systems. (P.I.-1.4.1)* 3. *Identify engineering principles and techniques applicable to solving problems in logic design. (P.I.-2.1.3)* 4. *Draw conclusions based on the analysis of Boolean algebraic expressions and logic circuits. (P.I.-2.4.4)* 5. *Examine various logic gates and integrated circuits to fulfill design requirements. (P.I.-3.2.1)*	**06-08**	CO- 2 CO- 3

	6. *Define design objectives and functional requirements for logic circuits. (P.I.-3.2.2)*		
03.	**Simplification of Boolean Functions** ***Learning Objective/s:*** *Learner is expected to illustrate different minimization techniques of logic design. Also expected to interpret and evaluate different minimization techniques of logic design vital for achieving optimal performance, reducing cost.* **Contents:** K-map, Two and Three variable maps, Four variable maps, product of sum simplification, NAND and NOR implementation, Don't Care conditions, Determinant and selection of Prime Implicants. ***Self-Learning Topics:*** *Simplification by Quine-McClusky Method.* ***Learning Outcomes :*** *A learner will be able to* 1. *Analyse and incorporate Don't Care conditions in logic simplification (P.I.-1.3.1)* 2. *Apply Boolean algebraic principles to simplify logic expressions. (P.I.-1.4.1)* 3. *Identify processes for simplifying Boolean expressions using K-maps. (P.I.-2.1.2)* 4. *Define mathematical concepts to simplify Boolean expressions using K-maps. (P.I.-2.4.1)* 5. *Generate multiple design solutions for logic circuit simplification using K-maps. (P.I.-3.2.2)* 6. *Compare design alternatives for logic circuit optimization. (P.I.-3.3.1)* 7. *Identify appropriate procedures and algorithms for simplifying Boolean expressions and implementing logic circuits. (P.I.-4.1.2)* 8. *Interpret data representations to draw conclusions about the optimization of logic circuits. (P.I.-4.3.3)*	**07-08**	CO- 2 CO- 3
04.	**Combinational Logic** ***Learning Objective/s:*** *Learner is expected to know and illustrate the concept of Combinational logic. Also expected to design and analyse complex logic circuits using combinational and sequential logic design principles to produce more complicated switching circuits.* **Contents:** Design Procedure, Adders, Subtractors, Code Conversions, Analysis Procedure, Multilevel NAND and NOR Circuits, Exclusive-OR Circuits, Binary Parallel Adder and Subtractor, Decimal Adder, Magnitude Comparator, Decoders and Encoders, Multiplexers, Read-only-Memory (ROM). ***Self-Learning Topics:*** *Programmable Logic Array (PLA), Programmable Array Logic (PAL).* ***Learning Outcomes :*** *A learner will be able to* 1. *Apply mathematical concepts such as binary arithmetic, Boolean algebra, and code conversions for optimized digital circuit. (P.I.-1.1.1)* 2. *Identify the design principles and operation of digital circuits such as adders, subtractors, encoders, decoders, and multiplexers. (P.I.-1.3.1)*	**06-07**	CO- 4

	3. *Identify parameters and requirements for designing digital modules to solve specific problems. (P.I.-2.1.2)* 4. *Design digital circuits with appropriate applicability to meet system requirements. (P.I.-2.3.1)* 5. *Determine design objectives and functional requirements for digital circuits and systems. (P.I.-3.2.1)* 6. *Draw multiple design solutions for digital circuits such as adders, subtractors, and code converters. (P.I.-3.2.2)* 7. *Analyse different design procedures and algorithms for designing digital circuits. (P.I.-4.1.2)* 8. *Categorize digital circuit characteristics and performance parameters in tabular and graphical forms. (P.I.-4.3.3)*		
05.	**Sequential Logic, Registers and Counters** ***Learning Objective/s:*** *Learner is expected to recall and interpret sequential logic, registers and counters. Also expected design and analyse Logic and switching devices used for construction of various digital circuits to provide memory, timing control, synchronization, state management* **Contents:** Flip-Flops, Triggering of flip-flops, Analysis of clocked sequential circuits, Design with state equations and state reduction table, Introduction to Asynchronous circuits, Circuits with latches. Registers, Shift registers, Ripple Counters, Synchronous Counters, Timing Sequences, The memory. ***Self-Learning Topics:*** *General State Machine Architecture* ***Learning Outcomes :*** *A learner will be able to* 1. *Apply mathematical concepts such as Boolean algebra, state equations, and timing sequences to analyze and design sequential circuits. (P.I.-1.1.1)* 2. *Apply theoretical knowledge of flip-flops, registers, counters, and memory systems to solve engineering problems. (P.I.-1.4.1)* 3. *Apply relevant mathematical concepts such as state equations, triggering of flip-flops, and timing sequences to solve sequential circuit problems. (P.I.-2.3.1)* 4. *Apply engineering mathematics to analyze and design sequential circuits such as flip-flops, registers, and counters. (P.I.-2.4.1)* 5. *Define functional requirements for sequential circuits such as flip-flops, registers, and counters. (P.I.-3.2.1)* 6. *Illustrate multiple design solutions for sequential circuits such as flip-flops, registers, and counters. (P.I.-3.2.2)* 7. *Determine the significance of investigating and solving problems related to flip-flops, registers, counters, and memory systems. (P.I.-4.1.1)* 8. *Select appropriate procedures and algorithms for designing sequential circuits such as flip-flops, registers, and counters. (P.I.-4.1.2)*	**07-09**	CO- 4
06.	**Recent advancements in Digital Logic** ***Learning Objective/s:*** *Learner is expected to apply the knowledge and skills required to navigate and analyse rapidly evolving landscape of digital logic and its applications in contemporary technology.*	**03-04**	CO- 5

	Contents: Qbit Quantum Chip, Neuromorphic Computing, Reconfigurable Logic Devices, Optical Computing logic gates, Memristor-based Computing, Machine learning platform for digital circuit design, 3D Integrated Circuits		
	Self-Learning Topics: *Hardware Security*		
	Learning Outcomes : *A learner will be able to* 1. *Apply discrete structures and linear algebra concepts to analyze and design quantum computing algorithms (P.I.-1.1.1)* 2. *Apply theoretical knowledge to design and analyze reconfigurable logic devices (P.I.-1.4.1)* 3. *Identify processes and algorithms for implementing machine learning techniques in logic design (P.I.-2.1.2)* 4. *Apply engineering mathematics to simulate and optimize neuromorphic computing (P.I.-2.4.1)* 5. *Define operational characteristics and parameters for memristor-based computing systems (P.I.-3.2.1)* 6. *Examine alternative design solutions to meet the functional requirements of optical computing and 3D integrated circuits (P.I.-3.2.2)* 7. *Identify relevant data sets and test cases for validating algorithms in neuromorphic computing (P.I.-4.1.2)* 8. *Show data related to machine learning in logic design in tabular or graphical forms (P.I.-4.3.3)* 9. *Contrast the use of specific tools and techniques for Memristor-based Computing, Machine Learning in Logic Design, and 3D Integrated Circuits (P.I.-5.1.1)* 10. *Demonstrate tools and techniques tailored for Memristor-based Computing, Machine Learning in Logic Design, and 3D Integrated Circuits (P.I.-5.2.2)*		
	Course Conclusion	**01**	
	Total	**45**	

Course Outcomes :

1. Identify various types of number systems and their conversions.
2. Construct the Boolean expressions and apply the Boolean theorems through logical gates
3. Apply knowledge of Boolean algebra and other minimization techniques for digital circuit design.
4. Demonstrate and Analyse the construction of programmable logic devices and different types of sequential circuits.
5. Explore emerging technologies, their principles and potential applications in streamlined digital circuit design

Performance Indicators:

P.I. No.	**P.I. Statement**
1.1.1	Apply mathematical techniques such as calculus, linear algebra, and statistics to solve problems

1.3.1	Apply engineering fundamentals.
1.4.1	Apply theory and principles of computer science engineering to solve an engineering problem
2.1.2	Identifies processes/modules/algorithms of a computer based system and parameters to solve a problem.
2.1.3	Identifies mathematical algorithmic knowledge that applies to a given problem.
2.3.1	Able to apply computer engineering principles to formulate modules of a system with required applicability and performance
2.4.1	Applies engineering mathematics to implement the solution.
2.4.4	Arrive at conclusions with respect to the objectives.
3.2.1	Ability to explore design alternatives
3.2.2	Ability to produce a variety of potential design solutions suited to meet functional requirements.
3.3.1	Ability to perform systematic evaluation of the degree to which several design concepts meet the criteria.
3.4.3	Ability to verify the functionalities and validate the design.
4.1.1	Define a problem for purposes of investigation, its scope and importance
4.1.2	Ability to choose appropriate procedure/algorithm, data set and test cases.
4.3.3	Represent data (in tabular and/or graphical forms) so as to facilitate analysis and explanation of the data, and drawing of conclusions
5.1.1	Identify modern engineering tools, techniques and resources for engineering activities
5.2.2	Demonstrate proficiency in using discipline specific tools

Text Books :

1. Digital Design, M. Morris Mano and Michael D. Ciletti, 6th Edition, 2018, Pearson Education
2. Digital Systems; Principles and Applications. Tocci, Widmer & Moss. 10th Edition, 2007, Pearson Prentice Hall
3. Modern Digital Electronics, R P. Jain, Kishor Sarawadekar, 5th Edition, 2022, McGraw Hill India
4. Schaum's Outline Of Digital Principles, Roger L. Tokheim, 3rd Edition, 2020, McGraw Hill

Reference Books :

1. Fundamentals of Digital Circuits, A. Anand Kumar, 2nd Edition, 2016, PHI Learning
2. Digital Logic Design- A Complete Overview, Code Xtracts, 2023, by Mocktime Publication

Other Resources :

1. NPTEL Course: Digital Systems Design, Prof. D. Roychoudhury, Department of Electronics & Electrical Communication Engineering, IIT Kharagpur,
   Web link- https://nptel.ac.in/courses/117105080
2. NPTEL Course: Digital System Design, Prof. Neeraj Goel, Department of Computer Science and Engineering at IIT Ropar, Web link- https://archive.nptel.ac.in/courses/108/106/108106177/

3. NPTEL Course: Embedded System Design With ARM, Indranil Sengupta, Computer Science and Engineering, IIT Kharagpur, Web link- https://onlinecourses.nptel.ac.in/noc22_cs93/preview

A. IN-SEMESTER ASSESSMENT (50 MARKS)

1. Continuous Assessment (20 Marks)

Suggested breakup of distribution

a) One MCQ Test as per GATE exam pattern / level: 05 Marks

b) One Class Test:05 Marks

c) One Open Notes Test: 05 Marks

d) Regularity and active participation :05 Marks

2. Mid Semester Examination (30 Marks)

Mid semester examination will be based on 40% to 50% syllabus.

B. END SEMESTER EXAMINATION (50 MARKS)

End Semester Examination will be based on syllabus coverage up to the Mid Semester Examination (MSE) carrying 20% to 30% weightage, and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Type	Course Code	Course Name	Credits
LC	ITLC301	DATA STRUCTURES LABORATORY	01

Examination Scheme		
Continuous Assessment	**End Semester Exam (ESE)**	**Total**
25	25	50

Pre-requisite:

1. ESCLC103: Programming Laboratory-I (C)

Program Outcomes addressed:

1. PO1: Engineering Knowledge
2. PO2: Problem analysis
3. PO3: Design/Development of Solution

Course Objectives:

1. To introduce learners with the use of data structures and algorithm analysis.
2. To instruct learners about creating complex data structures via basic programming concepts.
3. To train learners about creating realistic implementation of linked lists, stacks, and queues.
4. To guide learners in the actual use of various tree and graph types.
5. To provide knowledge to learners on how to develop searching, hashing, and sorting algorithms.
6. To prepare students to use linked lists, stacks, queues, trees, and graphs to complicated problems.

Module	Detailed Contents	Hrs	CO
00.	**Course Introduction** This course is intended to teach the design and analysis of basic data structures and their implementation in an object-oriented language. The data structures concepts are increasingly becoming the default choice of the IT industry especially industries involved in software development at system level.		
01.	**Introduction of basic data structures** ***Learning Objective/s:*** *Learner is expected to apply unions, pointers, 1D arrays, and structures to solve a given problem.* **Task 1:** WPC for demonstration of nested structures using function for student having name, id, marks [3]. Demonstrate the structure for 10 students. **Task 2:** Demonstrate pointers and character array. ***Self-Learning Topics:*** *Pointer implementation of all integrated data types.* ***Learning Outcomes:***	**04**	CO- 1

	A learner will be able to 1. *Compile and execute C program on Ubuntu OS using CLI. (P.I.-1.3.1)* 2. *Code array as 1D and 2D data structure. (P.I.-1.4.1)* 3. *Implement linear search using 1D-array. (P.I.-2.2.3)* 4. *Identify the capability of 16bit and 32bit machine to use integer data type. (P.I.-2.3.1)* 5. *Use 2D array for mathematical matrix operation. (P.I.- 3.4.2)* 6. *Compare the mythology using array and structures. (P.I.- 3.4.3)*		
02.	**Design and Implementation of Linear DS** ***Learning Objective:*** *Learner is expected to apply linear data structures and their application in fixed-size scenarios through the use of arrays.* **Task 3:** Write menu driven program to implement static stack with push, pop, peek and display functions of it. **Task 4:** Write menu driven program to implement static queue and circular queue of size 10 with insert, delete, peek and display functions of it. ***Self-Learning Topics:*** *Implement character stack, stack applications.* ***Learning Outcomes:*** *A learner will be able to* 1. *Restate the principle of stack and queue data structure. (P.I.-1.3.1)* 2. *Apply concept of array to implement functions of stack data structure. (P.I.-1.4.1)* 3. *Use array to design functions of queue data structure. (P.I.-2.2.3)* 4. *Identify and implement static applications at system level. (P.I.-2.3.1)* 5. *Implement evaluation and conversion of Infix, prefix, postfix expression. (P.I.-3.4.2)* 6. *Define problem and find solution using various data structures. (P.I.- 3.4.3)*	**06**	CO- 2
03.	**Design and Implementation of Non-Linear DS** ***Learning Objective:*** *Learners is expected to comprehend the primary advantage of linked lists compared to arrays and be proficient in using dynamic memory allocation.* **Task 5:** Implementation of singly linked list data structure with given function. **Task 6:** Implementation of doubly linked list data structure with given function. ***Self-Learning Topics:*** *Study and implement header linked list.* ***Learning Outcomes:*** *A learner will be able to* 1. *Use of dynamic data memory allocation for implementation. (P.I.-1.3.1)* 2. *Illustrate the concept and principle of linked list data structure. (P.I.-1.4.1)* 3. *Design the LL with various functions and compare with other type. (P.I.-2.2.3)* 4. *Apply the concept of LL in real time applications. (P.I.-2.3.1)* 5. *Model the application using LL data structure (P.I.- 3.4.2)* 6. *Demonstrate the LL for system and kernel level functions. (P.I.- 3.4.3)*	**08**	CO- 2

04.	**Design and implementation of graph and tree** ***Learning Objective:*** *Learner is expected to understand computer file systems and business organizational chart tree structures and implement graph data structures.* **Task 7:** Implement binary tree using insertion and deletion of node. **Task 8:** Implement tree traversal for in-order, preorder and post-order types. **Task 9:** Write program to implement adjacency matrix of graph. **Task 10:** Implement BFS and DFS traversal of graph. ***Self-Learning Topics:*** *Implement 2-3, and B and B+ tree mechanism and graph algorithms.* ***Learning Outcomes:*** *A Learner will be able to* 1. *Execute the code for tree data structure. (P.I.-1.3.1)* 2. *Identify use of 2D array to design graph. (P.I.-1.4.1)* 3. *Compare BFS and DFS traversal of graph. (P.I.-2.2.3)* 4. *Identify the real time application of Graph for Map optimization. (P.I.-2.3.1)* 5. *Explore various shortest path algorithms. (P.I.- 3.4.2)* 6. *Demonstrate system level functions implementation using tree data structures. (P.I.- 3.4.3)*	**04**	CO-3
05	**Design of searching and sorting** ***Learning Objectives:*** *Learner is expected to apply linear data structures and their application in fixed-size scenarios through the use of arrays.* **Task 11:** Write program to implement linear and binary search. **Task 12:** Write program using recursion for implementation of quick sort. **Task 13:** Write program for implementation of insertion/ selection sort. ***Self-Learning Topics:*** *Learn to code shell and bucket sort.* ***Learning Outcomes:*** *A learner will be able to* 1. *Calculate the time complexity of linear and binary search. (P.I.-1.3.1)* 2. *Code the searching functions. (P.I.-1.4.1)* 3. *Identify various sorting mechanisms (P.I.-2.2.3)* 4. *Apply any two types of sorting methods on given set of data. (P.I.-2.3.1)* 5. *Determine and analyze time complexity of searching and sorting above methods. (P.I.- 3.4.2)* 6. *Identify best method of sorting for large set of data. (P.I.- 3.4.3)*	**04**	CO-4
06.	**Implementation of applications of Data structures**	**04**	CO-5

	Learning Objective: *Learner is expected to implement complex problems using data structures and algorithms, and analysing data structures inside data management models* **Task 14:** WPC using stack data structure for infix to postfix algorithm. **Task 15:** Implementation of Josephus Problem using circular linked list. **Task 16:** Implementation of hashing functions with different collision resolution techniques.		
	Self-Learning Topics*:* *Study advanced data structures for real time problems.* ***Learning Outcomes:*** 1. *Study various complex problem in data management and retrieval. (P.I.-1.3.1)* 2. *Select the data structure to implement the solution of problem. (P.I.-1.4.1)* 3. *Analyze the working and use various data structure for real world problem. (P.I.-2.2.3)* 4. *Compare the use of stack and queue for various applications. (P.I.-2.3.1)* 5. *Compare the solution of specific problem by using more than one data structure. (P.I.- 3.4.2)* 6. *Model the collision resolution for large set of data and find computational speedup on available resources. (P.I.- 3.4.3)*		
	Minimum 2 tasks from each module, and total at least 12 tasks		
	Total	**30**	

Course Outcomes:

Learner will be able to

1. Design and use the basic concepts and principles of various data types.
2. Implement the concepts of the methods of Linear data structures.
3. Design and implement various functions of tree and graph.
4. Design the concepts and compare the techniques of searching, hashing and sorting.
5. Apply and examine the methods of linked lists, stacks, queues, trees and graphs to solve complex problems.

Performance Indicators:

P.I. No.	P.I. Statement
1.3.1	Apply engineering fundamentals
1.4.1	Apply theory and principles of computer science engineering to solve an engineering problem.
2.2.3	Identify existing solution/methods to solve the problem, including forming justified approximations and assumptions.
2.3.1	Able to apply computer engineering principles to formulate modules of a system with required applicability and performance.
3.4.2	Ability to implement and integrate the modules.
3.4.3	Ability to verify the functionalities and validate the design.

Text Books:

1. Data Structures through C in Depth, S. K Srivastava, Deepali Srivastava, 5th Edition, 2011, BPB Publications.
2. Data Structures Using C by Aaron M Tenenbaum, 1st Edition 2018, Pearson India.
3. Data Structures using C, Reema Thareja, 2nd Edition, 2011, Oxford.

Reference Books:

1. Fundamentals of Data Structures, Ellis Horowitz, Sartaj Sahni, 5th Edition, 2010, Galgotia Publications.
2. An introduction to data structures with applications, Jean Paul Tremblay, Paul G. Sorenson; 3rd Edition, 1984, Tata McGraw-Hill.
3. Data Structures using C and C++, Rajesh K. Shukla, 2nd Edition, 2009, Wiley India.

Other Resources:

1. NPTEL: Data Structures and Algorithms offered by IIT Delhi
   Web Link- https://archive.nptel.ac.in/courses/106/102/106102064/
2. NPTEL: Data Structures and program methodology by Dr. S.V.Rao offered by IIT Guwahati
   Web Link- https:/nptel.ac.in/courses/106103069

A. CONTINUOUS ASSESSMENT (25 MARKS)

Suggested breakup of distribution

a) Task Execution :10 Marks

Students will be given minimum 12 tasks based on list as per mentioned in the syllabus. Each task carries 10 Marks. Average will be taken of all tasks. Students are expected to execute the program for given task with respect to given data structure, also expected to perform searching & sorting operations on given dataset. Students will be evaluated based on logic building for the given task and expected output.

b) Practical Test: 10 Marks

Students will be given task (different for each student) and they will be evaluated based on the parameters mentioned in continuous assessment.

c) Regularity & Active participation: 05 Marks

B. END SEMESTER EXAMINATION (Practical and Oral Exam) (25 Marks)

Suggested breakup of distribution

a) Task Execution: 10 Marks

Students will be given task (different for each student) and they will be evaluated based on the parameters mentioned in continuous assessment.

b) Results and discussion, Inferences drawn based on above task: 05 Marks

c) Oral based on entire syllabus :10 Marks

Two examiners, one Internal and one External will do the evaluation.

Course Type	Course Code	Course Name	Credits
LC	ITLC302	SQL LABORATORY	01

Examination Scheme		
Continuous Assessment	**End Semester Exam (ESE)**	**Total**
25	25	50

Pre-requisite :

1. ESCLC103 : Programming Laboratory-I (C)

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 team work
6. PO10: Communication
7. PO11: Project management and finance
8. PO12: Life-long learning

Course Objectives:

Learner is expected to

1. Identify and define problem statements for real life applications
2. Construct conceptual data model for real life applications
3. Build Relational Model from ER/EER and demonstrate usage of relational algebra and apply SQL to store and retrieve data efficiently
4. Apply the concepts of transaction processing- concurrency
5. Implement database connectivity

Module	Detailed Contents	Hrs	CO
00.	**Course Introduction** This is foundation course which deals with fundamental concepts of SQL to store, update, remove, search, and retrieve information from the database and it is used in all real time applications for management of data.		
01.	**Notation of ER and Extended ER diagram, Mapping the ER and EER Model to the Relational Model** ***Learning Objective/s:***	**08**	CO- 1

	Learner is expected to gain knowledge of ER, Extended ER diagram to demonstrate conceptual design of database and expected to implement it *Learner is expected to define and interpret rules of conversion of ER into relational model to implement a table in a database. Also expected to analyze it for real time application* **Task 1:** Identify real world problem and develop the problem statement. Design an Entity-Relationship (ER) / Extended Entity-Relationship (EER) Model **Task 2:** Mapping ER/EER to Relational schema model for task 1.		
	Learning Outcomes: *A learner will be able to* 1. *Recall notation of ER diagram(P.I.-1.3.1)* 2. *Identify entity set, relationship set (P.I.- 2.1.1)* 3. *Use primary key, foreign key and mapping cardinality constraints. (P.I.- 2.3.2)* 4. *Identify relation between entity. (P.I.-1.4.1)* 5. *Design ER and EER diagram. (P.I.-3.1.2)* 6. *Convert ER into Relational model. (P.I.- 3.1.1)*		
02.	**Data Definition Commands, Data Manipulation commands, Data Control commands**, **Complex SQL queries** ***Learning Objective/s:*** *Learner is expected to list and identify Data Manipulation commands to implement data manipulation in database for real time application* *Learner is expected to define and apply Data Control commands to assign authorization to the database user as per their role and implement it for real time application* *Learner is expected to acquire knowledge and demonstrate retrieval of information as per requirement of organization and implement it for real time application* **Task 3:** Create a database using DDL and apply integrity constraints. **Task 4:** Perform data manipulations operations on populated database. **Task 5:** Perform Authorization using Grant and Revoke. **Task 6:** Implement Basic and complex SQL queries	**12**	CO- 2, CO- 3
	Learning Outcomes: *A learner will be able to* 1. *Create table by using SQL. (P.I.-2.1.1)* 2. *Apply integrity constraints by using SQL. (P.I.-2.3.2)* 3. *Apply Add, delete and update operation in the table by using SQL parameters. (P.I.-3.1.1)* 4. *Create database user(P.I.-3.1.1)* 5. *Use Grant command to give authorization as per roles assigned(P.I.-3.1.2)* 6. *Use Revoke command to give authorization as per roles assigned (P.I.- 5.1.1)* 7. *Implement basic queries(P.I.-5.1.2)* 8. *Implement basic complex queries(P.I.-5.2.2)*		
03.	**Views and Triggers** ***Learning Objective/s:***	**02**	CO- 4

	Learner is expected to define and demonstrate Views and Triggers to provide access to the required data only and implement it for real time application. **Task 7 :** Implementation of Views and Triggers real time application ***Learning Outcomes:*** *A learner will be able to* 1. *Summarize view (P.I.-2.3.2)* 2. *Write syntax of view (P.I.-2.1.1)* 3. *Create view for real time application (P.I.- 5.1.1)* 4. *Summarize trigger(P.I.-3.1.2)* 5. *Write trigger. (P.I.-3.1.1)* 6. *Create trigger for real time application(P.I.-5.1.2)* 7. *Define Materialized view (P.I.-1.3.1)* 8. *Differentiate view and materialized view. (P.I.-1.4.1)*		
04	**Transaction control Language, Functions and procedures, Database Programming , Mini project on real time problem** ***Learning Objective/s:*** *Learner is expected to define and demonstrate Views and Triggers to provide access to the required data only and implement it for real time application. Learner is expected to define and demonstrate Transaction Control Language to use commit and rollback command to save tables in databases and implement it for real time application* **Task 8:** Execute TCL commands for real time application **Task 9:** Implement functions and procedures in SQL **Task 10:** Demonstrate database connectivity for real time application **Mini Project:** Student will select any real life example and apply all the learned techniques of DBMS to store, update, remove, and retrieve information from the database. ***Learning Outcomes:*** *A learner will be able to* 1. *Use commit (P.I.-1.4.1)* 2. *Use Rollback Save point. (P.I.-1.4.1)* 3. *Use Rollback Save point. (P.I.-1.4.1)* 4. *Summarize functions(P.I.-5.1.1)* 5. *Summarize procedure(P.I.-5.1.2)* 6. *Create functions and procedures in SQL(P.I.-3.1.2)* 7. *Demonstrate database connectivity using JDBC for real time application(P.I.-3.1.1)* 8. *Implement real time database for any given problem statement (P.I.-12.2.2).* 9. *Collect requirement from all stockholder (P.I.-2.3.2,9.4.1)* 10. *Define problem statement without conflict (P.I.-2.1.1,9.5.1)* 11. *Communicate requirement among group members(P.I.-10.1.1)* 12. *Distribute project work as per expertise(P.I.-10.1.2)* 13. *Execute activities as per plan(P.I.-1.3.1,11.3.1)* 14. *Follow deadline of each activity (P.I.- 11.3.2)*	**08**	CO- 1, CO- 2, CO- 3, CO- 4, CO- 5
	Total	**30**	
Total 10 tasks and 1 mini project			

Course Outcomes:

Learner will be able to

1. Define problem statement and Construct the conceptual model for real life application
2. Create and populate a RDBMS using SQL
3. Formulate and write SQL queries for efficient information retrieval
4. Apply view, triggers and procedures to demonstrate specific event handling
5. Demonstrate database connectivity and Demonstrate the concept of concurrent transactions.

Performance Indicators:

P.I. No.	P.I. Statement
1.3.1	Apply engineering fundamentals
1.4.1	Apply theory and principles of computer science engineering to solve an engineering problem
2.1.1	Evaluate problem statements and identifies objectives
2.3.2	Identify design constraints for required performance criteria.
3.1.1	Able to define a precise problem statement with objectives and scope
3.1.2	Able to identify and document system requirements from stake holders
5.1.1	Identify modern engineering tools, techniques and resources for engineering activities
5.1.2	Create/adapt/modify/extend tools and techniques to solve engineering problems
9.4.1	Recognize a variety of working and learning preferences; appreciate the value of diversity on a team
9.5.1	Demonstrate effective communication, problem solving, conflict resolution and leadership skills
10.1.1	Read, understand and interpret technical and nontechnical information
10.1.2	Produce clear, well-constructed, and well-supported written engineering documents
11.3.1	Identify the tasks required to complete an engineering activity, and the resources required to complete the tasks
11.3.2	Use project management tools to schedule an engineering project so it is completed on time and on budget
12.2.2	Recognize the need and be able to clearly explain why it is vitally important to keep current regarding new developments in your field

Text Books :

1. Database System Concepts, Korth, Slberchatz, Sudarshan , Sixth Edition, 2011, McGraw Hill Education
2. Fundamentals of Database Systems, Elmasri and Navathe, Sixth Edition, 2010, Pearson
3. Database Management Systems, Raghu Ramkrishnan and Johannes Gehrke, ISE Editions, 1997 ,McGraw-Hill Education

Reference Books :

1. Database Systems Design, Implementation and Management , Peter Rob and Carlos Coronel, 9th Edition, 2009, Thomson Learning
2. SQL & PL / SQL for Oracle 11g Black Book, Dr. P. S. Deshpande, ISE Edition, 2011,Dreamtech Press
3. Database Management Systems , G. K. Gupta , 1st edition,2011,McGraw – Hill

Other Resources :

1. NPTEL Course on Database Management system by Prof.P.P.Das, Department of Computer Science and Engineering, IIT Khargpur
   Web link- https://archive.nptel.ac.in/courses/106/105/106105175/
2. Coursera course on Introduction to Relational Databases
   Web link- https://www.coursera.org/learn/introduction-to-relational-databases#modules

A. CONTINUOUS ASSESSMENT (25 MARKS)

Suggested breakup of distribution

a) Task Execution :10 Marks

Students will be given 10 tasks based on list as per mentioned in the syllabus. Each task carries 10 Marks. Average will be taken of all tasks. Students are expected to formulate problem statement, create relational schema, implement relational schema by using constraints and retrieve required information. Students will be evaluated based on logic building for the selected problem, rectification of syntax errors and expected output.

b) Mini Project Evaluation: 10 Marks

A group of 3-4 students should be assigned a real life problem statement. Students are expected to research and collect required resources to create a frontend and backend for the selected problem. Students should prepare a presentation/problem solving of 10-15 minutes. This project should be graded for 10 marks depending on the parameters as analysis, design, conversion to relational schema, database creation and implementation for selected problem statement.

c) Regularity & Active participation: 05 Marks

B. END SEMESTER EXAMINATION (Practical and Oral Exam) (25 Marks)

Suggested breakup of distribution

a) Task Execution: 10 Marks
   Students will be given task (different task for every student) and will be evaluated as per the parameters mentioned in continuous assessment.
b) Results and discussion, Inferences drawn from the above task: 05 Marks
c) Oral based on entire syllabus :10 Marks

Two examiners, one Internal and one External will do the evaluation.

Course Type	Course Code	Course Name	Credits
SBL	ITSBL301	PYTHON LABORATORY	02

Examination Scheme		
Continuous Assessment	**End Semester Exam (ESE)**	**Total**
50	50	100

Pre-requisite :

1. ESCLC103- Programming Laboratory-I (C)
2. ESCLC205- Programming Laboratory-II (Java)

Program Outcomes addressed :

1. PO 1: Engineering knowledge
2. PO 2: Problem analysis
3. PO 3: Design/Development of Solutions
4. PO 5: Modern tool usage
5. PO 9: Individual and team work
6. PO 10: Communication

Course Objectives :

1. To provide basics of python programming including data types, operator, conditional statements, looping statements, input, and output functions in Python
2. To impart knowledge of advanced data types of python programming.
3. To inculcate knowledge of object oriented programming concepts in python.
4. To impart with concepts of modules, packages, multithreading and exception handling.
5. To acquaint learner with File handling, GUI & database programming.
6. To impart knowledge of data visualization using Matplotlib, Data analysis using Pandas and Web programming using Flask/Django.

Module	Detailed Contents	Hrs	CO
00.	**Course Introduction** This course provides programming concepts of python from basics to advanced concepts. Design and write fully functional Python programs using commonly used data structures, custom functions, and reading and writing to files overview of oops concepts. provides basics of creating modules, packages and importing packages and provides fundamentals of GUI designing, database connectivity and web programming, data visualization an analysis. These concepts are essential for developing skill sets to work in the field of data science.	**01**	
01.	**Basics of python and introductions to advanced data types, strings and special functions .**	**11**	CO- 1

	Learning Objective/s: *Learner is expected to infer and apply regular programming constructs to write python programs.* *Learner is expected to illustrate and use advanced data types in python for defining an ordered and unordered collections.* *Learner is expected to summarize string functions and special functions for code optimization.*		
	Contents: Basics of Python: Variables, operators, control structures, conditional structures, functions, lists, tuples, set, dictionary and its built in functions strings and its built in functions, map reduce and filter function. **Task 1:** Choose any problem statement for example to find rank of student. Add methods/functions to add and display details of the student like Name, Roll No and Grade. **Task 2:** Use advanced data types to store students detailed information and perform built in operations. **Task 3:** Use Map function to find grade of a student from the set of iterables and filter function to list all students whose grade is "A".		
	Self-Learning Topics: *Decorators, iterators, generator functions* ***Learning Outcomes :*** *A learner will be able to* 1. *Use variables, operators, control and conditional structures to write program in python. (P.I.-1.3.1)* 2. *Apply Map and reduce functions to solve and execute a given program in python. (P.I.-1.4.1)* 3. *Identify various built-in operations of advanced data types that applies to a given problem. (P.I.-2.1.2)* 4. *Use dictionary to implement key value pair elements for storing data of any type (P.I.-2.2.3)* 5. *Use functions and loops in python to modularize and explore design alternatives. (P.I.-3.2.1)* 6. *Implement string built in functions to meet functional requirements to write a program in python. (P.I.-3.2.2)*		
02.	**Object oriented programming concepts in python** ***Learning Objective/s:*** *Learner is expected to summarize and apply basic concepts of object-oriented programming in python to make code more reusable and easier to work with larger programs.*	**12**	CO- 2
	Contents:		
	Overview of Object -oriented programming, creating classes and objects, self-Variable, constructors, operator overloading, method overloading Inheritance: Types of Inheritance (Single, Multiple, Multi -level, Hierarchical) constructors in inheritance, method overriding, abstract class, abstract method, interfaces in python.,		

	Task 4: Create a Teacher class to add details of the teachers their subject to respective class and display details using methods. **Task 5:** Create student child classes to inherit properties from the Teacher class and demonstrate method overriding in the child class.		
	Self-Learning Topics: *Single Responsibility Principle (SRP), Open/Closed Principle (OCP).* ***Learning Outcomes :*** *A learner will be able to* 1. *Define class and declare member variables, use constructors to initialize variables (P.I.-1.3.1)* 2. *Use multi-level inheritance to solve a problem of code reusability. (P.I -1.4.1).* 3. *Identify methods to be added to the class and access it using object of class. And a way to achieve run time polymorphism. (P.I -2.1.2)* 4. *Implement operator overloading in python. (P.I - 2.2.3)* 5. *Identify alternative for abstraction using interfaces. (P.I - 3.2.1)* 6. *Apply method overloading to implement and integrate the modules. (P.I -3.2.2)*		
03.	**Introduction to modules, packages, exception handling multithreading in python.** ***Learning Objective/s:*** *Learner is expected to paraphrase and implement the concepts of user defined and built in modules and packages that are useful for code modularization, code reusability*. *Learner is expected to infer and use multi-threading and exception handling in python and write own exceptions.*	**12**	CO- 3
	Contents: Modules: Writing modules, importing objects from modules, python built -in modules. SciPy: Linear algebra functions using Numpy and Scipy Packages: creating user defined packages and importing packages. Multi -threading: creating threads in python, exception handling: Compile time errors, Runtime errors, exceptions, types of exception, try statement, except block, raise statement, assert statement, user -defined exceptions. **Task 6:** Create a module by name Calculate_Grade and add the code of student grade calculation there and import it. **Task 7:** Create a package and add all the methods created in previous experiments and import that package in another file. **Task 8:** Create two threads by name display students details and calculate grade and add exception handling to handle name error and type errors.		
	Self-Learning Topics: *Study of media related modules in python.*		

	Learning Outcomes : *A learner will be able to* 1. *Use numpy module to create single and multidimensional arrays. (P.I- 1.3.1)* 2. *Apply scipy module to solve algebraic equations. (P.I -1.4.1)* 3. *Identify and write user defined exception for a given problem. (P.I -2.1.2).* 4. *Use scipy module to find determinant and inverse of matrix. (P.I -2.2.3)* 5. *Create your own module and implement it in another file. (P.I -3.2.1)* 6. *Implement user defined packages to achieve code modularity in programming. (P.I-3.4.2).* 7. *Identify tools run modules and packages in python. (P.I -5.1.1)* 8. *Use tool to implement python program for creating modules and packages. (P.I-5.1.2)*		
04.	**File handling and designing graphical user interface in python** ***Learning Objective/s:*** *Learner is expected to summarize and implement basics of File handling in Python.* *Learner is expected to summarize and create backend databases and connect GUI with databases to perform CRUD operations.*	**10**	CO- 4
	Contents: Graphical user interface (GUI): different GUI tools in python (Tkinter, PyQt) Working with containers, Canvas, Frame, Widgets(Button, Label, Text, Scrollbar, Check button, Radio button, Entry, Spinbox, Message etc.) Connecting GUI with databases to perform CRUD operations. (on supported databases like SQLite, MySQL, PostgreSQL) **Task 9:** Design student registration form using TKinter/PyQT. **Task 10:** Create a database to store student information using SQLite/MYSQL connect to frontend and display the result of student on a button click and perform CRUD operations on student database.		
	Self-Learning Topics: *Design GUI using Kivy, MongoDB database* ***Learning Outcomes :*** *A learner will be able to* 1. *Use basics of Tkinter to add widgets to a layout. (P.I -1.3.1)* 2. *Apply properties of widgets using TKinter to handle events. (P.I.-1.4.1)* 3. *Identify the required database to be installed according to the problem. (P.I-2.1.2)* 4. *Use PyQt to design a GUI for the given problem. (P.I -2.2.3)* 5. *Create a database using SQLite according to the given problem statement. (P.I-3.2.1)* 6. *Perform and integrate CRUD operations in python. (P.I -3.4.2)* 7. *Identify tools to install SQLite, MySQL. (P.I -5.1.1)* 8. *Use tool to implement python program to create database and perform CRUD operations. (P.I -5.1.2)*		
05.	**Data Visualization, analysis and web programming in python** ***Learning Objective/s:***	**14**	CO-5

	Learner is expected to infer concepts of data visualization and analysis of data using matplotlib and pandas. *Learner is expected infer skills of web programming using Flask/Django framework.*		
	Content: Visualization using Matplotlib: working with plots (line plot, bar graph, histogram, scatter plot, area plot, pie chart etc.), working with multiple figures. Data manipulation and analysis using Pandas: Introduction to Pandas, importing data into Python, series, data frames, indexing data frames, basic operations with data frame, filtering, combining and merging data frames, removing duplicates. Web programming using Flask, Django, **Task 11:** Draw bar chart to display number of girls and boys using matplotlib from the student database. **Task 12:** Draw pie chart to display analysis of student results using matplotlib. **Task 13 :** Use Pandas for data manipulation and analysis of student data.		
	Self-Learning Topics: *API essentials in python, pygame tool* ***Learning Outcomes:*** *A learner will be able to* 1. *Use matplotlib library to draw simple line graph. (P.I -1.1.1)* 2. *Apply basics of pandas to create dataframe. (P.I -1.3.1)* 3. *Identify which graph to plot using matplotlib for a given problem. (P.I -2.1.2)* 4. *Use pandas to import csv file and analyze a given dataset. (P.I -2.4.2)* 5. *Design and present individually web application using flask/Django . (P.I -3.1.1,9.1.1,9.2.1,10.1.2,10.1.3)* 6. *Ability to identify various ways of cleaning data using pandas. (P.I -3.2.2)* 7. *Identify tools to install matplotlib and pandas. (P.I -5.1.1)* 8. *Use tool to implement python program to create a dataframe. (P.I -5.1.2)*		
	Total	**60**	
Minimum 02 tasks from each module, and total at least 10 tasks			

Course Outcomes :

Learner will be able to

1. Apply basic concepts of structure, syntax, and semantics of the Python language and use advanced data types and functions in python.
2. Apply the concepts of object-oriented programming as used in Python
3. Create Python applications using modules, packages, multithreading and exception handling.
4. Implement File Handling and create GUI applications and perform database operations in Python.
5. Develop cost-effective robust applications using the latest Python trends and technologies

Performance Indicators:

P.I. No.	P.I. Statement
1.1.1	Apply the knowledge of discrete structures, linear algebra, statistics and numerical techniques to solve problems
1.3.1	Apply engineering fundamentals
1.4.1	Apply theory and principles of computer science engineering to solve an engineering problem
2.1.2	Identifies processes/modules/algorithms of a computer-based system and parameters to solve a problem
2.2.3	Identify existing solution/methods to solve the problem, including forming justified approximations and assumptions
2.4.2	Analyze and interpret the results using contemporary tools.
3.1.1	Able to define a precise problem statement with objectives and scope.
3.2.1	Ability to explore design alternatives.
3.2.2	Ability to produce a variety of potential design solutions suited to meet functional requirements.
3.4.2	Ability to implement and integrate the modules.
5.1.1	Identify modern engineering tools, techniques and resources for engineering activities .
5.1.2	Create/adapt/modify/extend tools and techniques to solve engineering problems.
9.1.1	Recognize a variety of working and learning preferences; appreciate the value of diversity on a team
9.2.1	Demonstrate effective communication, problem solving, conflict resolution and leadership skills
10.1.2	Produce clear, well-constructed, and well-supported written engineering documents
10.1.3	Create flow in a document or presentation - a logical progression of ideas so that the main point is clear

Books:

1. Introduction to computing and problem-solving using python, E Balagurusamy, First Edition,2017, McGraw Hill Publication.
2. Python Programming Using Problem Solving Approach, Reema Thareja, Second Edition, 2023, Oxford University. Press.
3. Python: The Complete Reference, Martin C. Brown, Fourth Edition, 2018, McGraw-Hill Publication.

Reference Books:

1. Headfirst Python- A Brain Friendly Guide, Paul Barry, 2nd Edition,2016, O'Reilly Media, Inc.
2. Problem Solving and Python Programming, Arockia Mary P, Kindle Edition,2021, Shanlax Publications.

Other Resources :

1. NPTEL Course: The Joy of Computing using Python, By Prof. Sudarshan Iyengar, Department of Computer Science and Engineering, IIT Ropar :-Web link- https://nptel.ac.in/courses/106106182/

2. NPTEL Course: Python for Data science By Prof. Ragunathan Rengasamy, Department of Computer Science and Engineering, IIT Madras :-Web link- https://archive.nptel.ac.in/courses/106/106/106106212/

3. Web link-https://www.w3schools.com/python/

4. Web link-https://www.geeksforgeeks.org/python-programming-language/

5. Web link-https://www.javatpoint.com/python-tutorial

A. IN-SEMESTER ASSESSMENT (50 MARKS)

1. Task Execution (30 Marks)

Students will be given minimum 10 tasks.

Students are expected to

i. Identify variables, data types methods/approach required to write the code for the given task and apply the same.
ii. Execute given task for different inputs and verify the result
iii. Import different Python libraries to solve given problem
iv. Implement basic file handling in Python
v. Create backend databases and connect GUI to perform CRUD operations
vi. Use data visualization tools
vii. Apply appropriate mechanisms to handle unexpected errors.

Students will be evaluated based on following:

i. Logic building for the given task (10 marks)
ii. Rectifying logical errors and syntax errors (06 marks)
iii. Well-structured and organized program (06marks)
iv. Verification of experiment output for different inputs (08 marks)

Refer the sample task given below.

Example:

Create a Teacher class to add details of the teachers their subject to respective class and display details using method.

Students are expected to identify.

i. variables, data types methods/approach required to create teacher class and add methods to display details of a given teacher
ii. Execute given task for different inputs and verify the result
iii. Follow the coding standards
iv. Identify errors and rectify the errors.

Students will be evaluated based on following:

i. Logic building for the given task (10 marks)
ii. Rectifying logical errors and syntax errors (06 marks)

iii. Well-structured and organized program (06 marks)
iv. Verification of experiment output for different inputs (08 marks)

2. **Regularity and active Participation (05 Marks)**

3. **Practical Test (15 Marks)**

a) Task Execution: 10 Marks

Students will be given task (different task for every student) to execute and will be evaluated as per the parameters mentioned in continuous evaluation

Students will be evaluated based on following:

i. Logic building for the given task (04 marks)
ii. Rectifying logical errors and syntax errors (02 marks)
iii. Well-structured and organized program (02 marks)
iv. Verification of experiment output for different inputs (02 marks)

b) Oral based on covered syllabus: 05 Marks

B. END SEMESTER EXAMINATION (Practical & Oral Exam) (50 Marks)

a) Task Execution: 30 Marks
Students will be given task (different task for every student) to execute and will be evaluated as per the parameters mentioned below
i. Logic building for the given task (10 marks)
ii. Rectifying logical errors and syntax errors (06 marks)
iii. Well-structured and organized program (06 marks)
iv. Verification of experiment output for different inputs (08 marks)

b) Presentation of Results and conclusion, Inferences drawn: 05 Marks

c) Oral based on entire syllabus: 15 Marks

Two examiners, one Internal and one External will do the evaluation.

Course Type	Course Code	Course Name	Credits
MP	ITMP301	MINI PROJECT- 1A	01

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

Course Objectives:

1. To familiarize students about available infrastructure at Department/Institute level, online resources, plagiarism, expectations from MP 1A and 1B, etc.
2. To guide students in identifying societal or research needs and formulating them into problem statements.
3. To facilitate problem-solving in group settings.
4. To apply basic engineering principles to address identified problems.
5. To foster self-learning and research skills.

Course Outcomes:

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

1. Identify problems based on societal or research needs and methodology for solving them.
2. Apply knowledge and skills to solve societal problems collaboratively.
3. Develop interpersonal skills necessary for teamwork.
4. Analyze, verify, and validate results effectively through various methodologies, including, test cases/benchmark data/theoretical/inferences/experiments/simulations, etc.
5. Evaluate the societal and environmental impacts of proposed solutions.
6. Adhere to standard engineering practices.
7. Excel in written and oral communication by technical report writing, oral presentation, and publishing results in
   - Research/white paper/article/blog writing/publication, etc.
   - Business plan for entrepreneurship product creation
   - Patent filing/copyright.
8. Gain technical competencies by participating in competitions, hackathons, etc.
9. Demonstrate lifelong learning capabilities through self-directed group projects.
10. Apply project management principles effectively.

Guidelines for the Mini Project

• At the beginning of semester-III, project guides are required to conduct around 4 hours' orientation sessions including following topics:

- Familiarizing students about infrastructure available at Department/Institute level and how to use it.
- How to identify societal problems and formulate project problem statement.
- How to carry out literature survey.
- What is plagiarism and what care needs to be taken while writing a report.
- What is project report template and how it should be used.
- What are expectations from mini-projects 1A and 1B.

• Mini project may be carried out in one or more form of following:

Product preparations, prototype development model, fabrication of set-ups, laboratory experiment development, process modification/development, simulation, software development, integration of software (frontend-backend) and hardware, statistical data analysis, creating awareness in society/environment etc.

• Students must form groups of 3 to 4 members either from the same or from different departments.
• Groups should conduct surveys to identify needs and develop problem statements in consultation with faculty.
• An implementation plan in Gantt/PERT/CPM chart format covering weekly activities must be submitted.
• Each group must maintain a logbook to record weekly progress, to be verified by the faculty supervisor.
• Faculty input should emphasize guiding by faculty and self-learning by group members.
• Groups should propose multiple solutions, select the best one in consultation with the supervisor, and develop a working model.
• The solution to be validated with proper justification and report to be compiled in standard format of the Institute. Research papers, competition certificates may be submitted as part of annexure to the report.
• With the focus on self-learning, innovation, addressing societal/research/innovation problems and entrepreneurship quality development within the students through the Mini Projects, it is preferable that a single project of appropriate level and quality be carried out in two semesters by all the groups of the students.
• However, based on the individual students or group capability, with the mentor's recommendations, if the proposed Mini Project adhering to the qualitative aspects mentioned above, gets completed in odd semester, then that group can be allowed to work on the extension of the Mini Project with suitable improvements/modifications or a completely new project idea in even semester. This policy can be adopted on a case by case basis.

In-Semester Continuous Assessment and End-Semester Examination Guidelines

- The Head of the Departments will assign a guide to each of the mini-projects and shall form a progress monitoring committee. The guide will carry out weekly monitoring of the project's progress. The committee shall carry out in-semester project evaluation based on presentations with a minimum of two evaluations per semester.
- Assessment will be based on individual contributions, understanding, and responses to questions asked.

- **Continuous Assessment marks distribution in semester III (50 marks):**
    - 10 marks for the Topic Approval Presentation in front of the progress monitoring committee
    - 15 marks for the Mid-Semester Progress Presentation in front of the progress monitoring committee
    - 25 marks for the Final Report & Presentation
- **Continuous Assessment marks distribution in semester IV (50 marks):**
    - 15 marks for the In-Semester Two Presentations
    - 10 marks for the Participation in Project Competitions, TPP, etc.
    - 25 marks for the Final Report & Presentation

The review/progress monitoring committee will assess projects based on the following criteria.

Semester III:

- Theoretical solution completion, including component/system selection/design of software solution and cost analysis.
- Two reviews will occur:
    - The first review will focus on finalizing the problem statement (topic approval).
    - The second review will focus on finalizing the proposed solution.

Semester IV:

- Expected tasks include procuring components/systems, constructing a working prototype, and validating results based on prior semester work.
- Reviews will be conducted as follows:
    - The first review will assess the readiness to build a working prototype.
    - The second review will involve a poster presentation and demonstration of the working model in the last month of the semester.

In addition to the above-mentioned points, the following performance criteria shall be included during the in-semester continuous assessment:

1. Quality of survey and need identification.
2. Clarity and innovativeness in problem definition and solutions.
3. Requirement gathering feasibility study, cost-effectiveness, and societal impact of proposed solutions.
4. Completeness and full functioning of the working model.
5. Effective use of skill sets and engineering norms.
6. Verification & validation of the solutions/test cases.
7. Individual contributions to the group.
8. Clarity in written and oral communication.

9. Participation in technical paper presentations/project competitions/hackathon competitions, etc.

End-Semester Examination in Semester IV (50 marks):

1. Presentation and demonstration to internal and external examiners: 20 marks.
2. Emphasis on problem clarity, innovativeness, societal impact, functioning of the model, skill utilization, and communication clarity: 30 marks.

Course Type	Course Code	Course Name	Credits
HSSM	HSSM301	PRODUCT DESIGN	02

Program Outcomes addressed:

1. PO2 : Problem Analysis
2. PO3 : Design/Development of Solutions
3. PO5 : Modern Tool Usage
4. PO6 : The Engineer & Society
5. PO7 : Environment & Sustainability
6. PO8 : Ethics
7. PO11: Project Management & Finance
8. PO12: Life-long learning

Course Objectives:

1. Understand the product design process and its user-centered principles
2. Apply fundamental design principles to create innovative product designs.
3. Demonstrate proficiency in generating and evaluating design concepts through ideation techniques.
4. Evaluate and synthesize sustainable and user-centric design practices in product development

Module	Details
01.	**Introduction to Product Design** Overview of product design process, Importance of user-centred design, Design thinking methodologies, Case studies of successful product designs, Introduction to design tools and software (e.g., Sketch, Adobe XD)
02.	**Design Principles and Fundamentals** Understanding design principles (e.g., balance, hierarchy, contrast), Human factors in design (ergonomics, anthropometrics), Material selection and properties, Basics of aesthetics and styling, Hands-on exercises in sketching and prototyping
03.	**Concept Generation and Ideation** Techniques for brainstorming and idea generation, Sketching and visualization techniques, Developing design briefs and specifications, Evaluating and selecting design concepts, Rapid prototyping methods (e.g., 3D printing, CNC machining)
04.	**Renewable energy & Energy efficiency** Detailed overview of the product development lifecycle, Design for manufacturability (DFM) considerations, Cost estimation and budgeting, Collaborative design tools and project management Regulatory and compliance requirements (e.g., safety standards)
05.	**User Experience (UX) Design** Understanding user needs and behaviour, Usability testing and feedback gathering, Wire framing and prototyping for digital products, Iterative design process, Accessibility and inclusive design principles

06.	**Sustainability in Product Design** Environmental impact assessment in product design, Sustainable materials and manufacturing processes, Design for disassembly and recycling, Circular economy principles Case studies of eco-friendly product designs
Total No. of Hours: 30	

Course Outcomes :

1. Apply design thinking methodologies effectively to solve design problems.
2. Demonstrate proficiency in utilizing design tools and techniques for product development.
3. Communicate and collaborate effectively for interdisciplinary teamwork.
4. Create functional and aesthetically pleasing product designs.
5. Integrate sustainable and user-centric design principles into product development processes.

Text Books :

1. "Product Design and Development" by Karl T. Ulrich and Steven D. Eppinger, published by McGraw-Hill Education; 7th edition (January 25, 2021).
2. "Engineering Design: A Project-Based Introduction" by Clive L. Dym and Patrick Little, published by Wiley; 4th edition (August 26, 2015).
3. "Universal Principles of Design" by William Lidwell, Kritina Holden, and Jill Butler, published by Rockport Publishers; Revised and updated edition (January 1, 2010).

Reference Books :

1. "Sketching: Drawing Techniques for Product Designers" by Koos Eissen and Roselien Steur, published by BIS Publishers; 2nd edition (March 1, 2011).
2. "Materials and Design: The Art and Science of Material Selection in Product Design" by Mike Ashby and Kara Johnson, published by Butterworth-Heinemann; 3rd edition (October 10, 2014).
3. "The Design of Everyday Things" by Don Norman, published by Basic Books; Revised and expanded edition (November 5, 2013).

Other Resources:

1. NPTEL Course: Product Design and Development , Prof. Inderdeep Singh, IIT Roorkee
   Weblink:- https://onlinecourses.nptel.ac.in/noc21_me83/preview

2. NPTEL Course: Product Design and Innovation, By Prof. Supradip Das, Prof. Swati Pal, Prof. Debayan Dhar, IIT Guwahati, IIT Guwahati,
   Web link- https://onlinecourses.nptel.ac.in/noc21_de01/preview

Course Type	Course Code	Course Name	Credits
PCC	ITPCC405	ENGINEERING MATHEMATICS-IV	03+01*

Examination Scheme					
Distribution of Marks			Exam Duration (Hrs.)		Total Marks
In-semester Assessment		End Semester Exam (ESE)			
Continuous Assessment	Mid-Semester Exam (MSE)		MSE	ESE	
20+25*	30	50	1.5	2	125

*For Tutorial

Pre-requisite: NIL

Program Outcomes addressed:

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

Course Objectives:

1. To provide the basic knowledge on the concepts of Mathematics in the field of Engineering.
2. To build a foundation to the methodology necessary for solving problems by applying the knowledge of Mathematics to the field of Engineering.

Module	Detailed Contents	Hrs	CO
00.	**Course Introduction** Engineering Mathematics IV aims to equip students with the foundational knowledge and skills necessary for analyzing uncertainty and making informed decisions in engineering contexts. This course has many applications in Information Technology For example, 1) Application of in Probability in Machine Learning, NLP part of speech Hidden Markov Model. 2) Application of in Correlation and Regression in Deep learning. 3) Application of Statistics in hypothetical or inferential learning. 4) Application of Algebraic Structure in Cyber Security and Cryptography.	**01**	
01.	**Probability Theory and Random Variable** ***Learning Objective:*** *The learner will be able to analyze random variables using the basic theory of probability and will be able to apply various mathematical techniques in determining probability functions.*	**06-08**	CO- 1
	Contents:		
	Conditional Probability, Bayes Theorem, Total Probability Theorem, Definition of Random Variable. Types of Random Variable: Discrete and Continuous, Probability Mass and Density Function.		

	Self-Learning Topics: *Cumulative Distribution and Density Function* ***Learning Outcomes:*** *A learner will be able to* 1. *Identify independent sets and disjoint sets and use its knowledge in the context of conditional probability. (P.I.-2.1.3)* 2. *Apply mathematical techniques of union, intersection and addition of sets, numbers for finding probabilities of events using Bayes' Theorem and Total Probability Theorem. (P.I.-1.1.1)* 3. *Identify if a given Random variable is Discrete or continuous in nature using existing definitions and formulas from Probability. (P.I.-2.1.2)* 4. *Apply mathematical techniques of integration and summation for finding Expectation, Variance, Probability density function and Probability distribution function. (P.I.-1.1.2)*		
02.	**Probability Distribution** ***Learning Objective:*** *Learner will be able to analyse and identify standard probability distribution functions and apply the knowledge of distribution for finding probabilities of various events.*	**07-09**	CO- 2
	Contents: Measures of Central Tendency and Dispersion, Binomial distribution, Poisson Distribution , Fitting of a Poisson Curve, Gaussian Distribution, Normal Distribution (Standard Normal distribution , Reverse problem of Normal distribution)		
	Self-Learning Topics: *Joint Probability Distribution* ***Learning Outcomes:*** *A learner will be able to* 1. *Apply mathematical techniques of exponents, algebra and basic probability for finding the probabilities of various events using Binomial, Poisson and Normal Distribution. (P.I.-1.1.1)* 2. *Apply the advance mathematical techniques of statistics to find the probabilities the random variable (P.I. -1.1.2)* 3. *Identify the area under a Standard Normal Curve (bounded or unbounded) and use its knowledge in the context of Normal Distribution. (P.I.-2.1.3)* 4. *Identify whether Poisson distribution or Normal Distribution is applicable to a given problem using basic definitions of distribution and the data inferred from the problem. (P.I.-2.1.1)*		
03.	**Sampling Theory-I** ***Learning Objective:*** *Learner will be able to formulate the null hypothesis and apply parametric testing to test the hypothesis.*	**05-07**	CO- 3

	Self-Learning Topics: *sampling distribution of proportions* ***Learning Outcomes:*** *A learner will be able to* 1. *Identify and test the hypothesis of significance difference between the parameter and the statistics (P.I.-2.2.2)* 2. *Identify and test the hypothesis of significance difference between the two means (P.I.-2.2.4)* 3. *Identify and apply appropriate test to be used to test the given hypothesis.(P.I.-2.1.1)* 4. *Determine the test statistics using the appropriate formula (P.I.-1.1.1)* 5. *Determine frequencies fitting a particular probability distribution(P.I.-1.1.2)*		
04.	**Sampling Theory-II** ***Learning Objective/s:*** *Learner will be able to formulate the hypothesis and apply non-parametric testing to test the it.* **Contents:** Chi-square test:Test of goodness of fit , Independence of attributes (Contingency table), distribution of sample variance F-test , significant difference between variances of two Samples. ***Self-Learning Topics:*** ***Yate's Correction, ANOVA*** ***Learning Outcomes:*** *A learner will be able to* 1. *Identify and test the hypothesis of test the independence of attributes (P.I.-2.2.2)* 2. *Identify and test the hypothesis of significance difference between the two variance (P.I.-2.2.4)* 3. *Determine the expected frequencies of the assumption. (P.I.-1.1.1)* 4. *Determine the expected frequencies of the contingency table(P.I.-1.1.2)*	**05-07**	CO- 3
05.	**Correlation and Regression** ***Learning Objective:*** *Learner will be able to analyze the mathematical dataset given and apply techniques of correlation and regression to identify the relationships between variables from the dataset.* **Contents:** Correlation, Karl Pearson's coefficients of correlation(r), Spearman's Rank correlation coefficient (R): Repeated Rank, Non-repeated rank, Regression, Line of regression, Curve fitting: Linear and Second-Degree Curves.	**07-08**	CO- 4

	Self-Learning Topics: *Fitting of an exponential Curve* ***Learning Outcomes:*** *A learner will be able to* 1. *Identify whether Karl Pearson's or Spearman's coefficient of correlation is to be used in establishing relationship between two variables depending on the dataset given. (P.I.- 2.1.3)* 2. *Apply basic mathematical techniques from algebra in finding the lines of regression and regression coefficients. (P.I.-1.1.1)* 3. *Apply Least Square Method to fit a particular to the given data (P.I.-1.1.2)* 4. *Identify whether a linear degree curve or a quadratic degree curve is to be fit for the given data set based on the knowledge of Curve Fitting (P.I.-2.2.2)*		
06.	**Algebraic Structure** ***Learning Objective/s:*** *The learner will be able analyze the Algebraic Structure using the basic properties.*	**07-09**	CO-5
	Contents: Rings, Integral domain, Fields, Ring Homomorphism, Ring Isomorphism		
	Self-Learning Topics: *Orthonormal basis, Basis and Dimension.* ***Learning Outcomes:*** *A learner will be able to* 1. *Apply mathematical operations defined on algebraic structures like Rings, Integral domain and Field and demonstrating closure under these operations. (P.I.-1.1.1)* 2. *Identify substructures within algebraic systems and the concept of homomorphism between them. (P.I.-2.1.2)* 3. *Apply the properties of homomorphism and one-one prove that the homomorphism is an isomorphism (P.I. 1.1.2)* 4. *Identify and characterize various algebraic structures based on their properties. (P.I.-2.2.2)*		
	Course Conclusion	**01**	
	Total	**45**	

Course Outcomes:
Learner will be able to

1. Analyse random variables and apply the concepts of probability for getting the spread of data.
2. Analyse the mathematical problem given and apply the concepts of distribution in finding probabilities.
3. Apply sampling theory principles and techniques to real-world research problems in various fields and interpret the result.
4. Analyse and interpret the data using Correlation and Regression.
5. Apply the properties and Identify the Algebraic Structure.

Performance Indicators:

P.I. No.	P.I. Statement
1.1.1	Apply mathematical techniques such as calculus, linear algebra, and statistics to solve problems
1.1.3	Apply advanced mathematical techniques such as integral and differential equations to describe/solve/construct a mathematical model of a system.
2.1.1	Articulate problem statements and identify primary objectives and key constraints.
2.1.2	Identify engineering systems, variables, and parameters to solve the problems
2.1.3	Identify the mathematical, engineering and other relevant knowledge that applies to a given problem
2.2.2	Identify, assemble and evaluate information and resources.
2.2.4	Compare and contrast alternative solution processes to select the best process

Text Books:

1. Higher Engineering Mathematics by Grewal B. S. 38th edition, Khanna Publication 2005.
2. Advanced Engineering Mathematics by Kreyszig E. 9th edition, John Wiley.
3. A Text Book of Applied Mathematics Vol. I & II by P.N.Wartikar & J.N.Wartikar, Pune, Vidyarthi Griha Prakashan, Pune.

Reference Books:

1. Topics in Algebra by Herstein
2. Fundamentals of Probability and Statistics V. K Kapoor and S. C. Gupta, S . Chand, Publications
3. Advanced engineering mathematics, H.K. Das, S . Chand, Publications

Other Resources:

1. NPTEL Course on NOC Probability for Computer Science IIT Kanpur by Prof Nitin Saxena
   Web Link- https://nptel.ac.in/courses/106104233/
2. NPTEL Course on Sampling Theory, IIT Kanpur by Prof Shalabh
   Web Link-https://nptel.ac.in/courses/111104073
3. NPTEL Course on NOC: Algebra -I IMSc, by Prof S Vishwanath, Prof Amritanshu Prasad
   Web Link- https://nptel.ac.in/courses/111106137

A. IN-SEMESTER ASSESSMENT (75 MARKS)

1. Continuous Assessment-Theory (20 Marks)

Suggested breakup of distribution

a) One MCQ test as per GATE exam pattern / level: 05 Marks

b) One Class test:05 Marks

c) One Team-Pair-Solo activity: 05 Marks

d) Regularity and active participation: 05 Marks

2. Continuous Assessment - Tutorial (25 Marks)

Suggested breakup of distribution

a) Tutorial Assignments and Class tests: 20 Marks

*Students must be encouraged to write at least 6 class tutorials on entire syllabus. At least 6 Class tests will be conducted based on class tutorials. Each class tests carries 20 Marks. Average will be taken of all class tests***.**

b) Regularity and active participation: 05 Marks

3. Mid Semester Examination (30 Marks)

Mid semester examination will be based on 40% to 50% syllabus.

B. END SEMESTER EXAMINATION (50 MARKS)

End Semester Examination will be based on syllabus coverage up to the Mid Semester Examination (MSE) carrying 20% to 30% weightage, and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Type	Course Code	Course Name	Credits
PCC	ITPCC406	COMPUTER NETWORK	03

Examination Scheme					
Distribution of Marks			Exam Duration (Hrs.)		Total Marks
Continuous Internal Evaluation		End Semester Exam			
Internal Evaluation	Mid-Sem Exam		MSE	ESE	
20	30	50	1.5	2	**100**

Pre-requisite:

1. ESC203: Basic Electronics Engineering
2. ITMDM301: Digital Logic & Design Analysis

Program Outcomes addressed:

1. PO1: Engineering knowledge
2. PO2: Problem analysis
3. PO3: Design/development of solutions
4. PO6: The engineer and society
5. PO7: Environment and sustainability
6. PO8: Ethics

Course Objectives:

Learner is expected to

1. Build an understanding about the concepts and fundamentals of computer networks.
2. Perceive comprehensive knowledge about the principles, protocols, reference models (OSI and TCP/IP) and its functionalities
3. Apply the concepts of Error detection and error correction to identify the errors in data
4. Implement various routing algorithms and analyze them.

Module	Detailed Contents	Hrs	CO
00.	**Course Introduction:** Computer Network is the foundation course which deals with concept of computer network, basis of communication, effective utilization of resources, optimize convenience and flexibility, safety standards and use of computer network in modern society.	**01**	
01.	**Introduction to Computer Networks** ***Learning Objective:*** *Learner is expected to perceive the knowledge of basic network theory, functionalities of each layer of the models and to apply knowledge in designing of network.*	**03-04**	CO-1

	Contents: Concept of computer network, categories of networks, Network Component: Hardware and software, Network topology and its types (Ring, mesh, star, bus, hybrid), Network structure and architecture (layering principles, services, protocols and standards), Network devices: Router, Hub, Switch, Repeater, Gateway, Reference Models: ISO/OSI Model and TCP/IP Model ***Self-Learning Topic:*** *Identify the different devices used in network connection in college campus.* ***Learning Outcomes:*** *A learner will be able to* 1. *Apply the fundamental concepts of network theory to identify different networking devices and layered communication architectures and use it ethically to design a network as per the society's requirement. (P.I.-1.3.1,8.2.2)* 2. *Apply layering principles, services, protocols and standards in different reference models and identify alternatives to be used while designing the network as per organizations need in ethical manner. (P.I.-1.4.1, 8.1.1)* 3. *Identify different types of network topology for the design of network as per the requirement. (P.I.-2.2.4)* 4. *Analyze the results of applied topology structure and network devices as per the user's requirement. (P.I.-2.4.4)*		
02.	**Physical Layer** ***Learning Objective:*** *Learner is expected to know and differentiate between various transmission media characteristics and implement understanding in real time applications.* **Contents:** Guided Transmission Media: Twisted pair (STP and UTP), Coaxial (Baseband and broadband), Fibre optics, Unguided Media: Radio waves, Microwaves Infrared, Transmission Impairments, switching: Circuit-Switched Networks, Packet switching, Structure of a switch. ***Self-Learning Topics:*** *Compare and contrast various transmission media.* ***Learning Outcomes:*** *The learner will be able to* 1. *Categorize the various types of transmission media and identify the impact of transmission media on environment and its sustainability (P.I.-1.3.1, 7.1.2,7.2.2)* 2. *Illustrate structure of switch and its different types. (P.I.-1.4.1)* 3. *Determine physical connections set up to the network. (P.I.-3.1.4)* 4. *Demonstrate an ability to select optimal design scheme for user's requirement. (P.I.-3.3.2)*	**03-05**	CO-2

03.	**Data Link Layer** ***Learning Objectives:*** *To impart the knowledge of error detection, error correction and deploy facts to identify the errors in data. Also expected to implement the various routing algorithms.* **Contents:** Services, Framing, Error Control, Flow Control, Error Detection and Correction (Hamming Code, Parity, CRC, Checksum), Problems based on CRC, Hamming distance etc. Elementary Data Link protocols: Stop and Wait, Sliding Window (Go Back N, Selective Repeat), HDLC, IEEE 802.3 Ethernet, Problems on sliding window protocols. Multiple Access Protocols: ALOHA, Slotted ALOHA, CSMA, CSMA/CD and CSMA/CA. ***Self-Learning Topics:*** *Differentiate link layer in IOT network and Normal Network.* ***Learning Outcomes:*** *The learner will be able to* 1. *Illustrate error control and flow control mechanism. (P.I.-1.3.1)* 2. *Apply statistics to determine error control and flow control. (P.I.-1.1.2)* 3. *Interpret different design issues at data link layers. (P.I.-2.2.4)* 4. *Implement and analyze multiple access protocols in data link layer. (P.I. 2.4.2)* 5. *Identify IEEE.802.3 Ethernet. (P.I.-3.1.4)* 6. *Implement and analyze elementary data link protocols and algorithms at data link layer for any communication network task. (P.I.-3.3.2)*	**08-10**	CO-3
04.	**Network Layer** ***Learning Objectives:*** *Learner is expected to acquaint the knowledge of various types of IP addressing and apply it in network design. Also expected to analyse and evaluate the performance of different routing protocols.* **Contents:** Network Layer design issues, Communication Primitives: Unicast, Multicast, Broadcast. IPv4 Addressing (class full and classless), numerical (calculation of network id, host ids, last address, first address, address space available etc.) Sub netting, Super netting, design problems, IPv4 Protocol, Network Address Translation (NAT), IPv6, Address resolution protocol (ARP). Routing algorithms: Distance Vector Routing, Shortest Path (Dijkastra), Link state routing, Protocols: RIP, OSPF, BGP ***Self-Learning Topics:*** *Study difference between IPV4 and IPV6. Network Class A, B, C, D, E and subnet mask.* ***Learning Outcomes:*** *The learner will be able to* 1. *Apply the knowledge IP addressing in network design. (P.I.-1.3.1)* 2. *Apply the knowledge sub netting and super netting to design a network stack in real time application. (P.I.-1.4.1)* 3. *Identify different design issues at network layer. (P.I.-2.2.4)* 4. *Conceptualize and design a network stack using IP addressing and sub netting / super netting schemes. (P.I.- 2.4.2)* 5. *Implement algorithms at network layer like RIP, OSPF, BGP etc. and select the optimal algorithm (P.I.-3.3.2)* 6. *Explore design alternatives for user's problem. (P.I.-3.2.1)*	**08-10**	CO-3, CO-4, CO-5

05.	**Transport Layer & Session Layer** ***Learning Objective:*** *To impart the knowledge of TCP and UDP protocols to provide the communication services directly to the application processes running on different hosts.* **Contents:** Transport Layer: Transport Layer Services, Connectionless & Connection-oriented Protocols, Transport Layer protocols: User Datagram Protocol: UDP Services, UDP Applications, Transmission Control Protocol: TCP Services, TCP Features, Segment, A TCP Connection, Windows in TCP, Flow Control, Error Control, TCP Congestion Control, TCP Timers Session Layer: Session layer design issues, Socket Programming, Session Layer protocol - Remote Procedure Call (RPC) ***Self-Learning Topics:*** *List real time example of UDP and TCP.* ***Learning Outcomes:*** *The learner will be able to* 1. *Illustrate error control and flow control mechanism. (P.I.-1.3.1)* 2. *Summarize Remote Procedure Call (RPC) in session layer. ((P.I.- 1.4.1)* 3. *Identify connectionless and connection-oriented transport layer protocols. (P.I.- 2.2.4)* 4. *Implement socket programming using TCP and UDP. (P.I.- 2.4.1)* 5. *Implement the transport layer protocols like TCP, UDP and select the suitable protocol as per requirement. (P.I.- 3.3.2)* 6. *Explore design alternatives for client server programming. (P.I.-3.2.1)*	**07-09**	CO-3, CO-5
06.	**Presentation Layer & Application Layer** ***Learning Objectives:*** *Learner is expected to identify the various data compression techniques used by presentation layer and apply it to prepare data for the application layer. Also expected to introduce various application layer protocols used by organizations as per the requirement.* **Contents:** Presentation Layer: Compression: Comparison between Lossy Compression and Lossless Compression, Huffman Coding, Speech Compression, LZW, RLE, Application Layer: Domain Name Space (DNS) Electronic Mail -SMTP, POP, FTP, Telnet, WWW Application: A case study to design a network for an organization meeting the following guidelines: Networking Devices, IP addressing, Routing Protocols to be used, Services to be used (TELNET, FTP server, Web server, File server, etc) ***Self-Learning Topics:*** *Difference between HTTP and FTP Protocol.* ***Learning Outcomes:*** *The learner will be able to* 1. *Illustrate various application layer protocols and design a network as per the requirement of organization by applying engineers' knowledge in the networking field. (P.I.-1.3.1, 6.1.1)* 2. *Identify the various compression techniques used by presentation layer and identify engineer's contribution to the protection of the public at different level (local, global and international) (P.I.-1.4.1, 6.2.1))* 3. *Interpret the various data compression techniques suitable for efficient communication. (P.I.-2.2.4)* 4. *Identify network devices, topology used, layering architecture as per the organization's requirement. (P.I.-2.3.2)* 5. *Implement Huffman Coding and LZW. (P.I.- 3.3.2)*	**08-09**	CO-3, CO-4, CO-5

	6. Explore application layer protocols in real time application. (P.I.-3.2.1)		
	Course Conclusion	**01**	
	Total	**45**	

Course Outcomes:

Learner will be able to

1. Apply the fundamentals of basic network theory and layered communication architectures to design a network for the given application.
2. Identify the different types of transmission media with real time applications.
3. Implement algorithms at the appropriate layer, identify and analyze error and flow control mechanisms.
4. Conceptualize and design a network stack using IP addressing and sub netting / super netting schemes.
5. Analyze network service quality performance.

Performance Indicators:

P. I. Number	**P. I. Statement**
1.1.2	Apply the concepts of probability, statistics and queuing theory in modeling of computer-based system, data and network protocols.
1.3.1	Apply engineering fundamentals.
1.4.1	Apply theory and principles of computer science engineering to solve an engineering problem.
2.2.4	Compare and contrast alternative solution/methods to select the best methods
2.3.2	Identify design constraints for required performance criteria.
2.4.1	Applies engineering mathematics to implement the solution.
2.4.2	Analyze and interpret the results using contemporary tools.
2.4.4	Arrive at conclusions with respect to the objectives.
3.1.4	Ability to choose appropriate quality attributes as defined by ISO/IEC/IEEE standard.
3.2.1	Ability to explore design alternatives.
3.3.2	Consult with domain experts and stakeholders to select candidate engineering design solution for further development.
6.1.1	Identify and describe various engineering roles; particularly as pertains to protection of the public and public interest at global, regional and local level.
6.2.1	Interpret legislation, regulations, codes, and standards relevant to your discipline and explain its contribution to the protection of the public.

7.1.2	Understand the relationship between the technical, socio economic and environmental dimensions of sustainability.
7.2.2	Apply principles of preventive engineering and sustainable development to an engineering activity or product relevant to the discipline.
8.1.1	Identify situations of unethical professional conduct and propose ethical alternatives.
8.2.2	Examine and apply moral & ethical principles to known case studies.

Text Books:

1. Computer Networks, Andrew S. Tanenbaum, David J. Wetherall, Fifth Edition, 2011, Prentice Hall
2. Data Communication and Networking", Behrouz A. Foruzan, Fifth Edition, 2013, Science Engineering & Math Publications

Reference Books:

1. Data and Computer Communication, W. Stallings, Tenth Edition, 2014, Pearson Education
2. TCP/IP Protocol Suite, B. A. Forouzan, Fourth Edition, 2010,Tata McGraw Hill edition,
3. Information Theory, Coding and Cryptography, Ranjan Bose, Second Edition, 2008, Tata McGraw-Hill
4. Introduction to Data Compression, Khalid Sayood ,Third Edition, 2010, Morgan Kaufman

Other Resources:

1. NPTEL Course: Computer Networks and Internet Protocol by Prof. Soumya Kanti Ghosh, Prof. Sandip Chakraborty, IIT Kharagpur
   Web Link- https://onlinecourses.nptel.ac.in/noc21_cs18/preview
2. NPTEL Course: Computer Networks by Prof. Hema A. Murthy**,** IIT Madras
   Web Link- https://nptel.ac.in/courses/106106091

A. IN-SEMESTER ASSESSMENT (50 MARKS)

1. Continuous Assessment (20 Marks)

Suggested breakup of distribution

a) One MCQ Test as per GATE exam pattern / level: 05 Marks

b) One Class Test:05 Marks

c) One Think Pair Share (TPS) activity: 05 Marks

d) Regularity and active participation :05 Marks

2. Mid Semester Examination (30 Marks)

Mid semester examination will be based on 40% to 50% syllabus.

B. END SEMESTER EXAMINATION (50 MARKS)

End Semester Examination will be based on syllabus coverage up to the Mid Semester Examination (MSE) carrying 20% to 30% weightage, and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Type	Course Code	Course Name	Credits
PCC	ITPCC407	OPERATING SYSTEM	03

Examination Scheme					
Distribution of Marks			Exam Duration (Hrs.)		Total Marks
In-semester Assessment		End Semester Exam (ESE)			
Continuous Assessment	Mid-Semester Exam (MSE)		MSE	ESE	
20	30	50	1.5	2	100

Pre-requisite:

1. ESCLC103: Programming Laboratory-I (C)
2. ITPCC303: Data Structures and Analysis

Program Outcomes addressed:

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

Course Objectives:

1. Facilitate the way students, comprehend the concepts and role of Operating System.
2. Intended to guide learners to understand Process Management and Scheduling Algorithms.
3. Aid learners to learn process coordination and deadlock handling in system.
4. Assist learners in acquiring a strong comprehension of the Memory and I/O Management policies.
5. Facilitate the way to comprehend and use OS as virtual machine and its benefits.

Module	Details	Hrs	CO
00.	**Course Introduction** This course consists of concept of operating system, basic information of computer, Purpose of computer and its various components, Memory hierarchy. This course is used to understand the interaction between various hardware's and software applications.	**01**	
01.	**Introduction of Operating System** ***Learning Objective:*** *Learner is expected to know and understand OS and its functions to solve real time-complex issues and maximize computational speed.*	**07-08**	CO- 1
	Contents: Introduction: Types of Computer System, Computer architecture, OS Structure, Operations, Services Interface, System Calls, System Structure, System Design and Implementation, OS Kernel, Types of kernels, Types of special purpose OS.		
	Self-Learning Topics: *Various types of computer and network system architectures.* ***Learning Outcomes:***		

	A learner will be able to 1. *Illustrate the functions of OS. (P.I.-1.3.1)* 2. *Correlate OS functions with software and hardware mechanism. (P.I.-1.4.1)* 3. *Compare various system calls at user and kernel level. (P.I.-2.2.5)* 4. *Identify various system calls and its constraints with OS functionalities. (P.I.-2.3.2)*		
02.	**Process Management** ***Learning Objective/s:*** *Learner is expected to know process management and apply process and thread scheduling.* **Contents:** Process Management: Process, Scheduling Inter-process Communication, Thread and its execution, CPU Scheduling: CPU Schedulers, scheduling Criteria Scheduling Algorithms. ***Self-Learning Topics:*** *Thread scheduling and system thread functions.* ***Learning Outcomes:*** *A learner will be able to* 1. *Illustrate various process scheduling algorithms. (P.I.-1.3.1)* 2. *Apply various process scheduling methods on given set of processes and analyze the obtained result. (P.I.-1.4.1)* 3. *Compare various system calls at user and kernel level. (P.I.-2.2.5)* 4. *Optimize process scheduling by changing various parameters of processes. (P.I.-2.3.2)*	**07-09**	CO- 2
03.	**Process Coordination** ***Learning Objective:*** *Learner is expected to know the process coordination and deadlock management policies in OS.* **Contents:** Process Synchronization: Critical Section, remainder section, Process Synchronization Hardware, Semaphores, Classical Problems of Synchronization, Deadlocks: Characterization Methods for Handling Deadlocks, Deadlock Prevention, Avoidance, Detection, Recovery. ***Self-Learning Topics:*** *Study a real time case study for Deadlock detection and recovery.* ***Learning Outcomes :*** *A learner will be able to* 1. *Summarize various inter-process coordination algorithm. (P.I.-1.3.1)* 2. *Apply various process scheduling methods on given set of processes and analyze the obtained result. (P.I.-1.4.1)* 3. *Analyze the deadlock avoidance and prevention mechanism. (P.I.-2.2.5)* 4. *Identify the suitable method to avoid and detect deadlock. (P.I.-2.3.2)*	**10-11**	CO- 3

04.	**Memory Management** ***Learning Objective:*** *Learner is expected to primary memory management policies and analyse the various page scheduling algorithms*	**06-07**	CO- 4
	Contents: Memory Management: Hardware Address, Binding Address, Space Dynamic Loading and Linking, Swapping, Contiguous Allocation, Segmentation, Paging Structure of the Page Table, TLB, Virtual Memory Management: Demand Paging Page Replacement Algorithms, Thrashing and multiprogramming.		
	Self-Learning Topics: *Memory management for any one Operating System, Implementation of Page Replacement Algorithms.* ***Learning Outcomes :*** *A learner will be able to* 1. *Compare and contrast page scheduling algorithms. (P.I.-1.3.1)* 2. *Apply various page scheduling methods on given set of references and analyze the obtained result. (P.I.-1.4.1)* 3. *Compare and analyse page hits and page miss proportions. (P.I.-2.2.5)* 4. *Identify the effect of thrashing on page scheduling. (P.I.-2.3.2)*		
05.	**Disk and I/O Management** ***Learning Objective:*** *Learner is expected to know and understand File and directory and I/O management and compare various disk scheduling policies.*	**04-06**	CO- 4
	Contents: File system: File concept; Access methods; Directory structure; File system mounting; File sharing; Protection: Implementing File system: File system structure; File system implementation; Directory implementation; Allocation methods; RAID levels. I/O Systems: Overview I/O Hardware Application, I/O Interface, Kernel I/O, Subsystem Transforming, 1/0 Requests to Hardware Operations Performance. System Protection: Goals, Domain Access matrix, System Security: The Security Problem, Threats Encryption, User Authentication.		
	Self-Learning Topics: *File System for Linux and Windows, Features of I/O facility for different OS.* ***Learning Outcomes :*** *A learner will be able to* 1. *Elaborate allocation methods for disk data. (P.I.-1.3.1)* 2. *Apply various disk scheduling methods on given set of cylinders and analyze the obtained result. (P.I.-1.4.1)* 3. *Compare various disk scheduling policies. (P.I.-2.2.5)* 4. *Identify I/O policies and its effect on system performance. (P.I.-2.3.2)*		

06.	**Virtual Machines**	**03-04**	CO- 5
	Learning Objective: *Learner is expected to know and understand the demonstration of virtual machine on host and guest OS.*		
	Contents: Type 0, 1, and 2 hypervisors, Advantages of virtual machines, Trap and emulate method, Handling system calls, interrupts, and privileged instructions in VMs, Binary translation and paravirtualization, Type 2 Hypervisors, Shadow and nested page tables, JVMs and application-level hypervisors, Resource allocation in virtual machines, VM migration, Storage virtualization.		
	Self-Learning Topics: *Study and use of cloud based virtual machines.*		
	Learning Outcomes : *A learner will be able to* *1. Illustrate various types of hypervisors. (P.I.-1.3.1)* *2. Apply virtualization types and compare the performance parameters of VM(P.I.-1.4.1)* *3. Compare resource allocation in virtual machines. (P.I.-2.2.5)* *4. Identify resource allocation in parallel VM. (P.I.-2.3.2)*		
	Course Conclusion	**01**	
	Total	**45**	

Course Outcomes:

Learner will be able to

1. Compare the structure and functions of Operating System.
2. Compare the performance of Scheduling Algorithms.
3. Interpret the process coordination and deadlock management.
4. Analyse memory and disk resource management.
5. Identify virtual machine usage and resource allocation.

Performance Indicators:

P.I. No.	**P.I. Statement**
1.3.1	Apply engineering fundamentals.
1.4.1	Apply theory and principles of computer science engineering to solve an engineering problem.
2.2.5	Compare and contrast alternative solution processes to select the best process.
2.3.2	Identify design constraints for required performance criteria.

Text Books:

1. Operating System Concepts, Abraham Silberschatz, Peter B Galvin, Greg Gagne, 9th Edition, Wiley India Pvt. Ltd 2018.
2. Operating Systems: Principles and Practice, Thomas Anderson and Michael Dahlin, 2nd Edition, 2014, Recursive Books.

Reference Books:

1. Operating Systems Internals and Design Principles, William Stallings, 9th Edition, 2018, Pearson.
2. Modern Operating Systems, Andrew S. Tanenbaum, Herbert Bos, 4th Edition, 2014, Pearson.

Other Resources:

1. Digital material:
   NPTEL: Introduction to Operating Systems by Prof. Chester Rebiero, IIT Madras
   Web Link-https://nptel.ac.in/courses/106106144
2. Digital material:
   NPTEL: Operating System Fundamental by Prof.Santanu Chattopadhay,IIT Kharagpur
   Web Link-https://archieve.nptel.ac.in/courses/106/105/106105214

A. IN-SEMESTER ASSESSMENT (50 MARKS)

1. Continuous Assessment (20 Marks)

Suggested breakup of distribution

a) One MCQ Test as per GATE exam pattern / level: 05 Marks

b) One Class Test: 05 Marks

c) Mind Map activity: 05 Marks

d) Regularity and active participation :05 Marks

2. Mid Semester Examination (30 Marks)

Mid semester examination will be based on 40% to 50% syllabus.

B. END SEMESTER EXAMINATION (50 MARKS)

End Semester Examination will be based on syllabus coverage up to the Mid Semester Examination (MSE) carrying 20% to 30% weightage, and the syllabus covered from MSE to ESE carrying 70% to 80% weightage

Course Type	Course Code	Course Name	Credits
PCC	ITPCC408	SOFTWARE ENGINEERING	03

Examination Scheme					
Distribution of Marks			Exam Duration (Hrs.)		Total Marks
In-semester Assessment		End Semester Exam (ESE)			
Continuous Assessment	Mid-Semester Exam (MSE)		MSE	ESE	
20	30	50	1.5	2	100

Pre-requisite: NIL

Program Outcomes addressed:

1. PO1: Engineering knowledge
2. PO2: Problem analysis
3. PO3: Development of Solutions
4. PO4: Conduct investigations of complex problems
5. PO5: Modern Tool Usage

Course Objectives :

1. To familiarize learner with the basic knowledge in software engineering.
2. To acquaint leaners to identify requirements, analyse and prepare models.
3. To familiarize learner to plan, schedule and track the progress of the projects.
4. To introduce leaners to design & develop the software solutions for the growth of society.
5. To familiarize learner to demonstrate and evaluate real time projects with respect to software engineering principles.
6. To introduce leaners to apply testing and assure quality in software solution.

Module	Detailed Contents	Hrs	CO
00.	**Course Introduction** Software Engineering Course deals with the basic principles of Software Process, with emphasis on the Process models and their usage for different types of Software. This is foundation course which deals with fundamental concepts of Requirement Analysis, Software Estimation and Scheduling, Risk and Configuration Management, Software Testing and Maintenance. The fundamental concepts of this subject are essential for working on Software Projects in Industry.	01	
01.	**Introduction to Software Engineering** ***Learning Objective/s:*** *Learner is expected to know the nature of software, software process and the different process models.* **Contents:**	05-06	CO- 1

	Nature of Software, Software Engineering, Software Process, Capability Maturity Model (CMM) Generic Process Model, Prescriptive Process Models: The Waterfall Model, V-model, Incremental Process Models, Evolutionary Process Models, Concurrent Models, Agile process, Agility Principles, Extreme Programming (XP), Scrum, Kanban model ***Self-Learning Topics:*** *Personal and Team Process Models.* ***Learning Outcomes :*** *A learner will be able to* 1. *Apply concepts of Process models to identify which process model best suits a particular software. (P.I.-1.3.1)* 2. *Use core principles of Capability Maturity Model to understand the importance of software in applications. (P.I.-1.4.1)* 3. *Differentiate Process models to identify which process model best suits a particular software. (P.I.-2.1.3)* 4. *Identify the level of software according to CMM model. (P.I.-2.2.3)*		
02.	**Requirement Analysis** ***Learning Objective/s:*** *Learner is expected to know and understand the concepts of requirement analysis in software engineering.* **Contents:** Software Requirements: Functional & non-functional – user-system requirement engineering process – feasibility studies – elicitation – validation & management – software prototyping – S/W documentation – Analysis and modeling Requirement Elicitation, Software requirement specification (SRS). Unified Modeling Language diagrams. ***Self-Learning Topics:*** *Prioritizing requirements (Kano diagram) - real life application case study.* ***Learning Outcomes :*** *A learner will be able to* 1. *Apply basic concepts of feasibility studies to check if a particular software is feasible for an organization. (P.I.-1.3.1)* 2. *Use requirement elicitation techniques to know about customer requirements. (P.I.-1.4.1)* 3. *Use tools to validate and manage requirements of a software. (P.I.-2.1.2)* 4. *Apply fundamentals of software prototyping and create software prototype. .(P.I.-2.2.3)* 5. *Determine requirements of software and develop SRS. (P.I.-3.1.6)* 6. *Identify suitable functional requirements for producing a variety of design solutions using UML for software. (PI-3.2.2)*	**07-09**	CO- 2
03.	**Software Estimation and Scheduling** ***Learning Objective/s:*** *Learner is expected to know and understand the concepts of software estimation and scheduling.* **Contents:**	**07-09**	CO- 3

	Management Spectrum, 3Ps (people, product and process) Process and Project metrics Software Project Estimation: LOC, FP, Empirical Estimation Models - COCOMO II Model, Specialized Estimation Techniques, Object based estimation, use-case based estimation Project scheduling: Defining a Task Set for the Software Project, Timeline charts, Tracking the Schedule, Earned Value Analysis ***Self-Learning Topics:*** *Typical Problems with IT cost estimates.* ***Learning Outcomes :*** *A learner will be able to* 1. *Identify Process and Project metrics for a software. (P.I.-1.3.1)* 2. *Use empirical estimation models to estimate cost of software. (P.I.-1.4.1)* 3. *Identify use cases to estimate cost and resources for a software. (P.I.-2.1.3)* 4. *Compare scheduling techniques and select best scheduling technique for a software. (P.I.-2.2.4)*		
04.	**Design Engineering** ***Learning Objective/s:*** *Learner is expected to know and understand concepts of design engineering.* **Contents:** Design Process & quality, Design Concepts, The design Model, Pattern-based Software Design. Architectural Design: Design Decisions, Views, Patterns, Application Architectures, Modeling Component level Design: component, Designing class based components, conducting component-level design. ***Self-Learning Topics:*** *Refinement aspects, Refactoring* ***Learning Outcomes :*** *A learner will be able to* 1. *Apply the concepts of Pattern based Software design to use in a software. system(P.I.-1.3.1)* 2. *Use architectural design (P.I.-1.4.1)* 3. *Identify the architectural view that best suits a software. (P.I.-2.1.3)* 4. *Analyze the class based components to be used in component level design. (P.I.-2.2.4)*	**05-06**	CO- 4
05.	**Software Risk, Configuration Management and Software Testing** ***Learning Objective/s:*** *Learner is expected to know and understand the concepts of software risk and configuration management.*	**09-10**	CO- 5

	Contents: Risk Identification, Risk Assessment, Risk Projection, RMMM Software Configuration management, SCM repositories, SCM process Testing: Software Quality, Testing: Strategic Approach, Strategic Issues- Testing: Strategies for Conventional Software. Dynamic Testing: Black Box Testing: Boundary Value Analysis, Equivalence Class Testing, State Table Based testing, Cause-Effect Graphing Based Testing, Error Guessing. White Box Testing Techniques: need, Logic Coverage Criteria, Basis Path Testing, Graph Matrices, Loop Testing, Static Testing: Formal Technical Review (FTR), Walkthrough. ***Self-Learning Topics:*** *Configuration Management for Web Apps.* ***Learning Outcomes :*** *A learner will be able to* 1. *Use RMMM to identify, assess and project risks in projects. (P.I.-1.3.1)* 2. *Apply SCM Process to solve an engineering problem associated with software. (P.I.-1.4.1)* 3. *Identifies processes/algorithms to find errors using testing techniques. (P.I.-2.1.3).* 4. *Compare the results of testing method used (P.I.-2.2.4).* 5. *Apply state table based to identify state of bugs. (P.I.-3.2.1)* 6. *Determine the functionalities and validate the test cases designed. (P.I.-3.4.3)* 7. *Derive appropriate procedure/algorithm, data set and test cases to find structural errors. (P.I.-4.1.2)* 8. *Outline structural bugs and logical bugs by running the test cases to refine the process over time. (P.I.-4.3.2)*		
06.	**Software Testing Tools and Quality Assurance** ***Learning Objective/s:*** *Learner is expected to know and understand concepts of software testing and assure quality of software solution.* **Contents:** Study of testing tools**.** Dynamic and static testing tools JIRA, Bugzilla. Software Quality Assurance Task and Plan, Metrics, Software Reliability, Software Quality Management and Assurance, McCall's quality factors and criteria, ISO9000:2000, SIX sigma. Basics of Software Maintenance and Reverse Engineering.	**04-05**	CO- 5

	Self-Learning Topics: *Web based and mobile based Software quality assurance factors and criteria.* ***Learning Outcomes :*** *A learner will be able to* 1. *Identify quality attributes for software quality assurance (P.I.-1.3.1).* 2. *Apply Software Quality Management and Assurance for to identify possible solution (P.I.-1.4.1)* 3. *Categorize automation tools for static and dynamic testing. (P.I.-3.2.2).* 4. *Use testing tool to design test cases for various modules. (P.I.-3.4.2).* 5. *Use appropriate testing tools and techniques to collect and analyze test data. (P.I.-4.3.1)* 6. *Analyze test cases stating possible errors and limitations using automation. (P.I.-4.3.2).* 7. *Use tools and techniques to design test data and test cases (P.I.-5.1.2)* 8. *Evaluate the credibility of results from tools used with reference to the accuracy and limitations. (P.I.-5.3.2)*		
	Course Conclusion	**01**	
Total		**45**	

Course Outcomes:

1. Illustrate use of basic knowledge in software engineering.
2. Identify requirements, analyze and prepare models.
3. Plan, schedule and track the progress of the projects.
4. Design & develop the software solutions for the growth of society.
5. To demonstrate and evaluate real time projects with respect to software engineering principles.
6. Apply testing and assure quality in software solution.

Performance Indicators:

P.I. No.	P.I. Statement
1.3.1	Apply engineering fundamentals
1.4.1	Apply theory and principles of computer science engineering to solve an engineering problem
2.1.3	Identifies mathematical algorithmic knowledge that applies to a given problem
2.2.4	Compare and contrast alternative solution/methods to select the best methods
3.1.6	Ability to develop software requirement specifications (SRS).
3.2.1	Ability to explore design alternatives.
3.2.2	Ability to produce a variety of potential design solutions suited to meet functional requirements.
3.4.2	Ability to implement and integrate the modules.
3.4.3	Ability to verify the functionalities and validate the design.
4.1.2	Ability to choose appropriate procedure/algorithm, data set and test cases.

4.3.2	Critically analyse data for trends and correlations, stating possible errors and limitations
5.1.2	Create/adapt/modify/extend tools and techniques to solve engineering problems.
5.3.2	Verify the credibility of results from tool use with reference to the accuracy and limitations, and the assumptions inherent in their use.

Text Books :

1. Software Engineering: A Practitioner‘s Approach, Roger Pressman, 9th edition , 2019, McGraw-Hill Publications
2. Software Engineering , Ian Sommerville, 9th edition, 2011, Pearson Education
3. Software Engineering Fundamentals , Ali Behfrooz and Fredeick J. Hudson, 9th edition, 1997, Oxford University Press.
4. The unified modeling language user guide, Grady Booch, James Rambaugh, Ivar Jacobson, Second Edition, 2005, Pearson Education

Reference Books :

1. An integrated approach to Software Engineering, Pankaj Jalote, Third edition, 2005, Springer publication.
2. Fundamentals of Software Engineering , Rajib Mall, Fifth Edition, 2014, Prentice Hall India
3. Software Engineering, Jibitesh Mishra and Ashok Mohanty, Third edition, 2011, Pearson Education
4. Software Engineering – Concepts and Practices, Ugrasen Suman, Third edition, 2013, Cengage Learning
5. Software Engineering principles and practice, Roger Pressman, Second edition , 2004, McGraw-Hill Publications

Other Resources:

1. NPTEL Course: Software Engineering By Prof. Rushikesh Joshi, Prof. Umesh Bellur, Prof. N.L. Sarda, Department of Computer Science and Engineering, IIT Bombay :-Web link- https://nptel.ac.in/courses/106/101/106101061/
2. NPTEL Course: Software Engineering By Prof. Rajib Mall, Department of Computer Science and Engineering, IIT Kharagpur :-Web link- https://nptel.ac.in/courses/106105087

A. IN-SEMESTER ASSESSMENT (50 MARKS)

1. Continuous Assessment (20 Marks)

Suggested breakup of distribution

a) One MCQ Test as per GATE exam pattern / level: 05 Marks

b) One Class test:05 Marks

c) One Mind Map activity: 05 Marks

d) Regularity and active participation :05 Marks

2. Mid Semester Examination (30 Marks)

Mid semester examination will be based on 40% to 50% syllabus.

B. END SEMESTER EXAMINATION (50 MARKS)

End Semester Examination will be based on syllabus coverage up to the Mid Semester Examination (MSE) carrying 20% to 30% weightage, and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Type	Course Code	Course Name	Credits
MDM	ITMDM402	MICROCONTROLLER AND EMBEDDED SYSTEM	03

Examination Scheme					
Distribution of Marks			Exam Duration (Hrs.)		Total Marks
In-semester Assessment		End Semester Exam (ESE)			
Continuous Assessment	Mid-Semester Exam (MSE)		MSE	ESE	
20	30	50	1.5	2	100

Pre-requisite :

1. ITPCC302: Computer Organization and Architecture

Program Outcomes addressed:

1. PO1: Engineering knowledge
2. PO2: Problem analysis
3. PO3: Development of Solutions
4. PO5: Modern Tool Usage

Course Objectives:

1. To familiarize learner with the concepts and architecture of embedded systems
2. To acquaint leaners with the basics of microcontroller 8051.
3. To familiarize learner with the concepts of microcontroller 8051 interface.
4. To introduce leaners with the concepts of ARM architecture.
5. To familiarize learner with the concepts of real-time operating system
6. To introduce leaners with the concepts of different design platforms used for an embedded systems application

Module	Detailed Contents	Hrs	CO
00.	**Course Introduction** Microcontrollers & embedded systems deal with the basic principles of microcontrollers, with emphasis on the Intel x51 and ARM microcontrollers and their associated peripheral chips. The fundamental concepts of this subject are essential for Internet of Things.	**01**	
01.	**Introduction to Embedded Systems** ***Learning Objective/s:*** *Learner is expected to know the concepts and architecture of embedded systems.* **Contents:**	**05-06**	CO- 1

	Overview of Embedded System Architecture, Application areas, Categories of embedded systems, specialties of embedded systems. Brief introduction to embedded microcontroller cores CISC, RISC, ARM, DSP and SoC		
	Self-Learning Topics: *Comparison of RISC and CISC.* ***Learning Outcomes :*** *A learner will be able to* 1. *Apply embedded systems concepts to identify different categories of embedded system with its significance. (P.I.-1.3.1)* 2. *Use core principles of embedded systems to understand the importance of embedded systems in applications. (P.I.-1.4.1)* 3. *Differentiate Embedded microcontroller cores like CISC, RISC. (P.I.-2.1.3)* 4. *Identify major performance criteria for the design of embedded systems. (P.I.-2.2.3)*		
02.	**The Microcontroller Architecture and Programming of 8051** ***Learning Objective/s:*** *Learner is expected to formulate transfer function models for complex electrical systems by breaking them down into smaller components or constructing signal flow graphs using electrical and mechanical engineering concepts.*	**07-09**	CO- 2
	Contents: Introduction to 8051 Microcontroller, Architecture, Pin configuration, Memory organization, Input /Output Ports, Counter and Timers, Serial communication, Interrupts. Instruction set, Addressing modes, Development tools, Assembler Directives, Programming based on Arithmetic & Logical Operations, I/O parallel and serial ports, Timers & Counters, and ISR.		
	Self-Learning Topics: *Write assembly language code for 8051 for any real time case study.* ***Learning Outcomes :*** *A learner will be able to* 1. *Formulate the programmer's model for 8051 by applying basic concepts. (P.I.-1.3.1)* 2. *Use registers of 8051 to write programs(P.I.-1.4.1)* 3. *Use development tools to program parallel & serial ports of 8051. (P.I.-2.1.2)* 4. *Apply fundamental 8051 concepts to use timers and counters in 8051. (P.I.-2.2.3)* 5. *Determine requirements of problem and decide instructions and registers to be used in 8051 programs. (P.I.-3.2.1)* 6. *Identify the development tools to write and run 8051 programs to check accuracy of solution (PI-3.2.2)*		
03.	**Interfacing with 8051 Microcontroller** ***Learning Objective/s:*** *Learner is expected to know and understand the concepts of microcontroller interface.*	**07-09**	CO- 3
	Contents: Interfacing ADC, DAC, Stepper motor, LCD , 8255 PPI .		

	Self-Learning Topics: *8051 interfacing with KBD matrix.* ***Learning Outcomes :*** *A learner will be able to* 1. *Identify pins to be used of 8051 to program with ADC, DAC and then analyze it to determine the time response. (P.I.-1.3.1)* 2. *Use registers of 8051 to write programs to operate stepper motor(P.I.-1.4.1)* 3. *Solve the given problem by interfacing 8255PPI with 8051 (P.I.-2.1.3)* 4. *Construct and interpret the result on LCD by interfacing it with 8051 for a system for its stability. (P.I.-2.2.3)*		
04.	**ARM 7 Architecture** ***Learning Objective/s:*** *Learner is expected to know and understand concepts of ARM architecture.* **Contents:** Architectural inheritance, Detailed study of Programmer's model, ARM Development tools, Instruction set: Data processing, Data Transfer, Control flow. Addressing modes. Writing simple assembly language programs. Pipelining, Brief introduction to exceptions and interrupts handling. ***Self-Learning Topics:*** *ARM code for real time problem* ***Learning Outcomes :*** *A learner will be able to* 1. *Apply the concepts of ARM architecture and development tools to use in an embedded system(P.I.-1.3.1)* 2. *Use registers of ARM to write assembly language programs (P.I.-1.4.1)* 3. *Identify the addressing modes and pipelining to be used for embedded applications. (P.I.-2.1.3)* 4. *Analyze the exceptions and interrupt handling in ARM embedded system. (P.I.-2.2.3)*	**07-09**	CO- 4
05.	**Opensource RTOS** ***Learning Objective/s:*** *Learner is expected to know and understand the concepts of real-time operating system.* **Contents:** Basics of RTOS: Real-time concepts, Hard Real time and Soft Real-time, basic architecture of an RTOS, scheduling systems, inter-process communication, performance Matrix in scheduling models, interrupt management in RTOS environment, memory management, file systems, I/O systems, advantage and disadvantage of RTOS. POSIX standards, RTOS issues – selecting a Real Time Operating System, RTOS comparative study. ***Self-Learning Topics:*** *Differences between general purpose OS & RTOS*	**07-09**	CO- 5

	Learning Outcomes : *A learner will be able to* 1. *Use interprocess communication for knowing basic architecture of RTOS(P.I.-1.3.1)* 2. *Apply scheduling systems in RTOS to know performance matrix inb scheduling models(P.I.-1.4.1)* 3. *Identify how interrupts and memory be managed in RTOS for stability. (P.I.-2.2.2)* 4. *Determine the POSIX standards and RTOS issues to select a suitable RTOS for embedded system. (P.I.-2.2.3)*		
06.	**Introduction to Embedded Systems Target Boards** ***Learning Objective/s:*** *Learner is expected to know and understand concepts of different design platforms used for an embedded systems application.* **Contents:** Introduction to Arduino, Raspberry Pi, etc. Opensource prototyping platforms. Basic Arduino programming; Extended Arduino libraries; Arduino-based Internet communication; Raspberry pi; Sensors and Interfacing: Temperature, Pressure, Humidity. ***Self-Learning Topics:*** ***Study the ARM Cortex or Galileo target board*** ***Learning Outcomes :*** *A learner will be able to* 1. *Formulate the prototyping platform to use a suitable embedded system board for an application. (P.I.-1.3.1)* 2. *Use Arduino libraries for a specific application on Arduino. (P.I.-1.4.1)* 3. *Identify the sensors to be used with a suitable embedded system board for an application. (P.I.-2.2.2)* 4. *Determine the how to use Arduino based Internet communication for an application(P.I.-2.2.3)* 5. *Adapt modern tool Arduino IDE sketch to program Arduino for an embedded system. (P..I-5.1.2)* 6. *Verify the results of embedded system using Arduino IDE sketch(P.I.- 5.3.2)*	**04-05**	CO- 5
	Course Conclusion	**01**	
	Total	**45**	

Course Outcomes:

Learner will be able to

1. Apply the fundamentals of embedded system to identify a suitable chip for the given application.
2. Illustrate architecture of 8051 and write embedded program for 8051.
3. Apply concepts of 8051 to interface it with the peripherals.
4. Use ARM architecture concepts to real world applications.

5. Identify the Real Time Operating system and Embedded target board to be used for applications.

Performance Indicators:

P.I. No.	P.I. Statement
1.3.1	Apply engineering fundamentals
1.4.1	Apply theory and principles of computer science engineering to solve an engineering problem
2.1.2	Identifies processes/modules/algorithms of a computer based system and parameters to solve a problem
2.2.2	Identifies functionalities and computing resources.
2.2.3	Identify existing solution/methods to solve the problem, including forming justified approximations and assumptions
3.2.1	Ability to explore design alternatives.
3.2.2	Ability to produce a variety of potential design solutions suited to meet functional requirements.
5.1.2	Create/adapt/modify/extend tools and techniques to solve engineering problems
5.3.2	Verify the credibility of results from tool use with reference to the accuracy and limitations, and the assumptions inherent in their use.

Text Books:

1. The 8051 microcontroller & Embedded systems, M. A. Mazidi, J. G. Mazidi, R. D. McKinlay, Third Edition, 2020, Pearson
2. The 8051 microcontroller & Embedded systems, Kenneth J. Ayala, Dhananjay V. Gadre, Second Edition, 2018,Cengage Learning
3. Embedded / real – time systems: concepts, design & programming, Black Book, Dr. K. V. K. K. Prasad, Fourth edition 2013,Dreamtech press,
4. Introduction to embedded systems, Shibu K. V, Second Edition, 2018, McGraw Hill
5. ARM System on chip Architecture, Steve Furber, Second Edition, 2015, Pearson

Reference Books:

1. Embedded systems an integrated approach, Laya B. Das, Third edition, 2013, Pearson publication.
2. ARM system developer's guide, Andrew N. Sloss, Dominic Symes, Chris Wright,First Edition, 2004, Morgan Kaufmann Publishers
3. Embedded system design A Unified hardware/software Introduction, Frank Vahid, Tony Givargis, Second Edition2006,Wiley publication
4. ARM Technical Reference manual

Other Resources:

1. NPTEL Course on Microprocessors and Microcontrollers by Prof. Santanu Chatopadhyay, Department of Electronics and Electrical Communication Engineering, IIT Kharagpur
   Web link- https://archive.nptel.ac.in/courses/108/105/108105102/
2. NPTEL Course on Embedded System Design with ARM by Prof. Indranil Sengupta, Department of Computer Science and Engineering, IIT Kharagpur
   Web link- https://onlinecourses.nptel.ac.in/noc22_cs93/preview

A. IN-SEMESTER ASSESSMENT (50 MARKS)

1. Continuous Assessment (20 Marks)

Suggested breakup of distribution

a) One MCQ Test as per GATE exam pattern / level: 05 Marks

b) One Class Test:05 Marks

c) One Think Pair Share (TPS) activity: 05 Marks

d) Regularity and active participation :05 Marks

2. Mid Semester Examination (30 Marks)

Mid semester examination will be based on 40% to 50% syllabus.

B. END SEMESTER EXAMINATION (50 MARKS)

End Semester Examination will be based on syllabus coverage up to the Mid Semester Examination (MSE) carrying 20% to 30% weightage, and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Type	Course Code	Course Name	Credits
LC	ITLC403	NETWORKS LABORATORY	01

Examination Scheme		
Continuous Assessment	**End Semester Exam(ESE)**	**Total**
25	25	50

Pre-requisite:

1. ESCLC103: Programming Laboratory-I (C)
2. ESCLC205: Programming Laboratory-II (Java)
3. ITSBL301: Python Laboratory

Program Outcomes addressed:

1. PO1: Engineering knowledge
2. PO2: Problem analysis
3. PO3: Design/development of solutions
4. PO5: Modern tool usage
5. PO6: The engineer and society
6. PO8: Ethics
7. PO11: Project management and finance

Course Objectives:

Learner is expected to

1. Build an understanding about fundamental concepts of computer network, protocols, architecture and applications.
2. Demonstrate hands-on experience of computer network simulation and modelling techniques using simulation software.
3. Implement client-server socket programming.
4. Demonstrate and interpret the traffic flow and the contents of protocol frames.
5. Design and configure a network for an organization.

Module	Detailed Contents	Hrs	CO
00.	**Course Introduction** The objective of Networks Laboratory course is to get practical knowledge of basic networking commands and working principles of various communication protocols using simulation software. Also analyses the structure and formats of TCP/IP layer protocols using network tools such as wireshark and network simulators.		
01.	**Basic Networking Commands** ***Learning Objective:*** *To impart the knowledge of basic networking commands and execute the networking commands to get network information.*	**02**	CO- 1

	Task 1: Understanding and execution of Basic networking Commands: ifconfig ,ip, traceroute, tracepath, ping, netstat, dig, nslookup, route, host, arp, hostname ***Self-Learning Topic:*** *Learn about various types of networks (LAN, WAN, MAN)* ***Learning Outcomes :*** *A learner will be able to* 1. *Comprehend how to configure network interfaces, assign IP addresses, and manage network interfaces using commands like ifconfig and ip. (P.I.- 1.3.1)* 2. *Diagnose network connectivity problems by utilizing commands like ping to check connectivity to remote hosts, traceroute and tracepath to trace the route packets take through the network, and netstat to display network statistics and active connections. (P.I.- 1.4.1)* 3. *Enhance system administration skills required for managing and maintaining computer networks in effective manner. (P.I.- 6.1.1, 6.1.2)*		
02.	**Network equipment** ***Learning Objective:*** *Learner is expected to be aware about network devices and exploit it in network design as per the users/ organization's requirement.* **Task 2:** Hands-on on network equipment. • Switches, Router • Hardware Firewall ***Self-Learning Topic:*** *Learn about other networking devices like repeater, gateway, hub etc.* ***Learning Outcomes :*** *A learner will be able to* 1. *Gain practical experience in configuring switches, routers, and hardware firewalls. (P.I.- 1.3.1)* 2. *Implement firewall rules in certain scenario. (P.I.- 1.4.1)* 3. *Prioritize network traffic, manage bandwidth usage, and improve network performance for critical applications. (P.I.- 2.4.2)* 4. *Apply security best practices by configuring access control lists on routers and firewalls. (P.I.- 2.2.4)* 5. *Identify anomalies, troubleshoot performance issues, and optimize network design. (P.I.- 3.2.1)* 6. *Gain experience in using network monitoring and analysis tools. (P.I.-3.3.2)* 7. *Analyze the requirements of users or organizations and select appropriate network devices to design efficient network architectures. (P.I.- 6.1.1, 6.1.2)*	**02**	CO- 1, CO- 2
03.	**Basics of Network simulation and simulation of Network Topology with different Protocols** ***Learning Objective/s:*** *Learner is expected to illustrate the basics of Network simulation. Also expected to implement different routing protocols and analyze it to make the best decisions for your network communication, security and management needs.*	**08**	CO- 3
	Task 3: Installation and configuration of NS-2 simulator. Write TCL scripts to create topologies.		

	Task 4: Write TCL scripts for topology with graphical simulation of traffic consideration (TCP, UDP) using NAM and plot the graph. **Task 5**: Implement distance vector routing protocol in NS2. ***Self-Learning Topic:*** *Implement link state routing protocols in NS2.* ***Learning Outcomes:*** *The learner will be able to* 1. *Invoke analytical studies of Computer Networks through network simulation societal impact of network technologies, including considerations related to security, privacy, and accessibility, and propose solutions that align with ethical and societal standards. (P.I.- 1.3.1, 6.1.1,6.2.1)* 2. *Demonstrate a comprehensive understanding of the fundamentals of network simulation. (P.I.- 1.4.1)* 3. *Identify modern engineering tools to simulate TCP, UDP, Link state routing protocols to emulate real-world networking scenarios. (P.I.- 5.1.1)* 4. *Identify the strengths and limitations of modern tools used for simulating and monitoring system performance. (P.I.- 5.2.1)* 5. *Develop project management skills by planning and executing network simulation projects, including defining project scopes, setting timelines, allocating resources, and evaluating project outcomes in terms of cost-effectiveness and efficiency. (P.I.- 11.1.2,11.3.1)*		
04.	**Socket Programming** ***Learning Objective:*** *To impart the knowledge about socket programming and implement it to create client and server applications in order to exchange information between processes on the same machine or across a network, allow access to centralized data.* **Task 6**: To study and Implement Socket Programming using TCP. **Task 7:** To study and Implement Socket Programming using UDP. ***Self-Learning Topics:*** *Learn about Echo Client and Server.* ***Learning Outcomes:*** *The learner will be able to* 1. *Summarize the underlying principles of networking protocols, communication mechanisms, and socket API functions. (P.I.- 1.3.1)* 2. *Implement client-server applications using socket programming. (P.I.- 1.4.1)* 3. *Utilize socket programming libraries and development tools to implement client-server applications and analyze the societal implications of networked systems. (P.I.- 5.1.1,6.1.1,6.1.2)* 4. *Demonstrate competence in employing modern tools for network application development. (P.I.- 5.2.1)*	**04**	CO- 3
05.	**Protocol analyzer and traffic analysis** ***Learning Objective:*** *Learner is expected to know and illustrate various network protocol analyzer tools and use it to analyze the traffic with the help of different performance measures*. **Task 8:** Study various network protocol analyzer tools and install one of the network protocol analyzer tools. **Task 9:** Analyze the network traffic using one of the network protocol analyzer tools.	**04**	CO- 4

	Self-Learning Topics: *Study tcpdump, Windump, Microsoft Message Analyzer, Ettercap, ISOFT Smart Sniff protocol analyzer tools and check the performance.* ***Learning Outcomes:*** *The learner will be able to* *1. Demonstrate the ability to measure and analyze network parameters for high throughput networks. (P.I.- 1.3.1)* *2. Apply appropriate measurement techniques to assess network performance. (P.I.- 1.4.1)* *3. Identify network protocol analyzer tools analyze the traffic with the help of different performance measures. (P.I.- 5.1.1)* 4. *Identify the strengths and limitations of protocol analyzer tools used for simulating and monitoring system performance. (P.I.- 5.2.1)*		
06.	**Network Design** ***Learning Objective:*** *Learner is expected to know and summarize IP addressing, networking protocols, layering architecture and implement it to design and configure a network for an organization.* **Task 10:** Perform remote login using Telnet Server. **Task 11:** Perform File Transfer and Access using FTP. **Task 12:** Design a network for an organization using the concepts of Addressing (IP Address Assignment), Naming (DNS) and Routing. Also mention the internetworking devices used.	**10**	CO-5
	Self-Learning Topics: *Any case study: Design network for any scenario as per users requirement.*		
	Learning Outcomes: *The learner will be able to* *1. Evaluate the societal impact of network technologies, including considerations related to security, privacy, and accessibility, and propose solutions that adhere to ethical and societal standards. (P.I.- 1.3.1,6.1.1,8.1.1)* *2. Develop effective communication, collaboration, and teamwork skills, demonstrating the ability to contribute positively to group dynamics and achieve common goals in network engineering projects.(P.I.- 1.4.1,6.2.1,8.2.2)*		
	Total	**30**	

Course Outcomes:

Learner will be able to

1. Execute and evaluate network administration commands. Also use network equipment to design the network for certain scenario.
2. Invoke analytical studies of computer networks through network simulation.
3. Implement the socket programming for client server architecture.
4. Measure and analyse the network parameters for a high throughput network.

5. Design a network using NS-3 toolkit and its importance in designing a real network.

Performance Indicators:

P. I. Number	P. I. Statement
1.3.1	Apply engineering fundamentals.
1.4.1	Apply theory and principles of computer science engineering to solve an engineering problem.
2.2.4	Compare and contrast alternative solution/methods to select the best methods
2.4.2	Analyse and interpret the results using contemporary tools.
3.2.1	Ability to explore design alternatives.
3.3.2	Consult with domain experts and stakeholders to select candidate engineering design solution for further development.
5.1.1	Identify modern engineering tools, techniques and resources for engineering activities
5.2.1	Identify the strengths and limitations of tools for (i) acquiring information, (ii) modelling and simulating, (iii) monitoring system performance, and (iv) creating engineering designs.
6.1.1	Identify and describe various engineering roles; particularly as pertains to protection of the public and public interest at global, regional and local level.
6.2.1	Interpret legislation, regulations, codes, and standards relevant to your discipline and explain its contribution to the protection of the public.
8.1.1	Identify situations of unethical professional conduct and propose ethical alternatives.
8.2.2	Examine and apply moral & ethical principles to known case studies.
11.1.2	Analyse different forms of financial statements to evaluate the financial status of an engineering project
11.3.1	Identify the tasks required to complete an engineering activity, and the resources required to complete the tasks

Text Books:

1. Computer Networks, Andrew S. Tanenbaum, David J. Wetherall, Fifth Edition, 2011, Prentice Hall
2. Data Communication and Networking", Behrouz A. Foruzan, Fifth Edition, 2013, Science Engineering & Math Publications

Reference Books:

1. Data and Computer Communication, W. Stallings, Tenth Edition, 2014, Pearson Education

2. TCP/IP Protocol Suite, B. A. Forouzan, Fourth Edition, 2010,Tata McGraw Hill edition,

3. Information Theory, Coding and Cryptography, Ranjan Bose, Second Edition, 2008, Tata McGraw-Hill

4. Introduction to Data Compression, Khalid Sayood ,Third Edition, 2010, Morgan Kaufman

Other Resources:

1. NPTEL Course: Computer Networks and Internet Protocol by Prof. Soumya Kanti Ghosh, Prof. Sandip Chakraborty, IIT Kharagpur
   Web Link- https://onlinecourses.nptel.ac.in/noc21_cs18/preview

2. NPTEL Course: Computer Networks by Prof. Hema A. Murthy**,** IIT Madras
   Web Link- https://nptel.ac.in/courses/106106091

A. IN-SEMESTER ASSESSMENT (25 MARKS)

1. Continuous Assessment (25 Marks)

Suggested breakup of distribution

a) Task Execution :10 Marks

Students will be given 10 tasks based on list as per mentioned in the syllabus. Each task carries 10 Marks. Average will be taken of all tasks. Students are expected to execute the program for given task with network simulator, protocol analyser and java. Students will be evaluated based on logic building for the given task, expected output and analysis of received results.

b) Practical Test: 10 Marks

Students will be given task (different for each student) and they will be evaluated based on the parameters mentioned in continuous assessment.

c) Regularity & Active participation: 05 Marks

B. END SEMESTER EXAMINATION (Practical and Oral Exam) (25 Marks)

Suggested breakup of distribution

a) Task Execution: 10 Marks

Students will be given task (different for each student) and they will be evaluated based on the parameters mentioned in continuous assessment.

b) Results and discussion, Inferences drawn based on above task: 05 Marks
c) Oral based on entire syllabus :10 Marks

Two examiners, one Internal and one External will do the evaluation

Course Type	Course Code	Course Name	Credits
LC	ITLC404	LINUX LABORATORY	01

Examination Scheme		
Continuous Assessment	**End Semester Exam(ESE)**	**Total**
25	25	50

Pre-requisite:

1. ESCLC103: Programming Laboratory-I (C)

Program Outcomes addressed:

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

Course Objectives:

1. To train learners with demonstration and installation of OS guide with basic commands.
2. To instruct learners about demonstration of file and directory management services using Linux commands.
3. To instruct learners about demonstration of user, memory and process management services using Linux commands.
4. To provide hands-on for learners for demonstration of basic shell script.
5. To provide hands-on for learners for demonstration of shell script for advance applications.
6. To prepare students to execute Perl and awk script.

Module	Detailed Contents	Hrs	CO
00.	**Course Introduction** This course discovers the significance of Linux operating System, an open-source operating system that offers security, customization, and cost-effectiveness. The Linux command line is a powerful tool that can be used to save time in a variety of ways. By using the command line, users can quickly navigate through the file system, search for files, create and delete directories, and even run programs. This course is majorly delivers the command line interaction of user with OS.	**01**	
01.	**Basic Utility Commands** ***Learning Objective:*** *Demonstration of Linux Installation and Basic Commands.* **Contents:** Utility Commands: echo, clear, exit, date, time, uptime, cal, cat, man, which, history, id, pwd, whoami, pr, lp, lpr, lpstat, lpq, lprm, cancel, mail. cal: The calendar, date: Displaying the system date, echo: Displaying message, printf: An alternative to echo, bc: The calculator, script: Recording your session, Email basics, mailx: The universal mailer passwd: Changing your password, who: Who are the users?, uname: Knowing your machine characteristics, tty: Knowing your terminal, stty: Displaying and setting terminal characteristics.	**03**	CO- 1

	Task 1: Execute various utility commands in Linux. ***Self-Learning Topics:*** *Demonstrate the commands line OS installation, memory partitions.* ***Learning Outcomes:*** *A learner will be able to* 1. *Compile and execute C program on Ubuntu OS using CLI. (P.I.-1.3.1)* 2. *Code array as 1D and 2D data structure. (P.I.-1.4.1)* 3. *Identify and use the mail commands for local smtp communication (P.I.-2.2.3)* 4. *Install Linux OS as single machine or alongside of Windows 10,11. (P.I.-2.3.1)* 5. *Demonstrate basic utility commands in Linux. (P.I.- 3.4.2)* 6. *Validate the credentials of system and other users in OS. (P.I.- 3.4.3)*		
02.	**File and Directory Management Commands** ***Learning Objective:*** *Learner is expected to understand and perform file and directory handling in Linux using command line interface.* **Contents:** The file: Ordinary file, Directory file, Device file, Filename, the parent-child relationship, UNIX file system tree, The Unix file system, the home directory, pwd: Checking your current directory, cd: Changing the current directory, mkdir: Making directories, rmdir: Removing directories, ls: Listing directory contents, Absolute pathnames, Relative pathnames Handling ordinary files, cat: Displaying and creating files, cp: Copying file, rm: Deleting files, mv: Renaming files, more: Paging output The lp subsystem: printing a file, file: knowing the filetypes wc: Counting lines, words and characters, od: Displaying data in octal, cmp: Comparing two files, comm: What is common, diff: Converting one file to other, gzip and gunzip: Compressing and decompressing files and folders. tar: The archival program, zip and unzip: Compressing and archiving together. Basic file attributes, ls -l: Listing file attributes, the -d option: Listing directory attributes. File ownership, File permissions, chmod: Changing file permissions, directory permission, Changing file ownership, chown: Changing file owner, chgrp: Changing group owner **Task 2:** Execute various file permission commands. **Task 3:** Execute file and directory management commands. ***Self-Learning Topics:*** *Commands to automate the disk space management and user alert by OS.* ***Learning Outcomes:*** *A learner will be able to* 1. *Associate file access rights to owner, group user and all system users. (P.I.-1.3.1)* 2. *Identify and change the mode of files and folders. (P.I.-1.4.1)* 3. *Apply the commands to compress the files and folders. (P.I.-2.2.3)* 4. *Identify and implement directory management (P.I.-2.3.1)* 5. *Select various types of files and count total number of files and directories. (P.I.-3.4.2)* 6. *Identify issues in file and directory management (P.I.- 3.4.3)*	**06**	CO- 2

03.	**Memory, Process and User Management Commands** ***Learning Objective:*** *Learners is expected to understand the tasks in memory and user management and user management and able execute relevant commands on CLI.*	**06**	CO- 2
	Contents: a) Execution of Memory Management Commands like free, /proc/meminfo, top, htop, df, du, vmstat, demidecode, sar, pagesize, etc. b) Execution of Process Management Commands like ps, pstree, nice, kill, pkill, killall, xkill, fg, bg, pgrep, renice, etc. c)Execution of User Management Commands like who, whoami, su, sudo, login, logout, exit, passwd, useradd/adduser, usermod, userdel, groupadd, groupmod, groupdel, gpasswd, chown, chage, chgrp, chfn, etc. **Task 4:** Execute memory management commands. **Task 5:** Create the process and kill using pid. **Task 6:** Execute user management commands.		
	Self-Learning Topics: *User and group management using shell script.*		
	Learning Outcomes: *A learner will be able to* 1. *List the process and its features. (P.I.-1.3.1)* 2. *Fetch the process id by using commands. (P.I.-1.4.1)* 3. *Execute command for closing the process. (P.I.-2.2.3)* 4. *Manage the users and their permissions. (P.I.-2.3.1)* 5. *Use of advance commands for various user and process management activities. (P.I.- 3.4.2)* 6. *Execute user and memory management from CLI Linux. (P.I.- 3.4.3)*		
04.	**Basic Shell Script** ***Learning Objective:*** *Learner is expected to understand Linux shell processing and syntax associated with it to design batch files.*	**04**	CO-3
	Contents: Write a basic shell script: with syntax of read, write statements, loop and control statements. **Task 7:** Write shell script for following problems. i. Write a shell script to perform arithmetic operations. ii. Write a shell script to calculate simple interest. iii. Write a shell script to determine largest among three integer numbers. iv. Write a shell script to determine a given year is leap year or not. *v.* Write a shell script to print multiplication table of given number using while statement.		
	Self-Learning Topics: *Execute shell script for array, structures and composite data types.*		
	Learning Outcomes: *A Learner will be able to* 1. *Create shell file. (P.I.-1.3.1)*		

	2. *Change the mode of execution of shell script (P.I.-1.4.1)* 3. *Execute the shell script. (P.I.-2.2.3)* 4. *Identify the conditions and learn to write the conditional statements in shell script. (P.I.-2.3.1)* 5. *Implement, for and while loop statement in shell script. (P.I.- 3.4.2)* 6. *Develop the shell script to handle device and network operations. (P.I.- 3.4.3)*		
05.	**Shell script for File and User Management** ***Learning Objectives:*** *Learner is expected to understand Linux shell processing and syntax associated with it to design batch files which are used for user and file management operations.*	**06**	CO-4
	Contents: Advance shell script: with file, directory and user management functions. **Task 8:** Write an advanced shell script for file and user management. i. Write shell script to check logged-in user details and number of logged-in user. ii. Write a shell script to read and check if the directory / file exists or not, if not make the directory / file. iii. Write a shell script using grep command to find the number of words, characters, and words and lines in a file. iv. Write shell script to calculate total number of files and folder in specified folder. v. Write a shell script that creates a directory and a file within it. Insert the contents into the file and duplicate the source folder to the specified target location. .		
	Self-Learning Topics: *Code shell script for network and infrastructure security.* ***Learning Outcomes:*** *A learner will be able to* *1. Code shell script to create folder. (P.I.-1.3.1)* *2. Code shell script to create file and content into it. (P.I.-1.4.1)* *3. Manage various tty users using shell script. (P.I.-2.2.3)* *4. Fetch user details using shell script. (P.I.-2.3.1)* *5. Develop Shell script to process the list. (P.I.- 3.4.2)* *6. Develop Shell script to take backup of device on another connected device. (P.I.- 3.4.3)*		
06.	**Execute Perl and Awk Script** ***Learning Objective:*** *Learner is expected to implement complex problems using data structures and algorithms, and analysing data structures inside data management models*.	**04**	CO-5
	Contents Introduction and use of Perl and Awk script, Syntax in Perl, Syntax in awk, Control and conditional statements in Perl and Awk script. Perform Perl and AWK script for **Task 9:** Study and Execute Perl script. (i) Write a Perl script to sort elements of an array. (ii) Write a Perl script to check a number is prime or not.		

	(iii) Write Perl script to read and write number array. **Task 10:** Study and Execute Perl script. (i) Write an awk script to print all even numbers in a given range. (ii) Write an awk script to develop a Fibonacci series (take user input for number of terms). (iii)Write awk script to find factorial of number.		
	Self-Learning Topics: *Perl script to develop applications in open-source systems.* ***Learning Outcomes*** *A learner will be able to* *1. Create Perl and awk file. (P.I.-1.3.1)* *2. Associate the path in Perl file. (P.I.-1.4.1)* *3. Execute Perl files. (P.I.-2.2.3)* *4. Solve various problems using Perl script. (P.I.-2.3.1)* *5. Use Perl to develop open-source system. (P.I.- 3.4.2)* *6. Develop the shell script to handle device and network operations. (P.I.- 3.4.3)*		
	Total	**30**	

Course Outcomes:

Learner will be able to

1. Use the basic utilities commands for OS installation.
2. Study and use file and directory management commands in Linux.
3. Study and use advance commands in Linux.
4. Execute basic and advance shell script programs.
5. Execute perl and awk script.

Performance Indicators:

P.I. No.	P.I. Statement
1.3.1	Apply engineering fundamentals
1.4.1	Apply theory and principles of computer science engineering to solve an engineering problem.
2.2.3	Identify existing solution/methods to solve the problem, including forming justified approximations and assumptions.
2.3.1	Able to apply computer engineering principles to formulate modules of a system with required applicability and performance.
3.4.2	Ability to implement and integrate the modules.
3.4.3	Ability to verify the functionalities and validate the design.

Text Books:

1. Unix Concepts and Applications, S. Das, 4th edition., 2017, McGraw Hill.
2. Mastering Unix Shell Scripting, R. Michael, 2nd edition, 2008, Wiley.
3. Linux Experiments and Open-Source Technologies, D. Ambawade, D. Shah, 2nd edition, 2014, Dreamtech Press.

Reference Books:

1. Unix Shell Programming, Y. Kanetkar, 3rd edition, 2003, BPB Publications.
2. Unix and Shell Programming, B. Forouzan and R. Gilberg, 4th edition, Cengage Learning, 2003.

Other Resources:

1. Digital material:
   Web Link- Install Ubuntu desktop | Ubuntu
2. Web Link- The Linux Command Handbook – Learn Linux Commands for Beginners (freecodecamp.org)

A. CONTINUOUS ASSESSMENT (25 MARKS)

Suggested breakup of distribution

a) Command based script execution :10 Marks

Students will be given 10 tasks based on list as per mentioned in the syllabus. Each task carries 10 Marks. Average will be taken of all tasks. Students are expected to execute the basic utility and advanced commands of Linux operating system also they have to perform command based shell, Perl, AWK script. Students will be evaluated based on logic building for the given script and expected output.

b) Practical Test: 10 Marks

Students will be given task (different for each student) and they will be evaluated based on the parameters mentioned in continuous assessment.

c) Regularity & Active participation: 05 Marks

B. END SEMESTER EXAMINATION (Practical and Oral Exam) (25 Marks)

Suggested breakup of distribution

a) Command based script **e**xecution: 10 Marks

Students will be given task (different for each student) and they will be evaluated based on the parameters mentioned in continuous assessment.

b) Results and discussion, Inferences drawn: 05 Marks

c) Oral based on entire syllabus :10 Marks

Two examiners, one Internal and one External will do the evaluation.

Course Type	Course Code	Course Name	Credits
LC	ITLC405	SOFTWARE DEVELOPMENT LABORATORY	01

Examination Scheme		
Continuous Assessment	**End Semester Exam(ESE)**	**Total**
25	25	50

Pre-requisite:

1. ESCLC103: Programming Laboratory-I (C)
2. ESCLC205: Programming Laboratory-II (Java)
3. ITSBL301 : Python Laboratory

Program Outcomes addressed:

1. PO 1: Engineering knowledge
2. PO 2: Problem analysis
3. PO 3: Design/Development of Solutions
4. PO 4: Conduct investigations of complex problems
5. PO 5: Modern tool usage
6. PO 7: Environment and Sustainability
7. PO 9: Individual and team work
8. PO 10: Communication
9. PO 11: Project management and finance

Course Objectives:

1. To familiarize leaners, the basics of software engineering principles.
2. To make learner understand documentation Requirements, analysis, planning and scheduling.
3. To acquaint leaners with skills to design test case plans for testing software using dynamic testing techniques.
4. To make learner able to apply knowledge of automation testing.
5. To make leaner infer and apply quality assurance and management.

Module	Detailed Contents	Hrs	CO
00.	**Course Introduction** This course deals with basics of software engineering principles, phases of software development life cycle, various process models which will be helpful to follow the process during software development, identify early challenges or cost constraints to know team's development process for the future. Software Testing tools are used in industries for automating the entire testing process. Software QA and testing helps prevent defects from reaching end-users. By detecting issues earlier in software development cycles through extensive testing, problems can be fixed before software gets deployed.		

01.	**Introduction to concepts of software engineering principles and software development process.** ***Learning Objective/s:*** *Learner is expected to infer basics of software engineering principles and software development life cycle and apply it for the project development process.* *Learner is expected to gain knowledge of process models and also expected to determine the right process followed for software development.*	**08**	CO- 1
	Task 1: Select a problem statement and write case study on Software Development Life Cycle for the same. **Task 2:** Implement Waterfall Model and Agile model for the selected problem statement. **Task 3:** Analyze the difference between waterfall model and agile model.		
	Self-Learning Topics: *Personal and Team Process Models.* ***Learning Outcomes :*** *A learner will be able to* 1. *Use software engineering principles to identify and document phases of software development life cycle. (P.I.-1.3.1,10.1.2)* 2. *Apply software engineering principles to solve an engineering problem and demonstrate the progress of project development for the selected problem statement. (P.I.-1.4.1,10.3.2)* 3. *Illustrate design alternatives for the progress of software development. (P.I.-3.2.1)* 4. *Select optimal process model for further development. (P.I.-3.4.1)* 5. *Identify the team's development process. (P.I.-2.1.1,11.3.1)* 6. *Analyze and estimate cost incurred to select best process and also analyze limitations of process models and select the most appropriate process model based on economic and financial considerations. (P.I.-2.2.5, 11.2.1)*		
02.	**Software Requirement Analysis and scheduling** ***Learning Objective/s:*** *Learner is expected to paraphrase and apply knowledge of documentation requirements, analysis, planning and scheduling for software development.*	**04**	CO- 2
	Task 4: Write software requirement specification, Work breakdown structure (WBS). **Task 5:** Prepare Gantt chart for the selected problem statement		
	Self-Learning Topics: *prioritizing requirements, Typical Problems with IT Cost Estimates.* ***Learning Outcomes :*** *A learner will be able to* 1. *Apply basics of software engineering to prepare SRS document for the selected problem statement. (P.I.-1.3.1)* 2. *Model WBS to schedule and allocate various task during SDLC. (P.I.-1.4.1)* 3. *Identify and document system requirements for the software development process. (P.I.-3.1.2)* 4. *Illustrate Gantt chart to maintain timeline for the software development process. (P.I.-3.1.6)* 5. *Use tools and techniques to prepare timeline chart P.I.- (5.1.2)*		

	6. *Identify limitations of the tools used to derive timeline chart. (P.I.-5.3.1)*		
03.	**Software Testing Techniques** ***Learning Objective/s:*** *Learner is expected to illustrate and apply black box testing techniques for designing test cases to identify and analyze structural errors.* *Learner is expected to infer knowledge of white box testing techniques and use white box testing techniques to ensure that all the internal components work as expected and are error-free.*	**08**	CO- 3
	Task 6: Design test cases using black box testing techniques for the selected project, execute the test cases and discuss the results. **Task 7:** Design test cases using path testing technique and execute test cases for the same selected problem statement to identify and fix the logical errors.		
	Self-Learning Topics: *Select the test cases (positive and negative scenarios) for the selected system and Design test cases for the system using any two studied testing techniques* ***Learning Outcomes :*** *A learner will be able to* 1. *Use BVC to test the boundary values of the input. (P.I.-1.3.1)* 2. *Apply black box and white box testing to solve an engineering problem associated to input classes. (P.I.-1.4.1)* 3. *Identify processes/algorithms to find errors using testing techniques. (P.I.-2.1.2).* 4. *Compare the results of testing method used (P.I.-2.2.4).* 5. *Apply state table based testing to identify state of bugs. (P.I.-3.2.1)* 6. *Determine the functionalities and validate the test cases designed. (P.I.-3.4.3)* 7. *Derive appropriate procedure/algorithm, data set and test cases to find structural errors. (P.I.-4.1.2)* 8. *Outline structural bugs and logical bugs by running the test cases to refine the process over time. (P.I.-4.3.2)*		
04.	**Automation and Testing Tools** ***Learning Objective/s:*** *Learner is expected to infer knowledge of easy approach of testing using automated tools and also expected to select and use automation tools which mainly focuses on reducing manual human activity.* *Learner is expected to summarize effectiveness, and coverage of software testing to save time and effort using automated tools. Also expected to compare the actual output against the expected outcome using testing tool.*	**06**	CO-4
	Task 8: Study and categorize various testing tools and implement anyone open-source testing tool. **Task 9:** Study and implementation of anyone bug tracking tool.		
	Self-Learning Topics: *Testing tool for agile based model* ***Learning Outcomes :*** *A learner will be able to* 1. *Infer need of automation in testing. (P.I.-1.3.1).* 2. *Identify automation tools for testing. (P.I.-1.4.1)* 3. *Categorize automation tools for static and dynamic testing. (P.I.-3.2.2).* 4. *Use testing tool to design test cases for various modules. (P.I.-3.4.2).*		

	5. *Use appropriate testing tools and techniques to collect and analyze test data. (P.I.-4.3.1)* 6. *Analyze test cases stating possible errors and limitations using automation. (P.I.-4.3.2).* 7. *Use tools and techniques to design test data and test cases (P.I.-5.1.2)* 8. *Evaluate the credibility of results from tools used with reference to the accuracy and limitations. (P.I.-5.3.2)*		
05	**Software quality Assurance** ***Learning Objective/s:*** *Learner is expected to summarize basics of software quality assurance and management. Also expected to use and analyse various quality factors and criteria which helps to prevent defects from reaching end-users* **Task 10:** Identify Quality Attributes and Relationships for the various properties used for the selected problem statement. **Task 11:** Implement quality attributes using McCall's quality factors and criteria. ***Self-Learning Topics:*** *Web based and Mobile based software quality assurance factors and criteria.* ***Learning Outcomes :*** *A learner will be able to* 1. *Identify quality attributes for software quality assurance. (P.I.-1.3.1,7.1.1).* 2. *Apply Software Quality Management and Assurance for to identify possible solution. (P.I.-1.4.1)* 3. *Apply engineering principles to formulate modules of a system through quality attributes using McCall's quality factors and Criteria. (P.I.-2.3.1,7.2.2,9.2.1,10.2.1)* 4. *Analyze quality attributes and criteria used for software development using ISO9000:2000, SIX sigma. (P.I.-2.3.2,9.3.1,10.2.2)*	**04**	CO-5
	Total	**30**	

Course Outcomes:

Learner will be able to

1. Use concepts of software engineering process models to optimize the flow of project development process.
2. Identify requirements, analyse, plan, schedule and track the progress of the projects.
3. Use various software testing methods and strategies to identify bugs.
4. Illustrate use of automation tools.
5. Apply the software quality assurance factors to Identify Quality Attributes and their Relationships.

Performance Indicators :

P.I. No.	P.I. Statement
1.3.1	Apply engineering fundamentals
1.4.1	Apply theory and principles of computer science engineering to solve an engineering problem
2.1.1	Evaluate problem statements and identifies objectives
2.1.2	Identifies processes/modules/algorithms of a computer-based system and parameters to solve a problem.
2.2.4	Compare and contrast alternative solution/methods to select the best methods
2.2.5	Compare and contrast alternative solution processes to select the best process.
2.3.1	Able to apply computer engineering principles to formulate modules of a system with required applicability and performance
2.3.2	Identify design constraints for required performance criteria
2.4.3	Identify the limitations of the solution and sources/causes
3.1.2	Able to identify and document system requirements from stake holders
3.1.6	Ability to develop software requirement specifications (SRS).
3.2.1	Ability to explore design alternatives.
3.2.2	Ability to produce a variety of potential design solutions suited to meet functional requirements.
3.4.1	Ability to refine architecture design into a detailed design within the existing constraints.
3.4.2	Ability to implement and integrate the modules.
3.4.3	Ability to verify the functionalities and validate the design.
4.1.2	Ability to choose appropriate procedure/algorithm, data set and test cases.
4.3.1	Use appropriate procedures tools and techniques to collect and analyze data
4.3.2	Critically analyse data for trends and correlations, stating possible errors and limitations
5.1.2	Create/adapt/modify/extend tools and techniques to solve engineering problems.
5.3.2	Verify the credibility of results from tool use with reference to the accuracy and limitations, and the assumptions inherent in their use.
7.1.1	Identify risks/impacts in the life-cycle of an engineering product or activity.
7.2.2	Apply principles of preventive engineering and sustainable development to an engineering activity or product relevant to the discipline
9.2.1	Demonstrate effective communication, problem solving, conflict resolution and leadership skills
9.3.1	Present results as a team, with smooth integration of contributions from all individual efforts.
10.1.2	Produce clear, well-constructed, and well-supported written engineering documents
10.2.1	Listen to and comprehend information, instructions, and viewpoints of others
10.2.2	Deliver effective oral presentations to technical and non-technical audiences
10.3.2	Use a variety of media effectively to convey a message in a document or a presentation

11.2.1	Analyze and select the most appropriate proposal based on economic and financial considerations.
11.3.1	Identify the tasks required to complete an engineering activity, and the resources required to complete the tasks.

Text Books:

1. Software Engineering: A practitioner's approach, Roger S. Pressman, 7 th edition ,2010, McGraw Hill
2. Fundamentals of Software Engineering, Rajib Mall, 7 th edition ,2014, Prentice Hall India
3. Software Testing Principles and Practices, Naresh Chauhan, 2 nd edition, 2016, Oxford Higher Education
4. Software Testing and quality assurance theory and practice, Kshirasagar Naik, Priyadarshi Tripathy, 1st edition 2008,Wiley Publication.

Reference Books:

1. An integrated approach to Software Engineering, Pankaj Jalote, , 3rd edition 2005, Springer/Narosa.
2. Effective Methods for Software Testing, Willam E. Perry, third edition, 2006,Wiley Publication.
3. Software Testing Concepts and Tools, Nageswara Rao Pusuluri, ISE Edition, 2006, Dreamtech press

Other Resources:

1. NPTEL Course: Introduction to software Engineering By Prof. N.L.Sarda, Department of Computer Science and Engineering, IIT Bombay
   Web link- https://archive.nptel.ac.in/courses/106/101/106101061/
2. Course on Software Testing By Prof. Rajib mall, Department of Computer Science and Engineering, IIT Kharagpur
   Web link- https://nptel.ac.in/courses/106105150/.

A. CONTINUOUS ASSESSMENT (25 MARKS)

Suggested breakup of distribution

a) Task Execution :10 Marks
Students will be given 11 tasks based on list as per mentioned in the syllabus. Each task carries 10 Marks. Average will be taken of all tasks. Students are expected to identify and apply software engineering principles also perform manual and automated testing to find the logical and structural errors and also apply quality assurance factors and criteria. Students will be evaluated based on parameters such as identification of process models, testing techniques and quality check.

b) Practical Test: 05 Marks

Students will be given task (different for each student) and they will be evaluated based on the parameters mentioned in continuous assessment.

c) Oral based on entire syllabus: 05 Marks

d) Regularity & Active participation: 05 Marks

B. END SEMESTER EXAMINATION (Practical and Oral Exam) (25 Marks)

Suggested breakup of distribution

a) Task Execution :10 Marks

Students will be given task (different for each student) and they will be evaluated based on the parameters mentioned in continuous assessment.

b) Documentation on Software Development Life Cycle: 05 Marks

c) Oral based on entire syllabus:10 Marks

Two examiners, one Internal and one External will do the evaluation.

Course Type	Course Code	Course Name	Credits
SBL	ITSBL402	FULL STACK DEVELOPMENT LABORATORY	02

Examination Scheme		
Continuous Assessment	**End Semester Exam (ESE)**	**Total**
50	50	100

Pre-requisite :

1. ESCLC205: Programming Laboratory-II (Java)
2. ITSBL301: Python Laboratory

Program Outcomes addressed :

1. PO1: Engineering knowledge
2. PO2: Problem analysis
3. PO3: Design/Development of solution
4. PO4: Conduct investigations of complex problems
5. PO5: Modern tool usage
6. PO9: Individual and team work

Course Objectives:

Learner is expected to

1. Design and develop webpages using HTML5.
2. Integrate CSS3 and Bootstrap for formatting web pages.
3. Implement JavaScript code to make web pages interactive.
4. Show proficiency in React and Angular for developing front end applications.
5. Integrate and implement code using Node.js and Mongodb for developing backend applications.

Module	Detailed Contents	Hrs	CO
00.	**Course Introduction** In the Full Stack Web Development Lab, students explore modern web development using React and Angular. They gain practical experience building dynamic web applications from frontend to backend.	**01**	
01.	**HTML5** ***Learning Objective/s:*** *Learner is expected to demonstrate and apply HTML tags to develop webpages with well-structured HTML. Also expected to create web pages using text formatting, graphics, audio, and video elements.*	**03**	**CO- 1**

	Contents: Elements, Attributes, Head, Body, Hyperlink, Formatting, Images, Tables, List, Frames, Forms, Multimedia. **Task 1:** Implement using HTML5: Elements, Attributes, Head, Body, Hyperlink, Formatting, Images, Tables, List, Frames, Forms, Multimedia		
	Self-Learning Topics: *Canvas and SVG Graphic, Parallax Scrolling* ***Learning Outcomes :*** *A learner will be able to* 1. *Apply HTML tags to develop simple web page. (P.I.- 1.3.1)* 2. *Apply suitable tags according to given problem. (P.I.- 1.4.1)* 3. *Integrate hyperlinks, formatting, images, tables, lists, frames, forms, and multimedia elements to create visually appealing and interactive web pages. (P.I.- 3.4.2)* 4. *Verify functionality of static website using HTML. (P.I.- 3.4.3)*		
02.	**CSS3** ***Learning Objective/s:*** *Learner is expected to apply CSS in styling tables and lists, also use advanced selectors to precisely target and style specific elements within a document.*	**04**	**CO-2**
	Contents: Syntax, Inclusion, Color, Background, Fonts, Tables, lists, CSS3 selectors, Pseudo classes, Pseudo elements **Task 2:** Implement using CSS3: Syntax, Inclusion, Color, Background, Fonts, Tables, lists, CSS3 selectors, Pseudo classes, Pseudo elements		
	Self-Learning Topics: *CSS Best Practices and Optimization* ***Learning Outcomes :*** *A learner will be able to* 1. *Apply syntax correctly, use CSS3 with ease, and incorporate styles into HTML compositions. (P.I.- 1.3.1)* 2. *Apply CSS3 selectors, pseudo-classes, and pseudo-elements, to demonstrate proficiency in adjusting color, backgrounds, fonts, tables, and lists. (P.I.- 1.4.1)* 3. *Identify CSS3 tags according to design good layout. (P.I.-2.1.2)* 4. *Identify design constraints of CSS3. (P.I.-2.3.2)*		
03.	**Bootstrap** ***Learning Objective/s:*** **Contents:** Grid system, Forms, Button, Navbar, Breadcrumb, Jumbotron **Task 3:**Implement using Bootstrap: Grid system, Forms, Button, Navbar, Breadcrumb, Jumbotron	**04**	**CO- 2**
	Self-Learning Topics: *Customizing Bootstrap Themes*		

	Learning Outcomes : *A learner will be able to* 1. *Develop and design responsive layouts with the grid system by using Bootstrap with proficiency. (P.I.- 4.2.1)* 2. *Use Bootstrap features to improve the overall usability and aesthetics of online applications. (P.I.- 4.3.1)*		
04.	**JavaScript** ***Learning Objective/s:*** *Learner is expected to recall and apply JavaScript and its concepts and develop understanding behind JavaScript applications.*	**16**	**CO- 3**
	Contents: Variables, Operators, Conditions, Loops, Functions, Events, Classes and Objects, Error handling, Validations, Arrays, String, Date **Task 4:** Implement using JavaScript: Variables, Operators, Conditions, Loops, Functions, Events, Classes and Objects. **Task 5:** Implement using JavaScript: Error handling, Validations, Arrays, String, Date.		
	Self-Learning Topics: *Testing and Test-Driven Development, Web APIs and Browser Features* ***Learning Outcomes:*** *A learner will be able to* 1. *Apply JavaScript to design and develop interactive webpages. (P.I.-1.3.1)* 2. *Apply knowledge of JavaScript, effectively utilizing operators, loops, dates, events, classes, objects, variables, class handling, validations, and loops. (P.I.-1.4.1)* 3. *Identify events and classes. (P.I.-2.1.2)* 4. *Identify functionalities of dynamic web experiences by adding animations, interactive elements, and responsiveness. (P.I.-2.2.2)*		
05.	**React and Angular** ***Learning Objective/s:*** *Learner is expected to recognize the steps involved in setting up and configuring a React and Angular development environment to ensure a smooth setup. Design and develop an understanding behind React apps and Angular apps.*	**20**	**CO-4**
	Contents: Installation and Configuration. JSX, Components, Props, State, Forms, Events, Routers, Refs, Keys. Overview of AngularJS, Need of AngularJS in real web sites, AngularJS modules, AngularJS built-in directives, AngularJS custom directives, AngularJS expressions, Angular JS Data Binding, AngularJS filters, AngularJS controllers, AngularJS scope, AngularJS dependency injection, Angular JS Services, Form Validation, Routing using ng-Route, ng-Repeat, ng-style, ng-view, Built-in Helper Functions, Using Angular JS with Typescript **Task 6:** Implement using React: Installation and Configuration. JSX. Implement using React: Components, Props, State, Forms, Events. Implement using React: Routers, Refs, Keys.		

	Task 7: Create a simple HTML "Hello World" Project using AngularJS Framework and apply ng-controller, ng-model and expressions. **Task 8:** Events and Validations in AngularJS. (Create functions and add events, adding HTML validators, using $valid property of Angular, etc.) Create an application for like Students Record using AngularJS		
	Self-Learning Topics: *Context API and Redux, State Management with NgRx (Optional), Testing and Debugging* ***Learning Outcomes:*** *A learner will be able to* 1. *Identify modern engineering tools and show installation of React and Angular. (P.I.- 5.1.1)* 2. *Demonstrate proficiency and create dynamic and effective user interfaces using React and Angular applications. (P.I.- 5.2.2)*		
06.	**Node.js** ***Learning Objective/s:*** *Learner is expected to apply callback functions and event loops, also able to install and configure Express with ease, and build a working Express application on their own to showcase server-side JavaScript coding proficiency. Also expected to build REST API using MongoDB.*	**12**	**CO-5**
	Contents: Installation and Configuration, Callbacks, Event loops, creating express app, create Mongodb application **Task 9:** Implement using Node.js: Installation and Configuration, Callbacks, Implement using Node.js: Event loops, Creating express app. Implement Mongodb application. **Task 10:** Implementation of Mini Project on selected case study.		
	Self-Learning Topics: *Template Engines and Views, Indexes and Query Optimization* ***Learning Outcomes:*** *A learner will be able to* 1. *Identify modern engineering tools and show competence of configuring and setting up Express to integrate and develop server-side applications. (P.I.-3.4.2, 5.1.1, 9.1.1)* 2. *Demonstrate proficiency using callbacks and comprehend event loops, and their ability to design completely functional Express applications—a sign of their server-side JavaScript development expertise in a team based project. (P.I.- 3.4.3,5.2.2, 9.3.1)*		
	Total	**60**	

Course Outcomes :

Learner will be able to

1. Identify and apply the appropriate HTML tags to develop a webpage.
2. Identify and apply the appropriate CSS tags to format data on webpage.

3. Use JavaScript to develop interactive web pages.
4. Construct front end applications using React and Angular.
5. Construct back-end applications using Node.js/Express and Mongodb.

Performance Indicators:

P.I. No.	P.I. Statement
1.3.1	Apply engineering fundamentals
1.4.1	Apply theory and principles of computer science engineering to solve an engineering problem
2.1.2	Identifies processes/modules/algorithms of a computer based system and parameters to solve a problem
2.2.2	Identifies functionalities and computing resources.
2.3.2	Identify design constraints for required performance criteria.
3.4.2	Ability to implement and integrate the modules.
3.4.3	Ability to verify the functionalities and validate the design.
4.2.1	Design and develop appropriate procedures/methodologies based on the study objectives
4.3.1	Use appropriate procedures, tools and techniques to collect and analyze data
5.1.1	Identify modern engineering tools, techniques and resources for engineering activities
5.2.2	Demonstrate proficiency in using discipline specific tools
9.1.1	Recognize a variety of working and learning preferences; appreciate the value of diversity on a team
9.3.1	Present results as a team, with smooth integration of contributions from all individual efforts

Text Books:

1. HTML & CSS: Design and Build Web Sites, Jon Duckett,, First Edition, 2011, Wiley.
2. HTML 5 Black Book (Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery) 2Ed., DT Editorial Services, Second Edition, 2016, Dreamtech Press.
3. Learning React Functional Web Development with React and Redux, Alex Banks and Eve Porcello, First Edition, 2017, Shroff/O'Reilly O'Reilly
4. Learning Node.js Development, Andrew Mead, Kindle Edition, 2018, Packet Publishing

Reference Books:

1. JavaScript & jQuery: Interactive Front-End Development, Jon Duckett, First edition, 2014, Wiley .
2. Full Stack Web Development For Beginners, Riaz Ahmed, 2021
3. Beginning Node.js, Express & MongoDB Development, Greg Lim, 2020

4. Full-Stack React Projects: Modern web development using React 16, Node, Express, and MongoDB, Shama Hoque, First edition, 2018, Packt Publication

Other Resources:

1. JavaScript Tutorial
   Web link: https://www.w3schools.com/js/
2. React: The library for web and native user interfaces
   Web link: https://react.dev/
3. Deliver web apps with confidence
   Web link: https://angular.io/
4. Run JavaScript Everywhere
   Web link: https://nodejs.org/en
5. Express4.18.3 Fast, unopinionated, minimalist web framework for Node.js
   Web link: https://expressjs.com/
6. MongoDB
   Web link: https://www.mongodb.com/

A. CONTINUOUS ASSESSMENT (50 MARKS)

1. Task Execution (30 Marks)

Students will be given minimum 10 tasks.

Students are expected to

i. Identify and apply the appropriate HTML tags to develop a webpage.
ii. Identify and apply the appropriate CSS tags to format data on webpage.
iii. Apply JavaScript to add functionality to web pages.
iv. Use React and Angular to develop the front-end user interface, incorporating components, state management, and routing for seamless navigation and interaction with the back-end API.
v. Construct web based Node.js applications using Express.
vi. Identify the components necessary for building a full stack application, including front-end frameworks like React and Angular, and back-end technologies like MongoDB, Express, and Node.js.
vii. Design a relational database schema using MongoDB for storing application data efficiently.
viii. Implement RESTful API endpoints using Express.js to handle CRUD operations for interacting with the MongoDB database.

Students will be evaluated based on following:

i. Logic building for the given task (10 marks)
ii. Rectifying logical errors and syntax errors (06 marks)
iii. Well-structured and organized program (06 marks)
iv. Effective use and integration of the various technologies involved in full stack development, including React, Angular, MongoDB, Express, and Node.js. (08 marks)

Refer the sample task given below.

Example:

Implement JSX code in React

Students are expected to identify.

i. JSX: Students are expected to identify JSX syntax throughout the components, such as , <h2>, <p>, <ul>, <li>, and <a>, which represent HTML elements. JSX allows mixing HTML-like syntax within JavaScript code in React.
ii. Components: Students should recognize that each component is defined as a function that returns JSX elements. This is a fundamental concept in React - components encapsulate the UI logic and structure.
iii. Props and State: Although not explicitly demonstrated in this example, students can understand that props and state can be passed to components to customize their behavior and appearance.
iv. Hooks: In the BlogPost component, students can identify the usage of the useParams hook from React Router to access URL parameters, demonstrating the use of hooks in React functional components.
v. Router: Students can see the usage of React Router's <Route> component to define routes and their corresponding components, allowing for declarative routing in the application.

By analyzing this code, students can gain a deeper understanding of how JSX syntax is used to define the UI of React components and how React Router facilitates navigation between different views in a React application.

Students will be evaluated based on following:

i. Logic building for the given task (10 marks)
ii. Rectifying logical errors and syntax errors (06 marks)
iii. Well-structured and organized program (06 marks)
iv. Effective use and integration of the various technologies involved in full stack development, including React, Angular, MongoDB, Express, and Node.js. (08 marks)

2. Regularity and active Participation (05 Marks)

3. Mini Project Evaluation (15 Marks)

A group of 3-4 students should be assigned a real life problem statement. Evaluation will focus on the project's ability to meet functional requirements, such as CRUD operations, user authentication, and data validation, ensuring that the application behaves as intended.

Attention will be given to the usability and intuitiveness of the application's interface, including navigation, responsiveness, and feedback mechanisms, to ensure a positive user experience.

Assessment will consider the quality of the codebase, including adherence to coding standards, modularity, reusability, and readability, promoting maintainability and scalability of the project.

Projects will be evaluated for performance optimization techniques, such as minimizing load times, reducing server requests, and efficient database queries, to ensure responsiveness and efficiency.

Evaluation will include the completeness and clarity of project documentation, including setup instructions, user guides, API documentation, and code comments, facilitating understanding and collaboration among developers.

B. END SEMESTER EXAMINATION (Practical & Oral Exam) (50 Marks)

a) Task Execution: 30 Marks
Students will be given task (different task for every student) to execute and will be evaluated as per the parameters mentioned in continuous evaluation

b) Mini Project Presentation: 20 Marks
Students will give mini project presentation and will be evaluated as per the parameters mentioned in continuous evaluation

Two examiners, one Internal and one External will do the evaluation.

Course Type	Course Code	Course Name	Credits
MP	ITMP402	MINI PROJECT- 1B	01

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

Course Objectives:

1. To familiarize students about available infrastructure at Department/Institute level, online resources, plagiarism, expectations from MP 1A and 1B, etc.
2. To guide students in identifying societal or research needs and formulating them into problem statements.
3. To facilitate problem-solving in group settings.
4. To apply basic engineering principles to address identified problems.
5. To foster self-learning and research skills.

Course Outcomes:

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

1. Identify problems based on societal or research needs and methodology for solving them.
2. Apply knowledge and skills to solve societal problems collaboratively.
3. Develop interpersonal skills necessary for teamwork.
4. Analyze, verify, and validate results effectively through various methodologies, including, test cases/benchmark data/theoretical/inferences/experiments/simulations, etc.
5. Evaluate the societal and environmental impacts of proposed solutions.
6. Adhere to standard engineering practices.
7. Excel in written and oral communication by technical report writing, oral presentation, and publishing results in
   - Research/white paper/article/blog writing/publication, etc.
   - Business plan for entrepreneurship product creation
   - Patent filing/copyright.
8. Gain technical competencies by participating in competitions, hackathons, etc.
9. Demonstrate lifelong learning capabilities through self-directed group projects.
10. Apply project management principles effectively.

Guidelines for the Mini Project

• At the beginning of semester-III, project guides are required to conduct around 4 hours' orientation sessions including following topics:

- Familiarizing students about infrastructure available at Department/Institute level and how to use it.
- How to identify societal problems and formulate project problem statement.
- How to carry out literature survey.
- What is plagiarism and what care needs to be taken while writing a report.
- What is project report template and how it should be used.
- What are expectations from mini-projects 1A and 1B.

• Mini project may be carried out in one or more form of following:

Product preparations, prototype development model, fabrication of set-ups, laboratory experiment development, process modification/development, simulation, software development, integration of software (frontend-backend) and hardware, statistical data analysis, creating awareness in society/environment etc.

• Students must form groups of 3 to 4 members either from the same or from different departments.
• Groups should conduct surveys to identify needs and develop problem statements in consultation with faculty.
• An implementation plan in Gantt/PERT/CPM chart format covering weekly activities must be submitted.
• Each group must maintain a logbook to record weekly progress, to be verified by the faculty supervisor.
• Faculty input should emphasize guiding by faculty and self-learning by group members.
• Groups should propose multiple solutions, select the best one in consultation with the supervisor, and develop a working model.
• The solution to be validated with proper justification and report to be compiled in standard format of the Institute. Research papers, competition certificates may be submitted as part of annexure to the report.
• With the focus on self-learning, innovation, addressing societal/research/innovation problems and entrepreneurship quality development within the students through the Mini Projects, it is preferable that a single project of appropriate level and quality be carried out in two semesters by all the groups of the students.
• However, based on the individual students or group capability, with the mentor's recommendations, if the proposed Mini Project adhering to the qualitative aspects mentioned above, gets completed in odd semester, then that group can be allowed to work on the extension of the Mini Project with suitable improvements/modifications or a completely new project idea in even semester. This policy can be adopted on a case by case basis.

In-Semester Continuous Assessment and End-Semester Examination Guidelines

- The Head of the Departments will assign a guide to each of the mini-projects and shall form a progress monitoring committee. The guide will carry out weekly monitoring of the project's progress. The committee shall carry out in-semester project evaluation based on presentations with a minimum of two evaluations per semester.
- Assessment will be based on individual contributions, understanding, and responses to questions asked.

- **Continuous Assessment marks distribution in semester III (50 marks):**
    - 10 marks for the Topic Approval Presentation in front of the progress monitoring committee
    - 15 marks for the Mid-Semester Progress Presentation in front of the progress monitoring committee
    - 25 marks for the Final Report & Presentation
- **Continuous Assessment marks distribution in semester IV (50 marks):**
    - 15 marks for the In-Semester Two Presentations
    - 10 marks for the Participation in Project Competitions, TPP, etc.
    - 25 marks for the Final Report & Presentation

The review/progress monitoring committee will assess projects based on the following criteria.

Semester III:

- Theoretical solution completion, including component/system selection/design of software solution and cost analysis.
- Two reviews will occur:
    - The first review will focus on finalizing the problem statement (topic approval).
    - The second review will focus on finalizing the proposed solution.

Semester IV:

- Expected tasks include procuring components/systems, constructing a working prototype, and validating results based on prior semester work.
- Reviews will be conducted as follows:
    - The first review will assess the readiness to build a working prototype.
    - The second review will involve a poster presentation and demonstration of the working model in the last month of the semester.

In addition to the above-mentioned points, the following performance criteria shall be included during the in-semester continuous assessment:

1. Quality of survey and need identification.
2. Clarity and innovativeness in problem definition and solutions.
3. Requirement gathering feasibility study, cost-effectiveness, and societal impact of proposed solutions.
4. Completeness and full functioning of the working model.
5. Effective use of skill sets and engineering norms.
6. Verification & validation of the solutions/test cases.
7. Individual contributions to the group.
8. Clarity in written and oral communication.

9. Participation in technical paper presentations/project competitions/hackathon competitions, etc.

End-Semester Examination in Semester IV (50 marks):

1. Presentation and demonstration to internal and external examiners: 20 marks.
2. Emphasis on problem clarity, innovativeness, societal impact, functioning of the model, skill utilization, and communication clarity: 30 marks.

Course Type	Course Code	Course Name	Credits
VEC	VEC402	ENVIRONMENT & SUSTAINABILITY	02

Program Outcomes addressed:

1. PO2 : Problem Analysis
2. PO6 : The Engineer & Society
3. PO7 : Environment & Sustainability
4. PO8 : Ethics
5. PO12: Life-long learning

Course Objectives :

1. To provide students with foundational knowledge and understanding of environmental science principles and concepts.
2. To explore the principles of sustainability and their applications in various domains of engineering and technology.
3. To familiarize students with the legal and ethical considerations associated with environmental management and sustainability practices.
4. To equip students with practical skills and strategies for promoting renewable energy, energy efficiency, waste management, and environmental impact assessment.

Module	Details
01.	**Foundations of Environmental Sciences** Introduction to Environmental Science, Earth's Systems: Atmosphere, Hydrosphere, Lithosphere, Biosphere, Ecological Principles: Energy flow, Nutrient cycling, Biodiversity, Environmental Degradation: Pollution, Deforestation, Habitat loss, Environmental Monitoring and Data Analysis.
02.	**Sustainability Basics** Concepts of Sustainability and Sustainable Development, Sustainable Resource Management: Water, Air, Land, Sustainable Agriculture and Food Systems, Sustainable Transportation and Urban Planning, Sustainable Business Practices and Corporate Social Responsibility
03.	**Legal & Ethical Considerations** Environmental Laws and Regulations: National and International Perspectives, Environmental Policies and Governance Frameworks, Ethical Issues in Environmental Decision Making, Environmental Justice and Equity, Corporate Ethics and Environmental Responsibility
04.	**Renewable energy & Energy efficiency** Introduction to Renewable Energy Sources: Solar, Wind, Hydro, Biomass, Geothermal, Energy Conversion Technologies and Systems Energy Efficiency Measures and Strategies, Policy Support for Renewable Energy Deployment, Economic and Environmental Impacts of Renewable Energy

05.	**Waste management & recycling** Solid Waste Management: Collection, Treatment, Disposal, Recycling Processes and Technologies, E-waste Management and Hazardous Waste Handling, Circular Economy Principles, Waste Reduction Strategies: Source Reduction, Reuse, Repair
06.	**Environmental Impact Assessment** Introduction to Environmental Impact Assessment (EIA), EIA Process: Screening, Scoping, Impact Assessment, Mitigation, Monitoring, Methods and Tools for Impact Assessment: GIS, LCA, Risk Assessment, Case Studies of EIA in Various Sectors: Infrastructure, Energy, Mining, Construction, Role of Stakeholders in EIA Process
Total no. of hours: **30**	

Course Outcomes :

1. Gain a comprehensive understanding of key environmental science principles and their relevance to engineering disciplines.
2. Apply principles of sustainability to analyze and address environmental challenges in engineering projects and processes.
3. Demonstrate awareness of legal and ethical considerations in environmental decision-making and management practices.
4. Develop proficiency in implementing renewable energy technologies and energy-efficient practices in engineering designs and operations.
5. Acquire knowledge and skills in waste management, recycling, and circular economy principles for sustainable resource utilization.
6. Apply environmental impact assessment methods to evaluate and mitigate the environmental impacts of engineering projects and activities.

Text Books :

1. Environmental Science: Toward a Sustainable Future by Richard T. Wright and Dorothy F. Boorse (Publisher: Pearson Education)
2. Introduction to Environmental Engineering and Science by Gilbert M. Masters and Wendell P. Ela (Publisher: Pearson Education)
3. Renewable and Efficient Electric Power Systems by Gilbert M. Masters (Publisher: Wiley)

Reference Books :

1. Environmental Law Handbook by Thomas F. P. Sullivan, David R. Buente Jr., and Sally Fairfax, Bernan Press
2. Sustainability Science by Bert J. M. de Vries, Springer
3. Environmental Impact Assessment: Theory and Practice by Peter Wathern, Routledge

Other Resources:

1. NPTEL Course: Introduction to Environmetal Engineering & Science- Fundamental & Sustainability Concepts, Prof.Brajesh Kumar Dubey, Department of Multidisciplinary IIT Kharagpur :-Web link https://archive.nptel.ac.in/courses/127/105/127105018/

2. NPTEL Course: Environment And Development, By Prof. Ngamjahao Kipgen, IIT Guwahati, Web link- https://onlinecourses.nptel.ac.in/noc23_hs133/preview