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 , Second and Third Year Syllabus

Prepared by : Board of Studies for Department of 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
BSL	Basic Science Laboratory Course
ELC	Experiential Learning Course
ESC	Engineering Sciences Course
ESL	Engineering Sciences Laboratory Course
HMC	Honours or Minor Core Course
HML	Honours or Minor Laboratory
HMP	Honours or Minor Mini Project
HSS	Humanities Social Sciences and Management Course
IKS	Indian Knowledge System Course
INT	Internship
L	Lecture
LBC	Laboratory Course
LLC	Liberal Learning Course
MDM	Multidisciplinary Minor Course
MDL	Multidisciplinary Laboratory Course
MJP	Major Project
MNP	Mini Project
OEC	Open Elective Course
P	Practical
PCC	Program Core Course
PEC	Program Elective Course
RPC	Research Project Coursework
RPR	Research Project
SBL	Skill Based Laboratory
SEC	Skill Enhancement Course
T	Tutorial
VEC	Value Education Course

B. Credit Structure

1. 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 (BSL)	01	01	--	--	--	--	--	--	**02**		
Engineering Science Course (ESC)	05	02	--	--	--	--	--	--	**07**	**16**	**12-16**
Engineering Science Laboratory Course (ESL)	04	05	--	--	--	--	--	--	**09**		
Program Core Course (PCC)	--	--	14	13	06	03	03	--	**39**	**50**	**44-56**
Laboratory Course (LBC)	--	--	02	03	02	02	02	--	**11**		
Program Elective Course (PEC)	--	--	--	--	03	03	06	03	**15**	**15**	**20**
Multidisciplinary Minor (MDM)	--	--	03	03	03	04	—	--	**13**	**13**	**14**
Multidisciplinary Laboratory Course (MDL)†	--	--	--	--	01	--	--	--	**01**	**01**	
Open Elective Course (OEC)	--	--	--	--	--	--	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 (HSS)	--	--	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 (MNP)	--	--	01	01	01	01	--	--	**04**	**10**	**04**
Major Project (MJP)	--	--	--	--	--	--	02	04	**06**		
Internship (INT)	--	--	--	--	--	--	--	08	**08**	**08**	**12**
Liberal Learning Course (LLC)	--	--	--	--	--	02	--	---	**02**	**02**	**04**
Total Credits	**21**	**22**	**24**	**24**	**20**	**19**	**18**	**18**	**166**	**166**	**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 Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		L	P	T	L	P	T	Total
BSC101	Engineering Mathematics I	3	--	1	3	--	1	4
BSC102	Engineering Physics-I	2	--	--	2	--	--	2
BSC103	Engineering Chemistry-I	2	--	--	2	--	--	2
ESC101	Engineering Mechanics	3	--	--	3	--	--	3
ESC102	Basic Electrical Engineering	2	--	--	2	--	--	2
BSL101	Engineering Physics-I Laboratory	--	1	--	--	0.5	--	0.5
BSL102	Engineering Chemistry-I Laboratory	--	1	--	--	0.5	--	0.5
ESL101	Engineering Mechanics Laboratory	--	2	--	--	1	--	1
ESL102	Basic Electrical Engineering Laboratory	--	2	--	--	1	--	1
ESL103	Programming Laboratory-I (C)	--	2*+2	--	--	2	--	2
SEC101	Basic Workshop Practice-I	--	2	--	--	1	--	1
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. Please consult the department's Curriculum Book for more information. 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 (HSS), Open Electives Course (OEC), Value Education Course (VEC), and Liberal Learning Course (LLC) may be conducted either online synchronously or asynchronously. For more information, please consult the curriculum book of department.

Examination Scheme – FY Semester-I

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	
BSC101	Engineering Mathematics-I	20+25@	30	50	1.5	2	125
BSC102	Engineering Physics-I	15	20	40	1.0	1.5	75
BSC103	Engineering Chemistry-I	15	20	40	1.0	1.5	75
ESC101	Engineering Mechanics	20	30	50	1.5	2	100
ESC102	Basic Electrical Engineering	15	20	40	1.0	1.5	75
BSL101	Engineering Physics-I Laboratory	25	--	--	--	--	25
BSL102	Engineering Chemistry-I Laboratory	25	--	--	--	--	25
ESL101	Engineering Mechanics Laboratory	25	--	--	--	--	25
ESL102	Basic Electrical Engineering Laboratory	25	--	25	--	--	50
ESL103	Programming Laboratory-I (C)	50	--	50	--	--	100
SEC101	Basic Workshop Practice-I	50	--	--	--	--	50
VEC101	Universal Human Values	50	--	--	--	--	50
	Total	**360**	**120**	**295**	--	--	**775**

$Please refer to the Curriculum Book of respective departments for guidelines on in-semester assessments for both theory and laboratory courses.

@For continuous assessment of tutorials.

Curriculum Structure – FY Semester-II

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		L	P	T	L	P	T	Total
BSC204	Engineering Mathematics-II	3	--	1	3	--	1	4
BSC205	Engineering Physics-II	2	--	--	2	--	--	2
BSC206	Engineering Chemistry-II	2	--	--	2	--	--	2
AEC201	Professional Communication and Ethics-I	2	2	--	2	1	--	3
ESC203	Basic Electronics Engineering	2	--	--	2	--	--	2
BSL203	Engineering Physics-II Laboratory	--	1	--	--	0.5	--	0.5
BSL204	Engineering Chemistry-II Laboratory	--	1	--	--	0.5	--	0.5
ESL204	Engineering Graphics Laboratory	--	2*+2	--	--	2	--	2
ESL205	Programming Laboratory-II (Java)	--	2*+2	--	--	2	--	2
ESL206	Basic Electronics Engineering Laboratory	--	2	--	--	1	--	1
SEC202	Basic Workshop Practice-II	--	2	--	--	1	--	1
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 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	
BSC204	Engineering Mathematics-II	20+25@	30	50	1.5	2	125
BSC205	Engineering Physics-II	15	20	40	1.0	1.5	75
BSC206	Engineering Chemistry-II	15	20	40	1.0	1.5	75
AEC201	Professional Communication and Ethics-I	50	--	--	--	--	50
ESC203	Basic Electronics Engineering	15	20	40	1.0	1.5	75
BSL203	Engineering Physics-II Laboratory	25	--	--	--	--	25
BSL204	Engineering Chemistry-II Laboratory	25	--	--	--	--	25
ESL204	Engineering Graphics Laboratory	50	--	50	--	--	100
ESL205	Programming Laboratory-II (Java)	50	--	50	--	--	100
ESL206	Basic Electronics Engineering Laboratory	25	--	25	--	--	50
SEC202	Basic Workshop Practice-II	50	--	--	--	--	50
IKS201	Indian Knowledge System	50	--	--	--	--	50
	Total	**415**	**90**	**295**	--	--	**800**

$Please refer to the Curriculum Book of respective departments for guidelines on in-semester assessments for both theory and laboratory courses.

@For continuous assessment of tutorials.

Curriculum Structure – SY Semester-III

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		L	P	T	L	P	T	Total
ITPCC301	Engineering Mathematics-III	3	--	1	3	--	1	4
ITPCC302	Computer Organization & Architecture	3	--	1	3	--	1	4
ITPCC303	Data Structure & Analysis	3	--	--	3	--	--	3
ITPCC304	Database Management System	3	--	--	3	--	--	3
XXMDM301	--	3	--	--	3	--	--	3
ITLBC301	Data Structure Laboratory	--	2	--	--	1	--	1
ITLBC302	SQL Laboratory	--	2	--	--	1	--	1
ITSBL301	Python Laboratory	--	4	--	--	2	--	2
ITMNP301	Mini Project-1A	--	3	--	--	1	--	1
HSS301	Product Design	2	--	--	2	--	--	2
	Total	**17**	**11**	**2**	**17**	**5**	**2**	**24**

NOTE:Four theory courses(Three 3-credit and one 4-credit) and one laboratory course (1-credit) offered by other department has to be taken by IT students, to complete 14-credit requirement for MDM.

Examination Scheme – SY Semester-III

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	
ITPCC301	Engineering Mathematics-III	20+25@	30	50	1.5	2	125
ITPCC302	Computer Organization & Architecture	20+25@	30	50	1.5	2	125
ITPCC303	Data Structure & Analysis	20	30	50	1.5	2	100
ITPCC304	Database Management System	20	30	50	1.5	2	100
XXMDM301	--	20	30	50	1.5	2	100
ITLBC301	Data Structure Laboratory	25	--	25	--	--	50
ITLBC302	SQL Laboratory	25	--	25	--	--	50
ITSBL301	Python Laboratory	50	--	50	--	--	100
ITMNP301	Mini Project-1A	50	--	--	--	--	50
HSS301	Product Design	50	--	--	--	--	50
	Total	**350**	**150**	**350**	--	--	**850**

$Please refer to the Curriculum Book of department for guidelines on in-semester assessments for both theory and laboratory courses.

@For continuous assessment of tutorials.

Curriculum Structure – SY Semester-IV

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		L	P	T	L	P	T	Total
ITPCC405	Engineering Mathematics-IV	3	--	1	3	--	1	4
ITPCC406	Computer Network	3		--	3	--	--	3
ITPCC407	Operating System	3	--	--	3	--	--	3
ITPCC408	Software Engineering	3	--	--	3	--	--	3
XXMDM402	--	3	--	--	3	--	--	3
ITLBC403	Networks Laboratory	--	2	--	--	1	--	1
ITLBC404	Linux Laboratory	--	2	--	--	1	--	1
ITLBC405	Software Development Laboratory	--	2	--	--	1	--	1
ITSBL402	Full stack Development Laboratory	--	4	--	--	2	--	2
ITMNP402	Mini Project-1B	--	3	--	--	1	--	1
VEC402	Environment and Sustainability	2	--	--	2	--	--	2
	Total	**17**	**13**	**1**	**17**	**6**	**1**	**24**

Examination Scheme – SY Semester-IV

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	
ITPCC405	Engineering Mathematics-IV	20+25@	30	50	1.5	2	125
ITPCC406	Computer Network	20	30	50	1.5	2	100
ITPCC407	Operating System	20	30	50	1.5	2	100
ITPCC408	Software Engineering	20	30	50	1.5	2	100
XXMDM402	--	20	30	50	1.5	2	100
ITLBC403	Networks Laboratory	25	--	25	--	--	50
ITLBC404	Linux Laboratory	25	--	25	--	--	50
ITLBC405	Software Development Laboratory	25	--	25	--	--	50
ITSBL402	Full stack Development Laboratory	50	--	50	--	--	100
ITMNP402	Mini Project-1B	50	--	50	--	--	100
VEC402	Environment and Sustainability	50	--	--	--	--	50
	Total	**350**	**150**	**425**	--	--	**925**

$Please refer to the Curriculum Book of department for guidelines on in-semester assessments for both theory and laboratory courses.

@For continuous assessment of tutorials.

Curriculum Structure – TY Semester-V

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		L	P	T	L	P	T	Total
ITPCC509	Automata Theory	3	--	--	3	--	--	3
ITPCC510	Artificial Intelligence	3	--	--	3	--	--	3
XXMDM503	--	3	--	--	3	--	--	3
ITPEC501Y	Program Elective Course-I	3	--	--	3	--	--	3
ITLBC506	Cloud Computing Laboratory	--	2	--	--	1	--	1
ITLBC507	Mobile Application Development Laboratory	--	2	--	--	1	--	1
XXMDL501	--	--	2	--	--	1	--	1
AEC502	Professional Communication and Ethics-II	1	2	--	1	1	--	2
ITMNP503	Mini Project-2A	--	3	--	--	1	--	1
HSS502	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
ITPEC5011	Analysis of Algorithms
ITPEC5012	Cloud Computing Services
ITPEC5013	Data ware Housing & Mining

Examination Scheme – TY Semester-V

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	
ITPCC509	Automata Theory	20	30	50	1.5	2	100
ITPCC510	Artificial Intelligence	20	30	50	1.5	2	100
XXMDM503	--	20	30	50	1.5	2	100
ITPEC501Y	Program Elective Course-I	20	30	50	1.5	2	100
ITLBC506	Cloud Computing Laboratory	25	--	25	--	--	50
ITLBC507	Mobile Application Development Laboratory	25	--	25	--	--	50
XXMDL501	--	25	--	25	--	--	50
AEC502	Professional Communication and Ethics-II	50	--	--	--	--	50
ITMNP503	Mini Project-2A	50	--	--	--	--	50
HSS502	Entrepreneurship	50	--	--	--	--	50
	Total	**305**	**120**	**275**	--	--	**700**

$Please refer to the Curriculum Book of department for guidelines on in-semester assessments for both theory and laboratory courses.

Curriculum Structure – TY Semester-VI

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		L	P	T	L	P	T	Total
ITPCC611	Cryptography & Network Security	3		--	3	--	--	3
XXMDM604	--	4		--	4	--	--	4
ITPEC602Y	Program Elective Course-II	3	--	--	3	--	--	3
ITLBC608	Cryptography & Network Security Laboratory	--	2	--	--	1	--	1
ITLBC609	Data Science Laboratory	--	2	--	--	1	--	1
ITSBL603	Devops Laboratory	--	4	--	--	2	--	2
ITMNP604	Mini Project-2B	--	3	--	--	1	--	1
ELC601	Research Methodology	2	--	--	2	--	--	2
LLC601Y*	Liberal Learning Course	2	--	--	2	--	--	2
	Total	**14**	**11**	**--**	**14**	**5**	**--**	**19**

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 prorams.

***Liberal Learning Course:**

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

Liberal Learning Courses	
Course Code	**Course Name**
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**
ITPEC6021	Infrastructure Management
ITPEC6022	Machine Learning**
ITPEC6023	Wireless Technology

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

Examination Scheme – TY Semester-VI

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	
ITPCC611	Cryptography & Network Security	20	30	50	1.5	2	100
XXMDM604	--	20	30	50	1.5	2	100
ITPEC602Y	Program Elective Course-II	20	30	50	1.5	2	100
ITLBC608	Cryptography & Network Security Laboratory	25	--	25	--	--	50
ITLBC609	Data Science Laboratory	25	--	25	--	--	50
ITSBL603	Devops Laboratory	50	--	50	--	--	100
ITMNP604	Mini Project-2B	50	--	50	--	--	100
ELC601	Research Methodology	50	--	--	--	--	50
LLC601	Liberal Learning Course	50	--	--	--	--	50
	Total	**310**	**90**	**300**	--	--	**700**

$Please refer to the Curriculum Book of department for guidelines on in-semester assessments for both theory and laboratory courses.

Curriculum Structure – B. Tech Semester-VII

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		L	P	T	L	P	T	Total
ITPCC712	Edge Computing	3	--	--	3	--	--	3
ITPEC703Y	Program Elective Course-III	3	--	--	3	--	--	3
ITPEC704Y	Program Elective Course-IV	3	--	--	3	--	--	3
OEC701Y	Open Elective Course –I	3	--	--	3	--	--	3
ITLBC710	Edge Computing Laboratory	--	2	--	--	1	--	1
ITLBC711	High Performance Computing Laboratory	--	2	--	--	1	--	1
ITMJP701	Major Project-A	--	6	--	--	2	--	2
HSS703	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 Course for Semester VII. Students can take this course from the following list of Program Elective Course-III and IV.

Course Code	Program Elective Course-III
ITPEC7031	Quantum Computing
ITPEC7032	Human Computer Interaction
ITPEC7033	Ethical Hacking & Digital Forensic

Course Code	Program Elective Course-IV
ITPEC7041	Big Data Analytics
ITPEC7042	Augmented Reality/Virtual Reality
ITPEC7043	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
OEC7011	Product Lifecycle Management
OEC7012	Reliability Engineering
OEC7013	Management Information System
OEC7014	Design of Experiments
OEC7015	Operation Research
OEC7016 @@	Cyber Security and Laws
OEC7017	Disaster Management and Mitigation Measures
OEC7018	Energy Audit and Management
OEC7019	Development Engineering

@@Students opting for Honours/Minor degree in Cybersecurity or relevant domain need to select other Open Elective.

Examination Scheme – B. Tech Semester-VII

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	
ITPCC712	Edge Computing	20	30	50	1.5	2	100
ITPEC703Y	Program Elective Course-III	20	30	50	1.5	2	100
ITPEC704Y	Program Elective Course-IV	20	30	50	1.5	2	100
OEC701Y	Open Elective Course –I	20	30	50	1.5	2	100
ITLBC710	Edge Computing Laboratory	25	--	25	--	--	50
ITLBC711	High Performance Computing Laboratory	25	--	25	--	--	50
ITMJP701	Major Project-A	50	--	--	--	--	50
HSS703	Financial Planning	50	--	--	--	--	50
	Total	**230**	**120**	**250**	--	--	**600**

$Please refer to the Curriculum Book of department for guidelines on in-semester assessments for both theory and laboratory courses.

Curriculum Structure – B. Tech Semester-VIII

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		L	P	T	L	P	T	Total
ITPEC805Y	Program Elective Course-V	3	--	--	3	--	--	3
OEC802Y	Open Elective Course-II	3	--	--	3	--	--	3
ITMJP802	Major Project-B	--	12	--	--	4	--	4
INT801	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 8th 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
ITPEC8051	Block Chain Technology
ITPEC8052	Network and Security
ITPEC8053	Computational Intelligence
ITPEC8054	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
OEC8021	Project Management
OEC8022	Finance Management
OEC8023	Entrepreneurship Development and Management
OEC8024	Human Resource Management
OEC8025	Professional Ethics and CSR
OEC8026	Circular Economy
OEC8027	IPR and Patenting
OEC8028	Digital Business Management
OEC8029	Environmental Management

Examination Scheme – B. Tech Semester-VIII

Course Code	Course Name	Examination Scheme					
		In-Semester Assessment$		End Sem Exam (ESE)	Exam Duration for Theory (in Hrs)		Total
		Continuous Assessment	Mid-Sem Exam		Mid-Sem	End-Sem	
ITPEC805Y	Program Elective Course-V	20	30	50	1.5	2	100
OEC802Y	Open Elective Course-II	20	30	50	1.5	2	100
ITMJP802	Major Project-B	50	--	50	--	--	100
INT801	Internship	50	--	50	--	--	100
Total		**140**	**60**	**200**	--	--	**400**

$Please refer to the Curriculum Book of department 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 consult the curriculum book of your department.

D. Multidisciplinary Minor Courses Offered by the Department of Information Technology for the Other Program Students

Curriculum Structure for MDM Courses

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		L	P	T	L	P	T	Total
ITMDM301	Data Structures and Algorithms	3	--	--	3	--	--	3
ITMDM402	Database Management System	3	--	--	3	--	--	3
ITMDM503	Cloud Computing	3	--	--	3	--	--	3
ITMDL501	Machine Learning Laboratory	--	2	--	--	1	--	1
ITMDM604	Soft Computing	4	--	--	4	--	--	4
	Total	**13**	**2**	**--**	**13**	**1**	**--**	**14**

Examination Scheme for MDM Courses

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	
ITMDM301	Data Structures and Algorithms	20	30	50	1.5	2	100
ITMDM402	Database Management System	20	30	50	1.5	2	100
ITMDM503	Cloud Computing	20	30	50	1.5	2	100
ITMDL501	Machine Learning Laboratory	25	--	25	--	--	50
ITMDM604	Soft Computing	20	30	50	1.5	2	100
	Total	**105**	**120**	**225**	--	--	**450**

E. Honours, Minor, and Honours in Reseach 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.

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 Examination (ESE)			
Continuous Assessment	Mid-Semester Exam (MSE)		MSE	ESE	
20 + 25*	30	50	1.5	2	125

*For Tutorial

Pre-requisite:

1. Differentiation of function of a single variable.
2. Types of matrices and their basic operations.
3. Vector Algebra.

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	Details	Hrs.
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. Application of matrices in control systems, wireless signals and computer graphics, Introduction to function of several variables to apply in Marginal rate of technical substitution, Elasticity of substitution, 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.	01
01.	**Matrices - I** ***Learning Objective:*** *Learner will be able to* • *Analyze 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

	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.	
	Self-Learning Topics:	
	Learning Outcomes: *A learner will be able to* *LO 1.1: Identify the correct procedure to express a square matrix as the sum of a Symmetric and Skew-Symmetric Matrix. (PI:2.1.1 & 2.2.3)* *LO 1.2: Identify the correct procedure to express a square matrix as the sum of a Hermitian and Skew-Hermitian Matrix. (PI:2.1.1 & 2.2.3)* *LO 1.3: Use elementary transformations to determine the rank of a matrix by finding its normal form. (PI:1.1.1 & 1.2.1)*	
02.	**Matrices - II** ***Learning Objective:*** *Learner will be able to* • *Analyze the differences between homogeneous and non-homogeneous simultaneous equations* • *Apply these concepts to find their solutions, if they exist.*	**5-7**
	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* *LO.2.1: Identify homogeneous and non-homogeneous simultaneous equations, express them into matrix form and use appropriate method to solve them. (PI-2.1.1 & 2.2.3)* *LO.2.2: Interpret & use the concept of rank to determine whether a given vector is linearly dependent or linearly independent (PI-1.1.1 & 1.2.1)*	
03.	**Matrices - III** ***Learning Objective:*** *Learner will be able to* • *Analyze the differences between homogeneous and non-homogeneous simultaneous equations* • *Apply these concepts to find their solutions, if they exist.*	**6-8**
	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* *LO 3.1: Apply fundamentals of determinant to find Eigen Values and Eigen Vectors. (PI-1.1.1 & 1.2.1)* *LO 3.2: Analyze, identify and use Cramer's Rule/homogeneous equation to determine Eigen vectors for corresponding Eigen values. (PI-2.1.3 & 2.2.4)*	
04.	**Differential Calculus of Several Variables-I** ***Learning Objectives:*** *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**
	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* *LO 4.1: Identify the basic concepts of partial differentiation (PD) with the prerequisite of differentiation of function of a single variable and apply suitable procedure to partially differentiate a function of several variables. (PI-2.2.3 & 2.1.3)* *LO 4.2: Apply the suitable method to solve a particular problem from the set of different types of learned functions. (PI-1.1.1 & 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*	**5-7**
	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* *LO 5.1: Apply Euler's Theorem to solve problems based on homogeneous function of two variables. (PI-1.1.1 & 1.2.1)*	

	LO 5.2: Identify the conditions for maxima and minima of functions of two variables and determine it. (PI-2.1.3 & 2.2.3)	
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**
	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* *LO 6.1*: *Apply fundamentals of vector algebra and differentiation of several variables to evaluate Gradient, Divergence & Curl. (PI-1.1.1 & 1.2.1)* *LO 6.2: Identify whether the given vector field is irrational or solenoidal and solve the problem by identifying the appropriate procedure. (PI-2.1.3 & 2.2.3).*	
	Course Conclusion	**01**
	Total	**45**

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.
2.1.3	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.

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. (*LO 1.1, LO 1.2, LO 1.3, LO 2.1, LO 2.2*)
2. Analyse the characteristic equation to determine the Eigen value, Eigen vector, also function of a matrix by applying Cayley-Hamilton theorem. (*LO 3.1, LO 3.2*)
3. Implement the fundamentals of partial differentiation to evaluate the maxima and minima of functions of several variables. (*LO 4.1, LO 4.2, LO 5.1, LO 5.2*)
4. Apply the concepts of Gradient, Divergence, and Curl in order to analyse and state the two types of fields, Irrotational and Solenoidal(*LO 6.1, LO 6.2*)

CO-PO Mapping Table with Correlation Level

CO ID	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BSC101.1	3	3	-	-	-	-	-	-	-	-	-
BSC101.2	3	3	-	-	-	-	-	-	-	-	-
BSC101.3	3	3	-	-	-	-	-	-	-	-	-
BSC101.4	3	3	-	-	-	-	-	-	-	-	-
Average	**3**	**3**	-	-	-	-	-	-	-	-	-

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

A. IN-SEMESTER ASSESSMENT (75 MARKS)

1. Continuous Assessment - 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

2. Continuous Assessment – Tutorial -(25 Marks)

1. Tutorials: 20 Marks
   Students must be encouraged to write at least 6 class tutorials. Each tutorial carries 20 Marks. Average will be taken of all six tutorials out of 20 marks.
2. Regularity and active participation: 5 marks

3. Mid Semester Exam (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%-30% weightage, and the syllabus covered from MSE to ESE carrying 70%-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 Examination (ESE)			
Continuous Assessment	Mid-Semester Exam (MSE)		MSE	ESE	
15	20	40	1	1.5	75

Pre-requisite:

NIL

Program Outcomes addressed:

1. PO1: Engineering knowledge
2. PO2: Problem analysis
3. PO6: The Engineer and The World

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	Details	Hrs.
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.	01
01.	**Interference in Thin Film and Diffraction** ***Learning Objective:*** *•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
	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* *LO 1.1: diagrammatically represent the mechanism of thin film interference and diffraction and write the parameters required for their application. (P.I.- 1.2.1)* *LO 1.2: interpret the interference and diffraction phenomena in real life examples. (P.I.- 1.2.1)* *LO 1.3: solve problems using the concepts of thin film interference and diffraction. (P.I.- 1.2.2)* *LO 1.4: identify the parameters which defines the quality of a grating. (P.I.- 2.1.2)* *LO 1.5: derive the expressions for various parameters and conditions of maxima and minima of intensity of a problem using the concepts of interference and diffraction. (P.I.- 2.1.3)*	
02.	**Laser** ***Learning Objective:*** • *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**
	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* *LO 2.1: state various parameters and phenomena related to lasers and their importance in LASER production. (P.I.-1.2.1)* *LO 2.2: identify different types of lasers in terms of principle, construction and working (P.I.-2.2.3)* *LO 2.3: identify the industrial and medical applications of laser. (P.I.-6.1.1)* *LO 2.4: state the disadvantages and limitations of using lasers in public. (P.I.-6.1.2)*	
03.	**Fiber Optics** ***Learning Objective:*** *•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**
	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* *LO 3.1: state various parameters related to the optical fibre and its application in fibre optics. (P.I.-1.2.1)* *LO 3.2: solve problems on optical fibre using the concepts and basic formulae. (P.I.- 1.2.2)* *LO 3.3: identify different types of optical fibre in terms of its relevant parameters. (P.I.-2.1.2)* *LO 3.4: derive the expressions for various parameters relevant to fibre optics. (P.I.-2.1.3)* *LO 3.5: apply the concept of optical fibre in fibre optic communication system. (P.I.- 6.1.1)*	
04.	**Semiconductor Physics** ***Learning Objectives:*** *•To apply the fundamental knowledge of band gap in semiconductors* *•To evaluate the concept of fermi level in semiconductor for solving problems.*	**4-6**
	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* *LO 4.1: state various parameters which defines a semiconductor and its applications of devices. (P.I.-1.2.1)* *LO 4.2: solve the problems involving fermi level. (P.I.-1.2.2)* *LO 4.3: identify the types of semiconductors based on band gap and Interpret the applications of semiconductors based on its band gap property. (P.I.-2.1.2)* *LO 4.4: sketch the effect of temperature and impurities on fermi level of semiconductor. (P.I.-2.1.3)*	
	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	

	LO 5.1: state the principles of various semiconductor devices and their applications. (P.I.-1.2.1) *LO 5.2: use the semiconductor devices for various measurements. (P.I.-2.1.3)* *LO 5.3: analyse Semiconductor devices in terms of their principle, construction, working. (P.I.-2.2.3)*	
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**
	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* *LO 6.1: recall different parameters, phenomena related to superconductor and its importance in superconductor and MAGLEV. (P.I.-1.2.1)* *LO 6.2: solve problems on superconductor using the concepts and basic formulae. (P.I.-1.2.2)* *LO 6.3: identify the type of superconductors in terms of various parameters. (P.I.-2.1.2)*	
	Course Conclusion	**01**
	Total	**30**

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.
6.1.2	Identify and explain the limitations in the usage of devices for public.

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. (*LO 1.1, LO 1.2, LO 1.3, LO 1.4, LO 1.5*)
2. apply to use the fundamental knowledge of semiconductor physics to identify the various parameters to solve the problem. (*LO 4.1, LO 4.2, LO 4.3, LO 4.4*)
3. apply the knowledge of Laser, fiber optics for health and safety issues by analyzing their properties and parameters. (*LO 2.1, LO2.1, LO 2.3, LO 2.4, LO 3.1, LO 3.2, LO 3.3, LO 3.4, LO 3.5*)
4. identify the role and impact of the semiconductor devices and superconductors by knowing their applications. (*LO 5.1, LO5.2, LO 5.3, LO 6.1, LO 6.2, LO 6.3*)

CO-PO Mapping Table with Correlation Level

CO ID	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BSC102.1	3	3	-	-	-	-	-	-	-	-	-
BSC102.2	3	3	-	-	-	-	-	-	-	-	-
BSC102.3	3	-	-	-	-	3	-	-	-	-	-
BSC102.4	3	3	-	-	-	-	-	-	-	-	-
Average	**3**	**3**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**

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 Bangal https://nptel.ac.in/courses/108108122

A. IN-SEMESTER ASSESSMENT (35 MARKS)

1. Continuous Assessment - 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% syllabus.

B. END SEMESTER EXAMINATION (40 MARKS)

End Semester Examination will be based on syllabus coverage up to the Mid Semester Examination (MSE) carrying 20%-30% weightage, and the syllabus covered from MSE to ESE carrying 70%-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 Examination (ESE)			
Continuous Assessment	Mid-Semester Exam (MSE)		MSE	ESE	
15	20	40	1	1.5	75

Pre-requisite:

1. Nil

Program Outcomes addressed:

1. PO1: Engineering knowledge
2. PO2: Problem analysis
3. PO6 -The engineer and the world

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	Details	Hrs.
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.	01
01.	**Green Chemistry** ***Learning Objective:*** *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
	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* *LO1.1 : State the principles green chemistry. (1.3.1)* *LO 1.2: Identify the hazards involved in the conventional industrial chemical reactions in order to protect health and environment. (6.1.1)* *LO 1.3: Synthesize drugs, chemical pesticides and industrial precursors using green chemistry principles as standard guidelines. (2.2.3) (6.2.1)* *LO 1.4: Analyze Bhopal gas tragedy reaction (2.1.3)* *LO 1.5: Apply the concept of green solvents in chemical industries for the sustainable development, (6.1.2)* *LO 1.6: Use the concept of Carbon Sequestering and Carbon Credit to assess public health and environment. (6.1.1)* *LO 1.7:* Calculate atom economy of the given reaction. (1.2.2)	
02.	**Water quality management**	**4-6**
	Learning Objective: *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.	
	Learning Outcomes: *A learner will be able to* *LO 2.1: Classify the impurities of water into various types of hardness. (2.1.3)* *LO 2.2: Analyze different types of hardness in water using numerical problems (2.1.3)* *LO 2.3: Identify the effect of hard water in boiler and other chemical industries for assessing the public safety. (6.1.1)* *LO 2.4: Calculate the various types of hardness in water sample using EDTA method. (1.2.2)* *LO 2.5: Apply various water treatments for assessing the public health (6.1.1)* *LO 2.6: Identify and estimate water quality indices to control pollution of water (6.1.2)* *LO 2.7: Calculate BOD and COD of sewage sample (1.2.2)*	
03.	**Science of Corrosion**	**4-6**
	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* *LO 3.1: Define corrosion and its types. (1.3.1)* *LO 3.2: State the mechanism of oxidation corrosion. (1.3.1)* *LO 3.3: Define the role of oxide layers in deciding the rate of corrosion. (1.3.1)* *LO 3.4: State and Apply the Pilling Bedworth rule to predict corrosion resistance of metals and alloys. (1.2.1) (1.3.1)* *LO 3.5: state the conditions for wet corrosion (1.2.1)* *LO 3.6: State the mechanisms of wet corrosion with the help of diagram and reactions. (1.3.1)* *LO 3.7: State different types wet corrosion with the help of examples. (1.3.1)* *LO 3.8: Apply the various protection methods for safety of metallic equipment and structures. (6.1.1)* *LO 3.9: Apply the metallic coatings on various metal surfaces for protection of machine health. (6.1.1)*	
04.	**Introduction to Thermodynamics** ***Learning Objectives:*** ***To state the fundamentals of thermodynamics and apply them in engineering.***	**4-6**
	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 *LO 4.1: Define a system, surroundings and variables. (1.3.1)* *LO 4.2: State first law of thermodynamics (1.2.1)* *LO 4.3: Apply first law of thermodynamics for calculation of work done or heat evolved. (1.2.2)* *LO 4.4: To show energy conversion in different forms. (1.3.1)* *LO 4.5: To calculate the enthalpy of given chemical system. (1.2.2)* *LO 4.6: To apply the concepts of thermodynamics in engineering (1.3.1)*	
05.	**Phase Equilibria** ***Learning Objective/s:*** *To interpret the various phase transformations using thermodynamics.*	**3-5**

	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* *LO 5.1: State and apply Gibb's phase rule equation to the given system, (1.2.1)* *LO 5.2: State the terms in the Gibb's phase rule equation. (1.2.1)* *LO 5.3: Draw the phase diagrams and state the salient features of the same. (1.3.1)* *LO 5.4: Calculate the number of degrees of freedom for each phase in a phase diagram using phase rule equations. (1.2.2)* *LO 5.5: State and apply the condensed phase rule to the eutectic alloys. (1.2.1)* *LO 5.6: State the applications of eutectics in the solder alloys (1.3.1)*	
06.	**Energy from non-conventional sources** ***Learning Objective/s:*** *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.*	
	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* *LO 6.1: Apply the concept of transesterification for the production of biodiesel (1.3.1)* *LO 6.2: Identify the properties of biodiesel as a green fuel for sustainability. (6.1.2)* *LO 6.3: Synthesize hydrogen by steam reforming of methane and electrolysis of water. (2.2.3)* *LO 6.4: Identify the challenges in hydrogen production, storage and transport for the benefit of society. (6.1.1)*	
	Course Conclusion	**01**
	Total	**30**

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 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 the public and public interest at global, regional and local level.

6.1.2 Analyse the environmental aspects of engineering problems for its impact on sustainability.

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

Course Outcomes:

A learner will be able to

1. Apply the laws of electrochemistry and thermodynamics for solving engineering problems. *(LO-3.1, LO-3.2, LO-3.3, LO-3.4,LO-3.5,LO-3.6, LO-3.7, LO-3.8, LO-3.9, LO-4.1, LO-4.1, LO-4.2, LO-4.3, LO-4.4, LO-4.5, LO- 4.6, LO- 5.1, LO- 5.2, LO- 5.3, LO- 5.4, LO- 5.5, LO-5.6, LO- 6.1, LO- 6.2, LO- 6.3, LO- 6.4)*
2. Analyze the quality of water and challenges in non-conventional energy sources for solving the real-world problems *(LO-1.1, LO- 1.2, LO-1.3, LO-1.4, LO- 1.5, LO-1.6, LO-1.7, LO- 2.1, LO- 2.2, LO- 2.3, LO- 2.4, LO- 2.5, LO- 2.6, LO- 2.7, LO- 6.1, LO- 6.2, LO- 6.3, LO- 6.4)*
3. Identify the suitable chemical product or material for the protection of environment and public health. *(LO-1.1, LO- 1.2, LO-1.3,LO-1.4,LO-1.5,LO-1.6,LO-1.7, LO- 2.1, LO- 2.2, LO-2.3,LO-2.4,LO-2.5,LO-2.6,LO- 2.7, LO-3.1, LO-3.2, LO-3.3,* LO-3.4,*LO-3.5,LO-3.6, LO-3.7, LO-3.8, LO-3.9, LO- 6.1, LO- 6.2, LO- 6.3, LO- 6.4)*
4. Interpret the impact of modern chemical industrial practices and energy sources for sustainable development. *(LO-1.1, LO- 1.2, LO-1.3,LO-1.4,LO-1.5,LO-1.6,LO-1.7, LO- 2.1, LO- 2.2, LO-2.3, LO- 2.4, LO- 2.5, LO- 2.6, LO- 2.7)*

CO-PO Mapping Table with Correlation Level

C O ID	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BSC103.1	3	2	-	-	-	3	-	-	-	-	-
BSC103.2	3	3	-	-	-	3	-	-	-	-	-
BSC103.3	3	3	-	-	-	3	-	-	-	-	-
BSC103.4	3	3	-	-	-	3	-	-	-	-	-
Average	**3**	**2.75**	-	-	-	**3**	-	-	-	-	-

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

A. IN-SEMESTER ASSESSMENT (35 MARKS)

1. Continuous Assessment - 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% syllabus.

B. END SEMESTER EXAMINATION (40 MARKS)

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

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	Details	Hrs.
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.	**01**
01.	***Coplanar force System: System of Coplanar Forces*** ***Learning Objective:*** *To impart the knowledge of fundamental concepts of Mathematics and Physics to analyze forces in engineering system..*	**5-7**
	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* *LO 1.1*: *To apply fundamental engineering concepts for resolution of system of forces. (P.I.-1.3.1)* *LO 1.2: Apply mechanical engineering concepts to find resultant forces acting in a system under the action of load. (PI-1.4.1)* *LO 1.3: To identify unknown forces in engineering systems due to application of load. (PI-2.1.2)* *LO 1.4: 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:*** *To use fundamental concepts of engineering knowledge of equilibrium and to analyze reactions under the influence different types of loading conditions.* **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. ***Self-Learning Topics:*** ***Learning Outcomes:*** *A learner will be able to* *LO 2.1: Apply fundamental mathematical knowledge for application of equilibrium concepts on rigid bodies(P.I.-1.1.2).* *LO 2.2: Apply mechanical concepts to coplanar force systems and calculate reactions in beams(P.I.-1.4.1).* *LO 2.3: Apply fundamental mathematical knowledge to find frictional parameters of a rigid body (P.I.-2.1.2).* *LO 2.4: Apply friction concepts to real-world scenarios involving inclined planes and ladders (P.I.-2.2.1).*	**7-9**
03.	**Kinematics of Particle** ***Learning Objective:*** *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	**8-10**

	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* *LO 3.1: apply knowledge to identify the motion of the object using the equations of motion (P.I.- 1.2.1).* *LO 3.2: apply the fundamental mathematics and mechanical engineering concepts to analyze different types of motions (P.I.-1.4.1).* *LO 3.3: Identify system variables to formulate trajectory equation of projectile motion (P.I.2.1.2).* *LO 3.4: Apply mathematical and engineering knowledge to find motion of the object in the real life situations (P.I.-2.1.3).*	
04.	**Kinematics of Rigid Body** ***Learning Objectives:*** *To understand the parameters required to quantify the Kinematics of Particle and Rigid body.*	**5-7**
	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.	
	Self-Learning Topics:	
	Learning Outcomes: *A learner will be able to* *LO 4.1: Apply engineering knowledge to identify the general plane motion(P.I.-1.3.1).* *LO 4.2: Apply mathematical knowledge to find translational, rotational and general plane motion of rigid bodies(P.I.-1.4.1).* *LO 4.3: Identify engineering systems and variables to find instantaneous center of rotation for link mechanism (P.I-2.2.1).* *LO 4.4: Use mathematical knowledge to find general plane motion analytically. (P.I.- 2.1.3).*	
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**
	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* *LO 5.1: Apply D'Alembert's Principle to analyze the particles in dynamic equilibrium, (P.I.-1.3.1)* *LO 5.2: Apply mechanical engineering knowledge to use work-energy principle for mechanical systems(P.I.-1.4.1).* *LO 5.3: To use mathematical knowledge, to analyze the systems using Work-Energy and Impulse-Momentum Principles(P.I.-2.1.3).* *LO 5.4: 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:*** *To understand the importance of Centroid which can affect the stability of the objects in the real life situations.* **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* *LO 6.1: Apply fundamental knowledge to find first moment of area. (P.I.-1.1.1).* *LO 6.2: Apply mechanical engineering knowledge to find centroid of composite body(P.I.-1.4.1).*	**3-5**
	Course Conclusion	**01**
	Total	**45**

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.

Course Outcomes: A 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. *(LO 1.1, LO 1.2, LO 1.3, LO 1.4, LO 2.1, LO 2.2, LO 2.3, LO 2.4)*
2. Analyse the motion of a particle using kinematic equations. *(LO 3.1, LO 3.2, LO 3.3, LO 3.4)*
3. Analyse the General plane motion of a rigid body using the concepts of instantaneous Centre of Rotation to find velocity and acceleration for a link Mechanism. *(LO 4.1, LO 4.2, LO 4.3, LO 4.4)*
4. Analyse the motion of a Particle using Kinetic equations. *(LO 5.1, LO 5.2, LO 5.3, LO 5.4*)
5. Apply the concept of Centroid to locate it for a plane lamina. *(LO 6.1, LO 6.2)*

CO-PO Mapping Table with Correlation Level

CO ID	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
ESC101.1	3	3	-	-	-	-	-	-	-	-	-
ESC101.2	3	3	-	-	-	-	-	-	-	-	-
ESC101.3	3	3	-	-	-	-	-	-	-	-	-
ESC101.4	3	3	-	-	-	-	-	-	-	-	-
ESC101.5	2	-	-	-	-	-	-	-	-	-	-
Average	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

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.

A. IN-SEMESTER ASSESSMENT (50 MARKS)

1. Continuous Assessment - Theory-(20 Marks)

1. Numerical Assignments (minimum 20 problems): 5 Marks
2. Class Test based on similar problems which were given as an assignment: 5 Marks
3. Open book test/Open notes test: 5 Marks
4. Regularity and active participation: 5 Marks

2. Mid Semester Exam (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%-30% weightage, and the syllabus covered from MSE to ESE carrying 70%-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

Pre-requisite :

NIL

Program Outcomes addressed:

1. PO1: Engineering knowledge
2. PO2: Problem analysis
3. PO6: The Engineer and The World
4. PO8: Individual and Collaborative 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 analyze DC circuits, AC circuits.
4. To introduce safety devices incorporated in residential electrical system for professional engineering practice.

Module	Detailed Contents	Hrs
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**
	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* *LO1.1 Apply the concepts of electrical engineering to understand role of each component of electrical power system. (P.I.-1.4.1)* *LO1.2 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.*	**5-7**
	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* *LO2.1 Apply concepts of Ohm's law and Kirchoff's laws to solve DC circuits. (P.I.- 1.4.1)* *LO2.2 Use concepts of star delta transformation to simplify DC circuits. (P.I.-1.3.1)* *LO2.3 Apply network theorems to analyze current distribution in DC circuits. (P.I.- 2.1.3)* *LO2.4 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)*	
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.*	**5-7**
	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* *LO3.1 Analyze the performance of AC circuit by calculating phase angle (power factor) between voltage and current waveform. (P.I.-2.1.2)* *LO3.2 Identify condition of resonance and calculate resonant frequency by overserving current and reactance in series AC circuits. (P.I.-2.1.3)*	

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**
	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* *LO4.1 Identify components in residential electrical system by understanding basic system requirements. (P.I.-1.3.1)* *LO4.2 Test and repair domestic appliances by applying concepts of basic electrical engineering. (P.I.-1.4.1)* *LO4.3 Identify safety devices for the protection of residential electrical system. (P.I.-6.1.1)* *LO4.4 Conduct a case study on residential lighting in a group to demonstrate communication, conflict resolution and leadership skills. (P.I.-8.2.1)* *LO4.5 Present the case study on residential lighting system design effectively as a team. (P.I.-8.3.1)*	
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**
	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* *LO5.1 Calculate the electrical energy consumed over a specified time by applying concepts of electrical engineering. (P.I.-1.4.1)* *LO5.2 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**
	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* *LO6.1 Compare and identify electrical motors for given application based on characteristics of load and motor. (P.I.-2.2.4)* *LO6.2 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**

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.
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.
8.2.1	Demonstrate effective communication, problem solving, and conflict resolution and leadership skills.
8.3.1	Present results as a team, with smooth integration of contributions from all individual efforts.

Course Outcomes:

Learner will be able to

1. Apply fundamental engineering concept to interpret Basic Electrical Systems, Residential Electrical System and Residential Energy Metering. (*LO1.1, LO1.2, LO4.1, LO5.1)*
2. Apply concepts of electrical engineering to solve problems on DC circuits and AC circuits. *(LO2.1, LO2.2, LO2.3, LO2.4, LO3.1, LO3.2)*
3. Interpret and identify safety devices for professional engineering practice.(*LO4.3, LO4.4*)
4. Conduct case study on residential lighting and present it to demonstrate effective communication and problem solving. *(LO4.4, LO5.2)*
5. Identify electrical motors based on requirement of application and characteristics of motor. *(LO6.1, LO6.2, LO4.5)*

CO-PO Mapping Table with Correlation Level

CO ID	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
ESC102.1	3	3	-	-	-	-	-	-	-	-	-
ESC102.2	3	3	-	-	-	-	-	-	-	-	-
ESC102.3	-	-	-	-	-	2	-	-	-	-	-
ESC102.4	3	-	-	-	-	-	-	3	-	-	-
ESC102.5	-	3	-	-	-	-	-	-	-	-	-
Average	**3**	**3**	-	-	-	**2**	-	**3**	-	-	-

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

A. 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.

B. End Semester Exam (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
BSL	BSL101	ENGINEERING PHYSICS-I LABORATORY	0.5

Examination Scheme					
Distribution of Marks			Exam Duration (Hrs.)		Total Marks
In-semester Assessment		End Semester Examination (ESE)			
Continuous Assessment	Mid-Semester Exam (MSE)		MSE	ESE	
25	-	-	-	-	25

Pre-requisite:

NIL

Program Outcomes addressed:

1. PO1: Engineering Knowledge
2. PO4: Conduct investigations of complex problems
3. PO8: Individual and collaborative team work
4. PO9: 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	Details	Hrs.
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.	**Experiment 1** ***Learning Objective:*** *1. To apply the knowledge of interference of light in thin film. .* *2. To determine a radius of curvature of lens and write valid conclusion*	
	Contents: Newton's Rings: Determine the radius of curvature (R) of given plano convex lens using Newton's Rings	
	Self-Learning Topics: -	

	Learning Outcome: *LO 1.1: A learner will be able to* *apply the concepts of interference in thin film and analyze the experimental data to calculate radius of curvature of the given plano convex lens. (P.I.1.2.1, P.I.1.2.2, P.I. 4.3.1, P.I..4.3.3)*	
02.	**Experiment 2** ***Learning Objective:*** 1. *To apply the knowledge of diffraction through multiple slit.* 2. *To find the wavelength of the LASER and write valid conclusion*	**02**
	Contents: Diffraction through Grating: Measurement of wavelength of He-Ne laser	
	Self-Learning Topics: -	
	Learning Outcome: *LO 2.1: A learner will be able to apply the concepts of diffraction through multiple slit and analyze the experimental data to calculate wavelength of the laser source. (P.I.1.2.1, P.I.1.2.2, P.I. 4.3.1, P.I..4.3.3)*	
03.	**Experiment 3** ***Learning Objective:*** 1. *To apply the knowledge of optical fibre.* 2. *To determine the numerical aperture of an optical fibre and write the conclusion.*	**02**
	Contents: Optical Fibre: Measurement of Numerical aperture.	
	Self-Learning Topics: -	
	Learning Outcome: *LO 3.1: A learner will be able to apply the knowledge of numerical aperture and analyze the experimental data to calculate numerical aperture of the given fibre. (P.I.1.2.1, P.I.1.2.2, P.I. 4.3.1, P.I..4.3.3)*	
04.	**Experiment 4** ***Learning Objectives:*** 1. *To apply the knowledge of Hall effect.* 2. *To determine a magnetic field using Hall effect in semiconductors*	**02**
	Contents: Hall effect**:** Determination of magnetic field.	
	Self-Learning Topics: -	
	Learning Outcome: *LO 4.1: A learner will be able to apply the concept of Hall effect phenomena and analyze the experimental data to calculate magnetic field generated by electromagnet. (P.I.1.2.1, P.I.1.2.2, P.I. 4.3.1, P.I..4.3.3)*	
05.	**Experiment 5** ***Learning Objective/s:***	**02**

	Contents: Photodiode: Drawing the I-V characteristics of photo diode	
	Self-Learning Topics: -	
	Learning Outcomes: *LO 5.1: A learner will be able to apply the working principle of photodiode and analyze the V-I characteristic curve to draw conclusion.* ***(P.I.1.2.1, P.I.1.2.2, P.I. 4.3.1, P.I..4.3.3)***	
06.	**Course Project** ***Learning Objective/s:*** *1. To apply various concepts of physics in a project.* ***2.*** *To develop the skill of execution of project through practical demonstration.*	**03**
	Contents: Selection of a project based on physics concepts, Literature survey, and Topic presentation.	
	Self-Learning Topics: -	
	Learning Outcome: *LO 6.1 : A learner will be able to identify a project based upon the concepts of physics and present the topic effectively as a team.* ***(P.I.1.2.1, P.I.1.2.2, P.I..8..1.2, P.I. 8.3.1, P.I. 9.1.1, P.I. 9.2.2)***	
	Course Conclusion	**01**
	Total	**15**

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.
4.3.1	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.
8.1.2.	Implement the norms of practice (e.g. rules, roles, charters, agendas, etc.) of effective teamwork,to accomplish a goal
8.3.1	Present results as a team, with smooth integration of contributions from all individual efforts.
9.1.1	Produce clear, well-constructed, and well- supported written engineering documents.
9.2.2	Deliver effective oral presentations to technical and non- technical audiences.

Course Outcomes: A learner will be able to -

1. A learner will be able to apply the fundamental knowledge of optical phenomena to determine various parameters through relevant experiments.(*LO 1.1, LO 2.1, LO3.1*)
2. A learner will be able to apply the fundamental knowledge of semiconductor devices to determine various parameters through relevant experiments. (*LO4.1, LO5.1*)

3. A learner will be able to apply the fundamental knowledge of physics to present proposed project work, write effective reports as a team. (*LO 6.1)*

CO-PO Mapping Table with Correlation Level

CO ID	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BSL101.1	3	-	-	3	-	-	-	-	-	-	-
BSL101.2	3	-	-	3	-	-	-	-	-	-	-
BSL101.3	3	-	-	3	-	-	-	3	3	-	-
Average	**3**	-	-	**3**	-	-	-	**3**	**3**	-	-

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, 1 st Edition, Wiley-Interscience.

Other Resources :

1. Online physics library, California State University:-Web linkhttps://phys.libretexts.org/
2. Physics website, The State University of New Jersey :-Web linkwww.physics.rutgers.ed

IN-SEMESTER ASSESSMENT (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
BSL	BSL102	ENGINEERING CHEMISTRY - I LABORATORY	0.5

Examination Scheme					
Distribution of Marks			Exam Duration (Hrs.)		Total Marks
In-semester Assessment		End Semester Examination (ESE)			
Continuous Assessment	Mid-Semester Exam (MSE)		MSE	ESE	
25	-	25	25	-	25

Pre-requisite:

1. Nil

Program Outcomes addressed:

1. PO1: Engineering Knowledge
2. PO2: Problem Analysis
3. PO6: The engineer and the world
4. PO8: Individual and collaborative 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	Details	Hrs.
00.	**Course Introduction** 1. Laboratory familiarization 2. Code of conduct in chemistry laboratory 3. Safety and precautions to be observed in chemistry laboratory 4. Orientation on evaluation of laboratory performance	01
01.	**Experiment 1** ***Learning Objective/s:*** *To estimate the total, temporary and permanent hardness of water using EDTA method to understand its quality for industrial use.*	02
	Estimation of Total, temporary and permanent hardness of water by EDTA method.	
	Self-Learning Topics: Nil	
	Learning Outcomes: *A learner will be able to* *LO-1.1 Analyse the quality of the industrial water by calculating the total hardness using complexometric titration method. (1.3.1), (2.1.3), (2.2.3), (6.1.1)*	

02.	**Experiment 2** ***Learning Objective/s:*** *To determine the chloride content of water to understand its suitability for domestic use* **Contents:** Estimation of chloride content of water sample ***Self-Learning Topics: Nil*** ***Learning Outcomes:*** *A learner will be able to* *LO- 2.1 Analyse the quality of the drinking water by calculating the chloride content using precipitation titration method.* *(1.3.1) (2.1.3) (2.2.3) (6.1.1)*	**02**
03.	**Experiment 3** ***Learning Objective/s:*** *To synthesise aspirin by using acetylation process and calculate its percent yield and atom economy to determine the nature of reaction.* To synthesize aspirin from salicylic acid ***Self-Learning Topics: Nil*** ***Learning Outcomes:*** *A learner will be able to* *LO-3.1 Synthesize aspirin using acetylation process and calculate its percentage yield (1.3.1) (2.2.3)*	**02**
04.	**Experiment 4** ***Learning Objective/s:*** *To calculate the enthalpy of dissolution of copper sulphate in water using simple calorimeter.* To determine the enthalpy of dissolution of copper sulphate at room temperature using water as a reaction medium. ***Self-Learning Topics: Nil*** ***Learning Outcomes:*** *A learner will be able to* *LO-4.1 Calculate enthalpy of the given system using first law of thermodynamics. (1.2.1), (1.3.1), (2.2.3)*	**02**
05.	**Experiment 5** ***Learning Objective/s:*** *To determine the effect of various factors affecting the rate of corrosion of iron* *To determine the factors affecting the rate of corrosion.* ***Self-Learning Topics: Nil*** ***Learning Outcomes:*** *A learner will be able to* *LO-5.1 Determine the effect of various factors on the rate of corrosion by applying the knowledge of electrochemistry (1.2.1) (1.3.1)*	**02**

06.	**Designing of experiment and presentation:** ***Learning Objective/s:*** *To develop the basic knowledge of analytical chemistry using titrimetric experiments*	**03**
	Contents: Standardization/estimation of chemical substances using titrimetric analysis.	
	Self-Learning Topics: Nil	
	Learning Outcomes: *A learner will be able to* *LO-6.1 Identify the existing titrimetric analysis to estimate the given substance and present the result as a team. (1.3.1)(2.2.3), (8.1.1), (8.3.1)*	
	Course Conclusion	**01**
	Total	**15**

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 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
8.1.1	Recognize a variety of working and learning preferences; appreciate the value of diversity on a team.
8.3.1	Present result as a team with smooth integration of contributions from all individual efforts.

Course Outcomes: A learner will be able to -

1. Apply the laws of electrochemistry and thermodynamics for performing the practicals. *(LO-4.1, LO-5.1)*
2. Formulate a drug by applying the concepts of chemistry. *(LO-3.1)*
3. Analyse the quality of water for assessing the public health. *(LO-1.1, LO-2.1)*
4. Demonstrate an ability to work effectively in a team for project-based activity. *(LO-6.1)*

CO-PO Mapping Table with Correlation Level

-CO ID	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BSL102.1	3	2	-	-	-	-	-	-	-	-	-
BSL102.2	2	2	-	-	-	-	-	-	-	-	-
BSL102.3	2	3	-	-	-	2	-	-	-	-	-
BSL102.4	2	2	-	-	-	-	-	3	-	-	-
Average	**2**	**2**	**-**	**-**	**-**	**2**	**-**	**3**	**-**	**-**	**-**

Textbooks:

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 textbooks: https://chem.libretexts.org
2. Lab Simulation: https://vlab.amrita.edu/?sub=2&brch=190&sim=1546&cnt=1

IN-SEMESTER ASSESSMENT (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
ESL	ESL101	ENGINEERING MECHANICS LABORATORY	01

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

Pre-requisite :
NIL

Program Outcomes addressed:

1. PO1: Engineering knowledge
2. PO2: Problem analysis
3. PO8: Individual and Collaborative 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	Details	Hrs.
	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.	**Coplanar Force System** ***Learning Objective:*** *Learner will be able to apply fundamental engineering concepts to demonstrate the concept of equilibrium of coplanar forces.*	**07**
	Contents: 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**.**	
	Self-Learning Topics:	
	Learning Outcomes: *A learner will be able to* *LO 1.1: Identify the type of force system in a team. (P.I.-1.3.1)* *LO 1.2: Determine the whether the system is in equilibrium or not and present the results in a team. (2.2.3,8.3.1)*	

	LO 1.3: Convert different mechanical systems into sub-stems by using free body diagram. (2.2.1) *LO 1.4: Determine the reactions of the beam for various loading conditions as a team.(P.I.-1.4.1,8.2.1).*	
02.	**Principle of Moment** ***Learning Objective:*** *Learner will be able to apply mechanical engineering concepts to demonstrate the principle of Moments using the Bell Crank Lever apparatus.* **Contents:** To demonstrate law of moments. Experiment 4: To verify moment equilibrium condition using bell crank lever. ***Self-Learning Topics:*** ***Learning Outcomes:*** *A learner will be able to* *LO 2.1: differentiate between moment and couple (P.I.-1.4.1).* *LO 2.2: verify moment equilibrium condition using bell crank lever and present the results as a team (P.I-1.3.1,8.3.1).* *LO 2.3: convert the bell crank lever diagram into subsystems by using free body diagram. (2.2.1)* *LO 2.4: Demonstrate effective communication while working as team for conducting the experiments (P.I-8.2.1).* *LO 2.5: Verify moment equilibrium condition using bell crank lever and present results as a team(P.I.-2.2.3,8.3.1).*	**07**
03.	**Friction** ***Learning Objective:*** *Learner will be able to determine coefficient of friction between two different surfaces in contact.* **Contents:** 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. ***Self-Learning Topics:*** ***Learning Outcomes:*** *A learner will be able to* *LO 3.1: Identify the effects of friction on different surfaces. (P.I.-1.4.1,8.2.1).* *LO 3.2: Identify the parameters affecting the friction values. (P.I.-2.1.2).* *LO 3.3: determine the coefficient of friction and present the results as a team. (P.I.-1.3.1,8.3.1)* *LO 3.4: compare and select the accurate method to determine coefficient of friction. (P.I.-2.2.3)*	**07**
04.	**Kinematics of particles**	**07**

	Learning Objectives: *Learner will be able to analyze the motion of particle.*	
	Contents: 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.	
	Self-Learning Topics:	
	Learning Outcomes: *A learner will be able to* *LO 4.1: Identify the variables associated with the projectile motion (P.I-1.2.1).* *LO 4.2: Determine the range and height of the particle during projectile motion and present the result as a team. (P.I.2.1.2,8.3.1)* *LO 4.3: Estimate velocities and distance travelled by the particle with a collaborative effort of a team. (P.I.-2.2.3,8.2.1).* *LO 4.4: Measure the speed of the particle. (P.I.-1.4.1).*	
	Course Conclusion	**01**
	Total	**30**

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 sub-problems.
2.2.3	Identify existing processes/solution methods for solving the problem, including forming justified approximations and assumptions.
8.2.1	Demonstrate effective communication, problem solving, conflict resolution and leadership skills.
8.3.1	Present results as a team, with smooth integration of contributions from all individual efforts.

Course Outcomes: A learner will be able to

1. Learner will be able to Demonstrate the Equilibrium of Coplanar Force System. *(LO 1.1, LO 1.2, LO 1.3, LO 1.4, LO 2.2)*
2. Learner will be able to demonstrate law of moments. *(LO 2.1, LO 2.2, LO 2.3, LO 2.4, LO 2.5)*
3. Learner will be able to determine coefficient of friction between two different

surfaces in contact. *(LO 3.1, LO 3.2, LO 3.3, LO 3.4)*

4. Learner will be able to analyse motion of a particle. *(LO 4.1, LO 4.2, LO 4.3, LO 4.4, LO 3.3)*

CO-PO Mapping Table with Correlation Level

CO ID	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
ESL101.1	3	3	-	-	-	-	-	3	-	-	-
ESL101.2	3	3	-	-	-	-	-	3	-	-	-
ESL101.3	3	3	-	-	-	-	-	3	-	-	-
ESL101.4	3	3	-	-	-	-	-	3	-	-	-
Average	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**-**

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 TImoshenkos Fifth Edition,2015, generic

IN-SEMESTER ASSESSMENT (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
ESL	ESL102	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 The World
4. PO8: Individual and Collaborative 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
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**
	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* *LO1.1 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, 8.3.1)* *LO1.2 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, 8.3.1)* *LO1.3 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, 8.2.1)*	
02.	***Learning Objective/s:*** *To impart knowledge on circuit assembly on breadboard and analysis of Alternating Current (AC) circuits.*	**08**
	Experiment: Analyze series and parallel connected AC circuits by determining circuit elements and resonant conditions.	
	Learning Outcomes: *A learner will be able to* *LO2.1 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, 8.2.1)* *LO2.2 Measure the resonance frequency in RLC series and parallel circuit and plot resonance curve. (4.1.4,8.3.1)*	
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**
	Experiment: Implementation of given residential electrical system incorporating safety devices and up-keeping of home appliances.	
	Learning Outcomes: *A learner will be able to* *LO3.1 Assemble small electrical circuits similar to residential wiring system along with safety devices and submit a report. (4.1.3, 8.3.1)* *LO3.2 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)* *LO3.3 Wire up PVC conduit wiring to control one lamp from two different places in a group. (Staircase wiring) (4.2.1, 8.3.1)* *LO3.4 Maintenance and up-keeping of household electrical appliances and submit a report. (4.1.3, 8.2.1)*	
04	***Learning Objective/s:*** *To introduce concept of motor selection for given application, transformer connections and its testing.*	**05**
	Experiment: • Identify electrical motors for given application. • Analyse transformer by identifying name plate details, transformation ratio, polarity and regulation.	

	Learning Outcomes: *LO4.1 Identify electrical motors for various electrical appliances like Fan, mixer, Vacuum cleaner, Washing machine, Water pump etc. and submit a report. (2.2.4, 8.2.1)* *LO4.1 Verify terminals, study the name plate details and calculate transformation ratio of single-phase transformers. (4.1.3, 8.3.1)* *LO4.1 Perform polarity test on transformers. (2.1.2,8.3.1)* *LO4.1 Determine voltage regulation of single-phase transformer by conducting direct load test and summarize results in a report. (4.2.1, 8.3.1)*	
	Total	**30**

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
8.2.1	Demonstrate effective communication, problem solving, conflict resolution and leadership skills.
8.3.1	Present results as a team, with smooth integration of contributions from all individual efforts

Course Outcomes:

Learner will be able to

1. Assemble the DC and AC circuits on breadboard and test the continuity. *(LO1.1, LO2.1, LO3.1)*
2. Select the meters to measure the required variables and analyse the performance of DC and AC circuits. (*LO1.2, LO1.3, LO2.2)*
3. Assemble simple residential electrical wiring incorporating safety devices. (*LO3.2, LO3.3, LO3.4)*
4. Select motor for household applications and test the transformer. (*LO4.1, LO4.2, LO4.3, LO4.4)*

CO-PO Mapping Table with Correlation Level

CO ID	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
ESL102.1	-	-	-	3	-	-	-	3	-	-	-
ESL102.2	-	-	-	3	-	-	-	3	-	-	-
ESL102.3	-	-	-	3	-	2	-	3	-	-	-
ESL102.4	-	3	-	3	-	-	-	3	-	-	-
Average	**-**	**3**	**-**	**3**	**-**	**2**	**-**	**3**	**-**	**-**	**-**

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

A. IN-SEMESTER 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

B. END SEMESTER ASSESSMENT (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
ESL	ESL103	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: Engineering tool usage
4. PO11: 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	Details	Hrs.
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:*** *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*	
	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.	**07**

	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* *LO 1.1: Apply algorithms on problem statements. (P.I.- 1.1.1)* *LO 1.2: Use symbols to draw flowcharts for problems. (P.I.- 1.3.1)* *LO 1.3: Identify data types, variables and operators to be used in C according to a problem. (P.I.- 2.1.2)* *LO 1.4: Solve the problem using operators in C. (P.I.- 2.2.3)* *LO 1.5: Adapt modern tool VS code to solve problem using data input/output, operators. (P.I.- 5.1.2)* *LO 1.6: 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:*** *Learner is expected to recall basics of Control Structures and understand Conditional structures. Also expected to apply it to solve problems in C.*	**16**
	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. **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* *LO 2.1: Apply if control statements in C. (P.I.- 1.1.1)* *LO 2.2: Use if else control statements in C. (P.I.- 1.3.1)* *LO 2.3: Identify data types, variables and loops to be used in C for a problem. (P.I.- 2.1.2)* *LO 2.4: Reframe the problem and use nested control structure to solve problems in C. (P.I.- 2.2.1)* *LO 2.5: Adapt modern tool VS code to solve problem using control structures (P.I.- 5.1.2)* *LO 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: *Learner is expected to recall function definition, declaration. and understand its usage. Also expected to apply it to solve problems in C.*	
	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.*	**12**
	Learning Outcomes: *A learner will be able to* *LO 3.1: Apply functions to write program in C. (P.I.- 1.1.1)* *LO 3.2: Use appropriate storage class in C. (P.I.- 1.3.1)* *LO 3.3: Identify data types, variables and type of user defined function to be used in C according to a problem. (P.I.- 2.1.2)* *LO 3.4: Reframe the problem and use recursive function to solve problems in C. (P.I.- 2.2.1)* *LO 3.5: Adapt modern tool VS code to solve problem using functions. (P.I.- 5.1.2)* *LO 3.6: 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**
	Learning Objectives: *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 *LO 4.1: Use 1D arrays to write program in C. (P.I.- 1.1.1)* *LO 4.2: Apply strings to write programs in C. (P.I.- 1.3.1)* *LO 4.3: Identify data types, variables and type of arrays to be used in C according to a problem. (P.I.- 2.1.2)* *LO 4.4: Reframe the problem and use arrays to solve problems in C. (P.I.- 2.2.1)* *LO 4.5: Adapt modern tool VS code to solve problem using arrays. (P.I.- 5.1.2)*	

	LO 4.6: 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**
	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.	
	Learning Outcomes : *A learner will be able to* *LO 5.1: Apply structures to write program in C. (P.I.- 1.1.1)* *LO 5.2: Use pointers in C to write programs. (P.I.- 1.3.1)* *LO 5.3: 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)* *LO 5.4: Reframe the problem and use pointer arithmetic to solve problems in C. (P.I.- 2.2.1)* *LO 5.5: Adapt modern tool VS code to solve problem using pointers, structures. (P.I.- 5.1.2)* *LO 5.6: Use VS code to check if the result of the C program using pointers is accurate (P.I.- 5.3.2)* *LO 5.7: Learn new ways to use pointers and structures in professional work. (P.I.- 11.1.1)* *LO 5.8: Identify new updates like dynamic memory management in C programming so that they can use it for writing efficient programs in future. (P.I.- 11.2.1)*	
	Course Conclusion	**01**
	Total	**60**

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
11.1.1 Describe the rationale for the requirement for continuing professional development
11.2.1 Identify historic points of technological advance in engineering that required practitioners to seek education in order to stay current.

Course Outcomes: A learner will be able to -

1. Illustrate the basic terminology used in computer programming concept of data types, variables and operators using C. (*LO 1.1, LO 1.2, LO 1.3, LO 1.4, LO 1.5, LO 1.6*)
2. Use control structure concepts in C programming (*LO 2.1, LO 2.2, LO2.3 LO 2.4, LO 2.5, LO 2.6*)
3. Develop functions and use it to solve problems in C using modern tools. (*LO 3.1, LO 3.2, LO 3.3, LO 3.4, LO 3.5, LO 3.6*)
4. Apply arrays and strings to solve problems in C. (*LO 4.1, LO 4.2, LO 4.3, LO 4.4, LO 4.5, LO 4.6*)
5. Demonstrate the use of structures, dynamic memory allocation and pointers in C. (*LO 5.1, LO 5.2, LO 5.3, LO 5.4, LO 5.5, LO 5.6, LO 5.7, LO 5.8*)

CO-PO Mapping Table with Correlation Level

CO ID	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
ESL103.1	3	3	-	-	3	-	-	-	-	-	-
ESL103.2	3	3	-	-	3	-	-	-	-	-	-
ESL103.3	3	3	-	-	3	-	-	-	-	-	-
ESL103.4	3	3	-	-	3	-	-	-	-	-	-
ESL103.5	3	3	-	-	3	-	-	-	-	-	3
Average	**3**	**3**	-	-	**3**	-	-	-	-	-	**3**

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		
Term Work	**Practical /Oral**	**Total**
50	--	50

Pre-requisite:

NIL

Program Outcomes addressed :

1. PO1:Engineering knowledge
2. PO5: Engineering tool usage
3. PO6: The Engineer and The World
4. PO8: Individual and collaborative team work
5. PO11: 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	Details	Hrs
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**
	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 *LO1.1: Read and interpret technical drawings, or schematics related to fitting tasks, identifying dimensions, tolerances, and other specifications accurately. (P.I.- 1.3.1, 11.3.1)* *LO1.2: Demonstrate proficiency in fitting techniques. (P.I.- 5.3.1)* *LO1.3: 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.- 1.4.1, 5.2.2, 11.3.1, 11.3.2)*	
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**
	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* *LO2.1: Identify and understand the various hardware components of a computer system. (P.I.- 5.1.2, 11.1.1)* *LO2.2: Assemble a computer system, set up and configure network infrastructure components to create a functional network environment. (P.I.- 1.2.1, 5.2.2, 11.2.1)* *LO2.3: Develop the skills to diagnose and troubleshoot common hardware and network problems. (P.I.- 1.3.1, 6.1.1, 6.3.1)*	
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**
	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* *LO3.1: Interpret welding symbols and blueprints accurately, understanding weld joint designs, dimensions, and specifications as per industry standards. (P.I.- 8.3.1, 11.3.1)* *LO3.2: 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.- 1.3.1, 1.4.1, 5.2.2, 5.3.1, 6.1.1, 6.3.1, 8.1.1, 11.3.2)*	
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* *LO4.1: Identify different parts of a lathe machine and understand operations that can be carried out on it. (P.I.- 11.1.1, 11.3.1)*	

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.
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.
6.3.1	Identify risks/impacts in the life-cycle of an engineering product or activity
8.1.1	Recognize a variety of working and learning preferences; appreciate the value of diversity on a team.
8.3.1	Present results as a team, with smooth integration of contributions from all individual efforts.

11.1.1 Describe the rationale for the requirement for continuing professional development.

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

11.3.1 Source and comprehend technical literature and other credible sources of information.

11.3.2 Analyse sourced technical and popular information for feasibility, viability, sustainability, etc.

Course Outcomes: A learner will be able to

1. Develop the necessary skill required to handle/use different fitting tools. (*LO 1.1, LO 1.2, LO 1.3*)
2. Develop skill required for hardware maintenance and installation of operating system. (*LO 2.1, LO 2.2, LO 2.3*)
3. Identify the network components and perform basic networking and crimping. (*LO 2.1, LO 2.2, LO 2.3*)
4. Prepare the edges of jobs and do simple arc welding. (*LO 3.1, LO 3.2*)

CO-PO Mapping Table with Correlation Level

CO ID	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
SEC101.1	3	-	-	-	3	-	-	-	-	-	3
SEC101.2	3	-	-	-	3	3	-	-	-	-	3
SEC101.3	3	-	-	-	3	3	-	-	-	-	3
SEC101.4	3	-	-	-	3	3		3	-	-	3
Average	**3**	**-**	**-**	**-**	**3**	**3**	**-**	**3**	**-**	**-**	**3**

Continuous Internal Assessment (CIA) - (50 Marks)

Job Work with complete workshop book : 40 Marks

Attendance 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 & The World
2. PO7 : Ethics
3. PO11: 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 :

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 Examination (ESE)			
Continuous Assessment	Mid-Semester Exam (MSE)		MSE	ESE	
20 + 25*	30	50	1.5	2	125

Pre-requisite:

1. Differentiation of several variable I & II
2. Vector Differentiation

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	Details	Hrs.
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. Forexample: 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*	6-8

	ofexact and linear DE.	
	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: ***Self-Learning Topics:*** *Application of differential equations of First Order and First Degree in electricalcircuits and thermodynamics.*	
	Learning Outcomes: *A learner will be able to* *LO 1.1* : *Identify the exact differential equation and linear differential equations and solve them using appropriate method by applying the fundamentals of differentiation and integration. (PI-2.1.3 , 2.2.3 & 1.1.1)* *LO 1.2 : Apply the fundamental engineering concepts to model a first order DE and solve it.(PI-1.3.1)*	
02.	**Linear Differential Equations with Constant Coefficients of Higher Order type f(D)y = X**	**7-9**
	Learning Objective: *Learner will be able to* 1. *Analyse and interpret the basic fundamentals of higher order differentialequations (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 amathematical model of linear differential equations.*	
	Learning Outcomes: *LO 2.1: Identify the nature of HODE and solve them by applying the concept of complementary function and particular integral using the fundamentals of differentiation and integrations. (PI-2.1.3, 2.2.3 & 1.1.1)* *LO 2.2 : Apply the fundamental engineering concepts to model a higher order DE and solve it.(PI-2.3.1 & 1.3.1)*	
03.	**Beta and Gamma Functions**	**5-7**
	Learning Objective: ***1.*** *Analyse and interpret the basic definition of Beta and Gamma Functions andtheir properties.* ***2.*** *Apply the definition and properties of Beta and Gamma Functions to solve definite integrals.*	
	Contents:	

	Definitions, Gamma Function, Beta Function, Properties of Beta and Gamma Function, Relationship between Beta and Gamma Function, Duplication Formula.	
	Self-Learning Topics:	
	Learning Outcomes: *A learner will be able to* *LO 3.1: Analyze a definite integral, apply the basic definition & properties of beta and gamma function to solve it by identifying the appropriate substitution. (PI-2.1.1, 1.1.1, 1.2.1 & 2.2.3).*	
04.	**Double Integration** ***Learning Objectives:*** 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 the Lamina.***	**7-9**
	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* *LO 4.1: Identify the region of integration. (P.I.-2.1.3)* *LO 4.2: Apply the fundamentals of integration to solve problem in double integration by changing the coordinate systems if applicable. (P.I.-1.1.1, 2.2.1)* *LO 4.3: 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 systemsand apply it to solve problem.* 2. *Apply the concepts of triple integrations to evaluate volume of a solid.*	**5-7**
	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* *LO 5.1: Identify the region of integration. (P.I.-2.1.3)* *LO 5.2: Apply the fundamentals of integration to solve problem in triple integration by changing the coordinate systems if applicable. (PI-1.1.1 & 2.2.1)* *LO 5.3 : Apply the concept of triple integration to find the volume of a solid. (PI- 1.2.1)*	

06.	**Integration of vector function** ***Learning Objective/s:*** Analyze the fundamentals of Line integral, surface integral and volume integral andapply it to solve problems using Green's Theorem, Stoke's Theorem & Gauss Divergence Theorem.	**7-9**
	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* *LO 6.1: Identify and apply the concept of vector differentiation & definite integral to evaluate Line integral, surface integral and volume integral.(PI-1.1.1, 1.2.1 & 2.1.3).* *LO 6.2: Differentiate between the problems and solve using appropriate theorem (Green's Theorem, Stoke's Theorem & Gauss Divergence Theorem). (P.I.- 2.2.4)*	
	Course Conclusion	**01**
	Total	**45**

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.
2.1.3	Identify the mathematical knowledge that applies to a given problem.
2.2.1	Reframe complex problems into interconnected sub-problems
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 mathematical models of an engineering problem.

Course Outcomes: A 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 (*LO 1.1, LO 1.2*)
2. Analyse the procedure to find complementary function and particular integral of higher order differential equation solve it by applying the suitable method. *(LO 2.1, LO 2.2)*
3. Implement the fundamentals of Beta and Gamma Function to evaluate the definite integral. *(LO 3.1)*
4. Apply the fundamentals of multiple integration to analyse and evaluate the area of a lamina and volume of a solid. *(LO 4.1 , LO 4.2, LO 4.3, LO 5.1, LO 5.2, LO 5.3)*
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. *(LO 6.1, LO 6.2)*

CO-PO Mapping Table with Correlation Level

CO ID	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BSC204.1	3	3	-	-	-	-	-	-	-	-	-
BSC204.2	3	3	-	-	-	-	-	-	-	-	-
BSC204.3	3	3	-	-	-	-	-	-	-	-	-
BSC204.4	3	3	-	-	-	-	-	-	-	-	-
BSC204.5	3	3	-	-	-	-	-	-	-	-	-
Average	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

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

A. IN-SEMESTER ASSESSMENT (75 MARKS)

1. Continuous Assessment - 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

2. Continuous internal evaluation of Tutorial (25 Marks)

1. Tutorials: 20 Marks

   Students must be encouraged to write at least 6 class tutorials. Each tutorial carries 20 Marks.

   Average will be taken of all six tutorials out of 20 marks.
2. Regularity and active participation: 5 marks

3. Mid Semester Exam (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%-30% weightage, and the syllabus covered from MSE to ESE carrying 70%-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 Examination (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 The World

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	Details	Hrs.
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:*** *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
	Contents: Crystals: Unit cell: Space lattice, Basis and Crystal structure: 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* *LO 1.1: state various parameters of unit cell of a crystal and its importance to identify crystal structures. (P.I.- 1.2.1)* *LO 1.2: diagrammatically describe the structure of different cubic unit cell. (P.I.- 1.2.1)*	

	LO 1.3: solve the problems related to crystal structure. (P.I.- 1.2.2.) *LO 1.4: identify cubic crystal structure knowing their various parameters. (P.I.- 2.1.2)* *LO 1.5. derive the unit cell parameters of cubic crystal structure. (P.I.- 2.1.3)*	
02.	**Analysis of Crystal Structure** ***Learning Objective:*** 1. *To interpret the use of X-ray law.* 2. *2. To apply the concept of Miller Indices and law to identify the crystal planes* **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: -*** *Crystals: Lattice parameters.* ***Learning Outcomes:*** *A learner will be able to* *A learner will be able to* *LO2.1: apply the hall effect phenomena for execution of experiment. (P.I.- 1.2.1)* *LO2.2: write the required theory and procedure for the experiment. (P.I.- 4.3.1)* *LO2.3: draw the principal planes of simple cubic structure. (P.I.- 4.3.3)* *LO2.4: identify the principal planes of simple cubic structure from the given models. (P.I.- 1.2.1)* *LO2.5: determine the miller indices for the same and interplanar distance and write the result. (P.I.- 1.2.2, P.I.- 4.3.3)*	**4-6**
03.	**Non-Crystalline Materials** ***Learning Objective:*** 1. *To gain the basic knowledge of non-crystalline solids.* 2. *2. To recognize the solids with amorphous structure and their importance in various applications* **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 A learner will be able to* *LO 3.1: differentiate crystalline and non-crystalline material. (P.I.- 1.2.1)* *LO 3.2: define non-crystalline material and list the properties of non-crystalline solid for various applications. (P.I.- 1.2.1)* *LO 3.3: identify the importance of short range order in non-crystalline materials. (P.I.- 2.1.2)* *LO 3.4: identify various non crystalline materials by knowing their properties. (P.I.- 2.2.3)*	**3-5**
04.	**Magnetic and Dielectric Materials**	**6-8**

	Learning Objectives: 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*	
	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* *LO 4.1: state various parameters related to magnetic and dielectric materials and their importance in various applications (P.I.- 1.2.1)* *LO 4.2: solve the problems involving magnetic and dielectric materials using the concepts and basic formulae. (P.I.- 1.2.2)* *LO 4.3: identify the types of ferromagnetic materials and dielectric materials in terms of their poperties. (P.I.- 2.1.2).* *LO 4.4: Draw the hysteresis loop for ferromagnetic materials by knowing the concept of magnetization. (2.1.3)* *LO 4.5: use magnetic materials and dielectric materials in various applications. (P.I.- 6.1.1)* *LO 4.6: 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**
	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 *LO 5.1: define nanomaterial and differentiate between two approaches of synthesizing nanomaterials. (P.I.- 1.2.1)* *LO 5.2: solve the problems related to surface area to volume ratio. (P.I.- 1.2.2)* *LO 5.3: classify various synthesis methods of nanomaterials in terms of approaches. (2.1.2).*	

	LO 5.4: write about various synthesis methods and identify the suitable method for the preparation of a different nanomaterials. (P.I.- 2.2.3) *LO 5.5: analyse the properties of nanomaterials. (P.I.- 6.1.1)*	
06.	**Characterization Techniques of Nanomaterials** ***Learning Objective/s:*** *The learner will be able to predict the tools for specific characterization of nanomaterials.*	**3-5**
	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* *LO 6.1*: *state working principle of different tools (SEM, TEM and AFM).and its application in analysing various properties of nanomaterials (P.I.- 1.2.1)* *LO 6.2*: *interpret the importance of electron microscope over optical microscope. to characterize nanomaterials (P.I.- 2.2.3)* *LO 6.3*: *analyse different characterization tools in terms of their principle, construction, working. (P.I.- 2.2.3)* *LO 6.4*: *identify merits, demerits and challenges in using the characterization tools. (P.I.- 6.2.2)*	
	Course Conclusion	**01**
	Total	**30**

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.

Course Outcomes:
A learner will be able to -

1. Learner will be able to apply the knowledge of crystal parameters to analyse the relevant basic engineering problems.
   (*LO 1.1, LO 1.2, LO 1.3, LO 1.4, LO1.5, LO 2.1, LO 2.2, LO 2.3, LO 2.4, LO2.5*)
2. Learner will be able to apply the fundamental knowledge of non-crystalline solids for various applications of it.
   (*LO 3.1, LO 3.2, LO 3.3, LO 3.4)*
3. Learner will be able to apply the fundamental knowledge of magnetic and dielectric materials in various technical fields by analyzing their intrinsic behaviours.
   (*LO 4.1, LO 4.2, LO 4.3, LO 4.4, LO 4.5, LO 4.6)*
4. Learner will be able to use the basic knowledge of nanomaterials and their characterization techniques to identify their applications in societal issues.
   (*LO 5.1, LO 5.2, LO 5.3, LO 5.4, LO 5.5, LO 6.1, LO 6.2, LO 6.3, LO 6.4*)

CO-PO Mapping Table with Correlation Level

CO ID	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BSC205.1	3	3	-	-	-	-	-	-	-	-	-
BSC205.2	3	3	-	-	-	-	-	-	-	-	-
BSC205.3	3	3	-	-	-	3	-	-	-	-	-
BSC205.4	3	3	-	-	-	3	-	-	-	-	-
Average	**3**	**3**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**

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. Introduction to solid state physics, Charles Kittel, Eighth Edition, 2005, Wiley
3. The Physics of Amorphous Solids, Richard Zallen, Wiley - VCH
4. Introduction to nanotechnology, Charles P Poole and Frank J Owens, 1st Edition, Wiley-Interscience.
5. Nano: The essentials: Understanding Nanoscience and Nanotechnology, T Pradeep, 1 st 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 linkwww.physics.rutgers.edu
3. Theory of the structure of Non-Crystalline Solids, Conference Review Paper, Int. conf. on Theory of the structure of Non-Crystalline Solids. Jozef Bicerano et al.
4. NPTEL Course: Nano structured materials-synthesis, properties, self-assembly and applications by Prof. A. K. Ganguli, IIT Delhi:- Web linkhttps://nptel.ac.in/courses/118102003.

A. IN-SEMESTER ASSESSMENT (35 MARKS)

Continuous Assessment - 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

Mid Semester Exam (20 Marks)

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

B. 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 Examination (ESE)			
Continuous Assessment	Mid-Semester Exam (MSE)		MSE	ESE	
15	20	40	1	1.5	75

Pre-requisite: NIL

Program Outcomes addressed:

1. PO1: Engineering knowledge
2. PO2: Problem analysis
3. PO6: The engineer and the world

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

	Self-Learning Topics: *Applications of aluminum alloys in aeronautical engineering.*	
	Learning Outcomes: *A learner will be able to* *LO 1.1 State the significance of making alloys (P.I.-1.3.1)* *LO- 1.2 State the role of carbon in steels (P.I.-1.3.1)* *LO-1.3 Classify the plain carbon steels on the basis of their carbon content. (P.I.-2.1.3)* *LO-1.4 Distinguish between plain carbon steels and alloy steels (P.I.-2.1.3)* *LO-1.5 Identify the role of various alloying elements in alloy steel (P.I.-2.1.3)* *LO-1.6 State the composition, properties and uses of SS and Heat resistant steel. (P.I.-1.3.1)* *LO-1.7 State the composition, properties and applications of duralumin in alclad. (P.I.-1.3.1)* *LO 1.8 State the concept of shape memory alloys and their applications in various industries. (P.I.-1.3.1)*	
02.	**Polymers**	**4-6**
	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* *LO 2.1 Apply the basic concepts of polymer chemistry (P.I.-1.3.1)* *LO -2.2 Synthesize thermoplastic and thermosetting polymers for industrial use. (P.I.-2.2.3)* *LO-2.3 Calculate the molecular weight of polymer by number average and weight average methods. (P.I.-1.2.2)* *LO-2.4 Apply the knowledge of high-performance polymeric materials for the protection of public health. (P.I.-6.1.1)* *LO-2.5 State the concept of glass transition temperature, factors affecting the same. (P.I.-1.3.1)* *LO-2.6 Identify the correct polymer for various applications on the basis of glass transition temperature. (P.I.-2.1.3)* *LO-2.7 State the concept of conducting polymers, electroluminescent polymer and biodegradablepolymers for various applications in industry. (P.I.-1.3.1)* *LO-2.8 Apply the knowledge of disposal of biodegradable polymers for protection of environment and sustainable development. (P.I.-7.2.1)*	
03.	**Advanced Functional materials**	**4-6**

	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.	
	Self-Learning Topics:	
	Learning Outcomes: *A learner will be able to* *LO-3.1 State the properties of composite materials (P.I.-1.3.1)* *LO-3.2 State the functions of matrix and dispersed phase (P.I.-1.3.1)* *LO- 3.3 Classify the composite materials on the basis of types of reinforcedmaterials used. (P.I.-2.3.1)* *LO- 3.4 Analyze the structural and mechanical properties of composites for industrial use. (P.I.-2.3.1)* *LO- 3.5 Analyze the properties of composite materials for the applications in aeronautical engineering. (P.I.-2.3.1).*	
04.	**Carbon Nanomaterials** ***Learning Objectives:*** *To use carbon nanomaterials on the basis of their mechanical and electrical properties in various industrial applications and modern devices.*	**3-5**
	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: *A learner will be able to* *LO-4.1 Define Carbon nanomaterials (P.I.-1.3.1)* *LO-4.2 Analyze the structures of graphene, CNTs and fullerene for their electrical and mechanical properties. (P.I.-2.3.1)* *LO-4.3 Apply the knowledge of properties of carbon nanomaterials in industry. (P.I.-1.3.1)*	
05.	**Batteries**	**4-6**
	Contents:	

	Introduction and Characteristics of batteries. Construction, working andapplications 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* *LO-5.1 State the characteristic properties of batteries (1.3.1)* *LO-5.2 Write the construction and working of Li-ion and fuel cell batteries. (1.3.1)* *LO-5.3 Analyze the uses of batteries in various devices for solving real-worldproblems. (2.1.3)* *LO-5.4 Identify the impact of disposal of batteries on the environment and society.(6.1.1)* *LO-5.5 Apply e-waste management of batteries for sustainable development and environment protection. (6.1.2)*	
06.	**Spectroscopic Techniques**	**3-5**
	Learning Objective/s: *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 fluorescence and phosphorescence, Jablonski diagram. Material Characterization using different Spectroscopic Techniques.	
	Self-Learning Topics: *Electromagnetic radiation, characteristics of electromagneticradiation, electromagnetic spectrum.*	
	Learning Outcomes:	
	A learner will be able to *LO-6.1 Classify spectroscopic techniques on the basis of atomic or molecular level of study. (P.I.-2.1.3)* *LO-6.2 State the fundamental selection rules in spectroscopic technique (P.I.-1.3.1)* *LO-6.3 State the Beer Lambert's law (P.I.-1.2.1)* *LO-6.4 To calculate absorbance, concentration and molar extinction coefficientof given compounds using Beer Lambert's law. (P.I.-1.2.2)* *LO-6.5 State the phenomena of fluorescence and phosphorescence. (P.I.-1.3.1)* *LO-6.6 Analyze the various radiative and non-radiative transitions occurring ina photo excited electron with the help of Jablonsky diagram. (P.I.-2.1.3)*	
	Course Conclusion	**01**
	Total	**30**

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 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 the public and public interest at global, regional and local level
6.1.2	Analyse the environmental aspects of engineering problems for its impact on sustainability.

Course Outcomes: A learner will be able to -

1. Apply the concepts of engineering chemistry for solving the engineering problems (*LO-1.1, LO-1.2, LO-1.3, LO-1.4, LO-1.5, LO-1.6, LO-1.7, LO-1.8, LO-2.1, LO-2.2, LO-2.3, LO-2.4, LO-2.5, LO-2.6, LO-2.7, LO-2.8, LO-3.1, LO-3.2, LO-3.3, LO-3.4, LO-3.5, LO-4.1, LO-4.2, 4.3, LO-5.1, LO-5.2, LO-5.3, LO-5.4, LO-5.5, LO-6.1, LO-6.2, LO-6.3, LO-6.4, LO-6.5, LO-6.6)*
2. Analyse the quality and properties of engineering materials for solving real world problems. (*LO-1.1, LO-1.2, LO-1.3, LO-1.4, LO-1.5, LO-1.6, LO-1.7, LO-1.8, LO-2.1, LO-2.2, LO-2.3, LO-2.4, LO-2.5, LO-2.6, LO-2.7, LO-2.8, LO-3.1, LO-3.2, LO-3.3, LO-3.4, LO-3.5, LO-4.1, LO-4.2, 4.3, LO-5.1, LO-5.2, LO-5.3, LO-5.4, LO-5.5, LO-6.1, LO-6.2, LO-6.3, LO-6.4, LO-6.5, LO-6.6)*
3. Identify the suitable engineering material for the protection of the environment and public health. (*LO-2.1, LO-2.2, LO-2.3, LO-2.4, LO-2.5, LO-2.6, LO-2.7, LO-2.8, LO-3.1, LO-3.2, LO-3.3, LO-3.4, LO-3.5, LO-5.1, LO-5.2, LO-5.3, LO-5.4, LO-5.5,)*
4. Apply the knowledge of e-waste management and biodegradable polymers for the sustainable development. (*LO-2.1, LO-2.2, LO-2.3, LO-2.4, LO-2.5, LO-2.6, LO-2.7, LO-2.8, LO-5.1, LO-5.2, LO-5.3, LO-5.4, LO-5.5,)*

CO-PO Mapping Table with Correlation Level

CO ID	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BSC206.1	3	3	-	-	-	3	-	-	-	-	-
BSC206.2	3	3	-	-	-	3	-	-	-	-	-
BSC206.3	3	3	-	-	-	3	-	-	-	-	-

BSC206.4	3	3				3					
Average	3	3				3					

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

A. IN-SEMESTER ASSESSMENT (35 MARKS)

1. Continuous Assessment - Theory-(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% syllabus.

B. END SEMESTER EXAMINATION (40 MARKS)

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

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

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

Pre-requisite:

1. Keen desire to build confidence, develop language skills and reduce fear of public speaking
2. Intermediate knowledge of Spoken English
3. Intermediate level grasp of English Grammar and Vocabulary

Program Outcomes addressed:

1. PO 7: Ethics
2. PO 8: Individual and Collaborative Teamwork
3. PO 9: Communication
4. PO 11: 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	Details	Hrs.
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:*** *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 then be shared using ICT tools, ethical use of social media and appropriate professional etiquette, as individuals and team members.*	**7-9**
	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 employees and get 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* *LO1.1: Identify the various channels of communication in a business organization (9.2.1)* *LO1.2: Differentiate between verbal and non-verbal communication. (8.2.3)* *LO1.3: Apply verbal and non-verbal cues to communicate more effectively in a group (8.2.1)* *LO1.4: Identify barriers in communication and overcome them efficiently (7.1.1)* *LO1.5: Implement the correct method of listening, speaking, reading and writing keeping 'You-attitude' in perspective. (7.2.2)* *LO1.6: Deliver a short speech for special occasions or an extempore with appropriate professional tools and social etiquette. (9.2.2, 9.3.2))* *LO1.7: Introduce self with confidence and composure to the class. (8.2.4)* *LO1.8: Implement appropriate grooming and ethical way of presenting oneself (11.1.1)* *LO1.9: Utilise the knowledge of responsible and ethical use of social media (7.1.1)* *LO1.10: Exhibit flexibility and empathy in the professional space (8.2.2)* *LO1.11: Identify conflict situations and attempt to come up with a resolution. (8.2.1)*	
02.	***Verbal Aptitude For Employment***	**2-4**
	Learning Objective: *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 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 *LO2.1: Identify the commonly found grammatical errors in the written and spoken format of communication. (9.1.1)* *LO2.2: Apply appropriate words and parts of speech such as prefixes, suffixes, synonyms and antonyms in the written and oral form of communication. (9.2.2)* *LO2.3: Eliminate the use of pleonasms, tautologies and redundancies during communication (9.1.3)* *LO2.4: Employ proper idioms, proverbs and clichés in their written and*	

	spoken communication (9.1.3) *LO2.5: Listen to grammatically correct input, understand and analyse the same (11.3.1)*	
03.	***Developing Basic Language Skills-LSRW Skills*** ***Learning Objective:*** *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**
	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 (*Celestial Omnibus*) 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) Understanding the importance of Copyrights b) Paraphrasing, referencing and In-text citations 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* *LO 3.1: Listen to team members, peers respectfully, without prejudice to understand ideas and opinions. (8.2.2, 8.2.3, 9.2.1)* *LO3.2: Read and comprehend long/short, technical/non-technical passages. (9.1.1)* *LO3.3: Comprehend and derive appropriate answers to the questions related to each passage. (9.2.1)* *LO3.4: Analyse and derive significant information from a given passage (9.1.1)* *LO3.5: Summarise passages in paragraph format and as graphical organisers (9.1.3)* *LO3.6: Identify the utility and importance of Copyrights (7.2.2, 9.3.1, 11.1.1)* *LO3.7: Generate plagiarism reports by running a plagiarism check (7.2.2, 9.3.2, 11.3.1)*	
04.	***Business Correspondence*** ***Learning Objectives:*** *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.*	**6-8**
	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* *LO 4.1: Apply the 7 C's of Business correspondence? Why is 'You attitude' important in business communication? (7.1.1, 7.2.2)* *LO 4.2: Write a Sales/Complaint/Adjustment/Request letter using the correct format. (9.3.2)* *LO 4.3: Generate a job application letter? State: How does it promote your growth? (11.1.1)*	
05.	***Basic Technical Writing*** *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.*	**4-6**
	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* *LO 5.1: Delineate the difference between technical writing, academic writing and literary writing. (9.1.1)* *LO5.2: Frame clear definitions (9.1.3)* *LO5.3: Write and present a clear set of instructions for the end user for a particular task (9.1.3, 9.2.2)* *LO5.4Critically choose a research topic and write a research paper (11.3.1)*	

	Activities for Practical:	**4**
	1. Listening skill - Listening to audio and video content of various types like Monologues, dialogues, formal talk and discussion about the same.	**2**
	2. Self-Introduction and introducing others - Learning formal self-introduction and introducing colleagues through practice activity.	**6**
	3. Group Discussion on various relevant topics - Minimum three rounds to be conducted for facilitating enough practice.	**4**
	4. Debates on several relevant issues- Two rounds to be conducted.	**2**
	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 technical paper will be held. Students will create a short research paper using the given template.	**4**
	8. Team activity: Poster Presentation on a specific theme based awareness creation- students will work as a team of 4 members to create the poster as per the given guidelines, followed by presentation.	**2**
	9. Assignment on Business Correspondence- practice for drafting various business letters	**2**
	10. Assignment on writing accurate technical instructions for the end user.	**01**
	Course Conclusion	**60**
	Total	

Performance Indicators:

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

9.2.2 Deliver effective oral presentations to technical and non-technical audiences

9.3.1 Create technical figures, reports with data to complement reports and presentations

9.3.2 Use a variety of media effectively to convey a message in a document or a presentation

11.1.1 Describe the rationale for the requirement for continuing professional development

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

Course Outcomes: A learner will be able to -

1. Evaluate information they listen to and express their ideas ethically and with greater clarity. (*LOs 1.1, 1.2, 1.5, 2.1, 2.2, 2.4, 2.5, 3.1, 3.4, 4.3, 5.1)*
2. Present convincingly before an audience using accurate and appropriate lexis and enhanced digital content. (*LOs 1.5, 1.6, 1.7, 1.8, 1.9, 3.6)*
3. Read and analyse objectively, summarize graphically and paraphrase effectively. (*LOs 2.1, 2.2, 2.3, 2.4, 2.5, 3.2, 3.3, 3.4, 3.5)*
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. (*LOs 1.3, 1.4, 1.5, 1.7, 1.8, 1.9, 1.10, 3.7, 3.6, 4.1, 4.2, 4.3)*
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. *(LOs 1.9, 2.3, 4.1, 4.2, 4.3, 5.1, 5.2, 5.3, 5.4)*
6. Conduct ably and ethically within the social circles with empathy and confidence, thus exhibiting a well-groomed and balanced personality(*LOs 1.10, 1,11, 2.4, 3.1, 3.6, 3.7)*

CO-PO Mapping Table with Correlation Level

CO ID	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
AEC201.1	-	-	-	-	-	-	-	3	3	-	2
AEC201.2	-	-	-	-	-	-	-	-	3	-	-
AEC201.3	-	-	-	-	-	-	-	-	3	-	2
AEC201.4	-	-	-	-	-	-	3	-	2	-	2
AEC201.5	-	-	-	-	-	-	-	-	3	-	2
AEC201.6	-	-	-	-	-	-	2	3	2	-	2
Average	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**-**	**2**

Text Books :

1. SanjayKumar&PushpLata(2018).CommunicationSkills,NewDelhi:OxfordUniversityPress
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.

IN- SEMESTER ASSESSMENT (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 Examination (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. PO11: Life-long learning

Course Objectives:

1. To impart the knowledge to demonstrate competence in comprehending the concepts of semiconductor 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 life applications such as an amplifier, switch, etc.
3. To introduce number system and use logic gates to analyse and design circuits for a given expression.
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 new developments in the relevant fields.

Module	Details	Hrs.
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**	5-7

	Learning Objective: 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* *LO 1.1: Apply fundamental engineering concepts to comprehend the characteristics and parameters of semiconductor diodes. (P.I.-1.3.1)* *LO 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)* *LO 1.3: Identify engineering systems to analyze the applications of diode such as switch, rectifier, clipper, clampers etc. (P.I.-2.1.2)* *LO 1.4: Identify existing methods for analyzing voltage, currents of zener diode and opto –electronic devices. (P.I.-2.2.3)*	
02.	**Introduction to Transistor**	**6-8**
	Learning Objective: ***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.*	
	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* *LO 2.1: Apply fundamental engineering concepts to comprehend the concept of biasing with potential divider bias circuit. (P.I.-1.3.1)*	

	LO 2.2: 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) *LO 2.3: Identify engineering systems to find gain, operating point of bipolar junction transistor etc. (P.I.-2.1.2)* *LO 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:*** 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**
	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* *LO 3.1: Integrate mathematical tools to perform conversion in number System. (P.I.- 2.2.2)* *LO 3.2: Compare alternative solutions to select the best methodology to implement logic gates. (P.I.-2.2.4)* *LO3.3: Determine design objectives to implement electronic circuits using logicgates (P.I.-3.1.6)* *LO3.4: Apply formal design principles to build simplified circuits using universal gates. (P.I.-3.3.3)*	
04.	**Electronic Instruments** ***Learning Objectives:*** *To comprehend the working of CRO, DSO, function generators, power supply and access sources to read technical datasheets of instruments.*	**1-3**
	Contents: Introduction to Basic instruments: Components of generalized measurement system Concept of accuracy, precision, linearity, sensitivity, resolution, hysteresis, calibration.	
	Self-Learning Topics: ----	
	Learning Outcomes:	
	A learner will be able to	

	LO 4.1: Apply concepts of electronics and communication engineering and allied disciplines to comprehend the working principle of CRO and DSO. (P.I.-1.4.1) *LO 4.2: Comprehend technical datasheets of instruments. (P.I.-11.3.1)*	
05.	**Introduction to Transducers** ***Learning Objective/s:*** *To demonstrate competence in engineering fundamentals to introduce the concept transducer for the desired application.* **Contents:** Transducers, classification of transducers, selection of transducers, Resistance- temperature detector (RTD), inductive transducers, Linear variable differential transformer (LVDT). ***Self-Learning Topics:*** ***Learning Outcomes :*** *A learner will be able to* *LO 5.1: Apply fundamental engineering concepts to comprehend the concept of transducers and its working. (P.I.-1.3.1)* *LO 5.2: Apply concepts of electronics and communication engineering to comprehend various types of transducers used in electronics. (P.I.-1.4.1)*	**2-4**
06.	**Introduction to Sensors** ***Learning Objective/s:*** *To demonstrate competence in engineering fundamentals to comprehend the concepts of sensor as per the application.* **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* *LO 6.1: Apply laws of natural science to an engineering problem to understand the concept of sensors. (P.I.-1.2.1)* *LO 6.2: Apply concepts of electronics and communication engineering and allied disciplines to comprehend the types of sensors. (P.I.-1.4.1)*	**3-5**
	Course Conclusion	**01**
	Total	**30**

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 solve engineering 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 justified approximations 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 for particular specifications.
11.3.1	Source and comprehend technical literature and other credible sources of information.

Course Outcomes: A learner will be able to -

1. Apply the fundamentals of engineering to demonstrate the concepts of semiconductor diodes and analyse its applications. *(LO 1.1, LO 1.2, LO1.3, LO1.4*)
2. Apply the fundamentals of engineering to design transistor-based applications such as an amplifier, switch, etc. *(LO 2.1, LO 2.2, LO2.3, LO2.4*)
3. Formulate mathematical models to introduce number system and use logic gates to design circuits for a given expression. *(LO 3.1, LO 3.2, LO3.3, LO3.4*)
4. Recognize the utilisation of measuring devices and its working. *(LO 4.1, LO 4.2*)
5. Apply the fundamentals of engineering to introduce various transducers and sensors to adapt to the current technologies regarding new developments in the relevant fields. *(LO 5.1, LO 5.2, LO6.1, LO6.2*)

CO-PO Mapping Table with Correlation Level

CO ID	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
ESC203.1	3	3	-	-	-	-	-	-	-	-	-
ESC203.2	3	3	-	-	-	-	-	-	-	-	-
ESC203.3	-	3	3	-	-	-	-	-	-	-	-
ESC203.4	2	-	-	-	-	-	-	-	-	-	2
ESC203.5	3	-	-	-	-	-	-	-	-	-	-

Average	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**

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 Publishing Company Pvt. Ltd.
3. Electronic Devices and Circuits, Salivahanan, N Suresh Kumar, 2013, 3rd edition, McGraw Hill Publications.
4. Basic Electronics & Linear Circuits, Bhargava N. N., D C Kulshreshtha and S C Gupta, 2013, 2nd edition, Tata McGraw Hill.
5. Electronic Devices and Circuit Theory Robert L. Boylestad Louis Nashelsky,11th edition, Pearson New International Edition.

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, PHI Learning.
4. Electronic Instrumentation and Measurements (3rd Edition) – David A. Bell, 2013, Oxford University 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 (50 MARKS)

1. Continuous Assessment - Theory-(20 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 (30 Marks)

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

END SEMESTER EXAMINATION (50 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
BSL	BSL203	ENGINEERING PHYSICS-II LABORATORY	0.5

Examination Scheme					
Distribution of Marks			Exam Duration (Hrs.)		Total Marks
In-semester Assessment		End Semester Examination (ESE)			
Continuous Assessment	Mid-Semester Exam (MSE)		MSE	ESE	
25	-	-	-	-	25

Program Outcomes addressed:

1. PO1: Engineering Knowledge
2. PO4: Conduct investigations of complex problems
3. PO8: Individual and Collaborative Team Work
4. PO9: 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	Details	Hrs.
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.	**Experiment 1** ***Learning Objective:*** *To apply the concept of miller indices to identify principal crystal planes. To determine the interplanar distance in simple cubic structure.*	02
	Contents: Miller Indices: Study of miller indices for planes in simple cubic structure.	
	Self-Learning Topics: -	
	Learning Outcome: *LO1.1: A learner will be able to apply the concept of miller indices and analyze principal crystal planes to determine the interplanar distance in simple cubic structure. (P.I.- 1.2.1, 1.2.2, 4.3.1, 4.3.3)*	

02.	**Experiment 2** ***Learning Objective:*** *To simulate XRD pattern for a given crystal system* **Contents:** X-ray Diffraction: Simulation of X-ray Diffraction (XRD) pattern of a material. ***Self-Learning Topics: -*** ***Learning Outcome:*** *LO2.1. A learner will be able to apply the knowledge of x-ray diffraction and analyze the crystal structure by simulating XRD pattern for various materials using software and write the result. (P.I.- 1.2.1, 1.2., 4.1.3, 4.3.3)*	**02**
03.	**Experiment 3** ***Learning Objective:*** 1. *To apply the knowledge magnetic materials in order to study the phenomena of magnetic hysteresis.* 2. *To gain the knowledge of importance of hysteresis loop.* **Contents:** Magnetization: Drawing hysteresis curve (B-H curve) of a magnetic material. ***Self-Learning Topics: -*** ***Learning Outcome:*** *LO 3.1: A learner will be able to apply basic concepts of magnetization and analyze the B-H curve of a ferromagnetic material to determine the loss of energy per unit volume to magnetize the material and write the result. (P.I.- 1.2.1, 1.2., 4.3.1, 4.3.3).*	**02**
04.	**Experiment 4** ***Learning Objectives:*** 1. *To apply the knowledge of dielectric materials.* 2. *To determine the dielectric constant of a given material.* **Contents:** Dielectrics: Determination of dielectric constant of a given material. ***Self-Learning Topics: -*** ***Learning Outcome:*** *LO4.1: A learner will be able to apply the knowledge of dielectrics and analyse experimental data to determine the dielectric constant of the given material and write the result. (P.I.- 1.2.1, 1.2.2, 4.3.1, 4.3.3)*	**02**
05.	**Experiment 5** ***Learning Objective/s:*** *To simulate and visualize nanostructures.* **Contents:** Nanomaterials: Simulation experiment for structure of nanomaterials.	**02**

	Self-Learning Topics : -	
	Learning Outcome : LO5.1: *A learner will be able to apply the knowledge of nanomaterials and analyse the structure of the nanomaterials using simulation software and write the result. (P.I.- 1.2.1, 1.2., 4.1.3, 4.3.3)*	
06.	**Course Project** ***Learning Objective/s:*** 1. *To apply various concepts of physics in a project.* 2. *To execute the chosen project through practical demonstration*	**03**
	Contents: Report writing and Demonstration of the project.	
	Self-Learning Topics: -	
	Learning Outcomes: *A learner will be able to* *LO6.1: apply the concepts of physics to execute, demonstrate and present the project effectively as a team. (P.I.- 1.2.1, 1.2.2, 4.2.1, 4.3.1, 8.1.2, 8.3.1,9.1.2, 9.2.2)*	
	Course Conclusion	**01**
	Total	**15**

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.
4.1.3	Apply appropriate instrumentation and/or software tools to make measurements of physical quantities.
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.
8.1.2	Implement the norms of practice (e.g. rules, roles, charters, agendas, etc.) of effective teamwork, to accomplish a goal.
8.3.1	Present results as a team, with smooth integration of contributions from all individual efforts.
9.1.2	Produce clear, well-constructed, and well- supported written engineering documents.
9.2.2	Deliver effective oral presentations to technical and non- technical audiences.

Course Outcomes:

1. Learners will be able to apply the fundamental knowledge of different materials to determine various parameters through relevant experiments.
   (*LO 1.1, LO3.1, LO 4.1*)

2. Learners will be able to apply the basic concept of different materials to simulate their structures and diffraction pattern using relevant software. (*LO 2.1, LO5.1*)

3. Learners will be able to use fundamental knowledge of physics for the execution, presentation of the chosen project as a team and write effective report. (*LO 6.1*)

CO-PO Mapping Table with Correlation Level

CO ID	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BSCLC203.1	3	-	-	3	-	-	-	-	-	-	-
BSCLC203.2	3	-	-	3	-	-	-	-	-	-	-
BSCLC203.3	3	-	-	3	-	-	-	-	-	-	-
BSCLC203.4	3	-	-	3	-	-	-	3	3	-	-
Average	**3**	**-**	**-**	**3**	**-**	**-**	**-**	**3**	**3**	**-**	**-**

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. 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 linkwww.physics.rutgers.edu

IN-SEMESTER ASSESSMENT (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
BSL	BSL204	ENGINEERING CHEMISTRY -II LABORATORY	0.5

Examination Scheme					
Distribution of Marks			Exam Duration (Hrs.)		Total Marks
In-semester Assessment		End Semester Examination (ESE)			
Continuous Assessment	Mid-Semester Exam (MSE)		MSE	ESE	
25	-	25	25	-	25

Pre-requisite: Nil

Program Outcomes addressed:

1. PO1: Engineering Knowledge
2. PO2: Problem Analysis
3. PO6: The engineer and the world
4. PO8: Individual and collaborative 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	Details	Hrs.
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.	**Experiment 1** ***Learning Objective/s:*** ***To calculate percentage of iron in plain carbon steel and relate it with the classification of plain carbon steel.***	02
	To determine the percentage of iron present in a plain carbon steel	
	Self-Learning Topics: Nil	
	Learning Outcomes: *LO -1.1 A learner will be able to calculate the percentage of iron in plain carbon steel by redox titration method. (1.2.1), (1.3.1), (2.2.3).*	
	Experiment 2	

02.	*Learning Objective/s:* *To apply the knowledge of condensation polymerization for the synthesis of urea formaldehyde.* **Synthesis of Urea formaldehyde.** ***Self-Learning Topics: Nil*** ***Learning Outcomes:*** *LO-2.1 A learner will be able to synthesize thermosetting resin using condensation polymerization reaction and calculate its yield and state its societal benefits. (1.2.1), (1.3.1), (2.2.3), (6.1.1).*	**02**
03.	**Experiment 3** *Learning Objective/s:* *To compare the viscosity of pure solvent and the solution of polymer for calculating the molecular weight of polymer.* To Determine molecular weight of a polymer using Ostwald's viscometer. ***Self-Learning Topics: Nil*** ***Learning Outcomes:*** *LO-3.1 A learner will be able to c*alculate the specific viscosity of polymer with respect to pure solvent and its molecular weight using Ostwald's Viscometer (1.2.1), (1.3.1), (2.2.3).	**02**
04.	**Experiment 4** *Learning Objective/s:* *To construct the Daniel cell and calculate its E^0 using Nernst equation.* To determine the emf of galvanic cell-Daniel cell. ***Self-Learning Topics: Nil*** ***Learning Outcomes:*** *LO-4.1 A learner will be able to construct and calculate E^0 of Daniel cell using electrode reactions and compare with theoretical values to conclude whether Daniel cell is working or not. (1.2.1), (1.3.1), (2.2.3).*	**02**
05.	**Experiment 5** *Learning Objective/s:* *To determine the concentration of iron and verify Beer Lambert's law.* To determine iron from the given sample using UV-Visible spectrophotometer. ***Self-Learning Topics: Nil*** ***Learning Outcomes :***	**02**

	LO-5.1 A learner will be able to measure the absorbance of standard and unknown concentrations of given analyte using UV-Visible spectrophotometer and verify Beer Lambert's law (1.2.1), (1.3.1), (2.2.3).	
06.	***Demonstration*** *Learning Objective:* *To develop the basic knowledge of analytical chemistry using titrimetric experiment.*	**04**
	Demonstration of titrimetric experiment and conclusion.	
	Self-Learning Topics: Nil	
	Learning Outcomes: *LO-6.1 A learner will be able to analyze and calculate the proposed substances in an experiment using fundamental laws and basic concepts of engineering chemistry and demonstrate the results as a team (1.2.1), (1.2.2), (1.3.1), (2.1.3) (8.1.1), (8.3.1).*	
	Total	**15**

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 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 the public and public interest at global, regional and local level
8.1.1	Recognize a variety of working and learning preferences; appreciate the value of diversity on a team.
8.3.1	Present result as a team with smooth integration of contributions from all individual efforts.

Course Outcomes: A learner will be able to -

1. Apply the laws of electrochemistry and spectroscopy for performing the practicals. (*LO- 4.1, LO-5.1)*
2. Analyze the materials for engineering applications. (*LO-1.1, LO-3.1, LO-5.1)*
3. Synthesize the polymer and use it for societal benefits. (*LO-2.1)*
4. Demonstrate an ability to work effectively in a team for the project. (*LO-6.1)*

CO-PO Mapping Table with Correlation Level

CO ID	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BSL204.1	3	2	-	-	-	-	-	-	-	-	-
BSL204.2	3	2	-	-	-	-	-	-	-	-	-
BSL204.3	2	2	-	-	-	2	-	-	-	-	-
BSL204.4	3	2	-	-	-	-	-	3	-	-	-
Average	**3**	**2**	-	-	-	**2**	-	**3**	-	-	-

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

IN-SEMESTER ASSESSMENT (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
ESL	ESL204	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: Engineering tool usage
4. PO9: 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	Details	Hrs.
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.	**Introduction to Engineering Graphics** ***Learning Objective:*** *To identify different types of lines and dimensioning standards as per IS system.* **Contents:** 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.	**08**

	Learning Outcomes: *A learner will be able to* *LO 1.1: represent the fundamental drawing essentials such as line types, line weights, dimensioning systems, tolerance, etc. (P.I.-2.2.3)* *LO1.2: Identify standard procedures according to IS conventions. (P.I.-2.2.2)* *LO1.3: Demonstrate the use of basic AutoCAD commands. (P.I.-5.1.1)* *LO1.4: Draw simple drawings with the use of basic AutoCAD commands. (P.I.-5.2.2)*	
02.	**Projection of Points and Lines, Orthographic and Sectional Views** ***Learning Objective:*** *To develop the imagination in creating the orthogonal and sectional orthographic viewsfor communicating the features in the product.*	**20**
	Contents: 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 CADSoftware (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 intoorthogonal and sectional orthographic drawings.	
	Learning Outcomes: *A learner will be able to* *LO 2.1: 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.-1.3.1,9.3.1)* *LO 2.2: Develop the ability to create orthographic projections of objects in different views, including front, top, and side views. (P.I.-1.4.1,9.1.1)* *LO 2.3: Create sectional orthographic projections of objects including half and full sections. (P.I.-2.1.3, 9.1.1)* *LO 2.4: 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.-2.2.3,9.3.1)* *LO 2.5: Demonstrate the use of basic AutoCAD commands. (P.I.- 5.1.1)* *LO2.6: Apply the basics of AutoCAD to create the simple orthographic drawings. (P.I.- 5.2.2,9.3.1)*	
03.	**Isometric Drawing**	
	Learning Objective: *To develop the ability in visualization of the two-dimensional views of the object*	

	to produce the isometric drawing.	
	Contents: 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 isometricdrawings.	**12**
	Learning Outcomes: *A learner will be able to* *LO 3.1: Identify the nature of simple geometries when plotted on isometric plane. (P.I.- 1.3.1)* *LO3.2: apply the fundamental geometrical procedures from mathematics to draw the given isometric views. (P.I.-1.2.1)* *LO3.3: Develop their ability to visualize three-dimensional objects and represent them on a two-dimensional surface. (P.I.-2.1.3,9.3.1)* *LO3.4: Draw the isometric drawings from the two-dimensional views. (P.I.-2.2.3)* *LO3.5: create isometric drawings of objects in AutoCAD. (P.I.-5.1.1,9.1.1)* *LO 3.6: develop proficiency in the orientation and scale of the object while drawing the AutoCAD (P.I.-5.2.2,9.1.1)*	
04.	**Orthographic Reading** ***Learning Objectives:*** ***To develop the ability of the students to read the orthographic and sectional orthographicprojections to draw the missing views.***	**05**
	Contents: Orthographic Reading: The identification of missing views from the givenviews. 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 ofOrthographic projections.	
	Learning Outcomes: *A learner will be able to* *LO 4.1: Read and interpret technical drawings that use orthographic and sectionalorthographic projections. (P.I.-,2.2.3,9.1.1)* *LO 4.2: identify the missing view by visualizing the two views in combined manner. (P.I.-1.3.1)* *LO 4.3: redraw the simple orthographic view into sectional orthographic view (P.I.-1.2.1)* *LO 4.4: identify the position and orientation of the missing view. (P.I.-2.2.1)* *LO 4.5: Demonstrate the use of basic AutoCAD commands to produce the missing viewby reading the orthographic projections on a two-dimensional space. (P.I.- 5.1.1, 9.3.1)* *LO 4.6: use the theory of projection efficiently to create the missing view in AutoCAD (P.I.-5.2.2)*	

05.	**Projection of Planes and Solids, and Sectioning of Solids** ***Learning Objective/s:*** *To develop the ability to imagine the solid geometries and represent the views in a twodimensional space.*	
	Contents: 1.1 Projection of Planes: Projection of Triangular, Square, Rectangular, Pentagonal, Hexagonal or Circular planes inclined to either HP or VP only. 1.2 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. 1.3 Section of Solids: Section of Prism, Pyramid, Cylinder and Cone cut by plane perpendicular to at least one reference plane and incline to other in simple positions of the solid. (Section in initial position only)	**14**
	Learning Outcomes : *A learner will be able to* *LO 5.1: create orthographic projections of planes and different types of solids. (P.I.- 1.3.1)* *LO 5.2: create different views of solid geometries. (P.I.-1.2.1)* *LO 5.3: 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.-2.2.4,9.1.1)* *LO 5.4: create section views of solids using different cutting planes in different orientations and represent them in the form of two-dimensional drawings. (P.I.- 2.2.3,9.3.1)*	
	Total	**60**
MINIMUM 2 experiments should be conducted from each module.		

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 given problem.
2.2.2	Identify, assemble and evaluate information and resources.
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.
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.
9.1.1	Read, understand and interpret technical and non-technical information.
9.3.1	Create engineering-standard figures, reports and drawings to complement writing and presentations.

Course Outcomes: A learner will be able to -

1. Apply the basic concepts and standards in accordance with IS conventions and demonstrate basic commands using AUTOCAD. *(LO 1.1, LO 1.2, LO1.3, LO1.4, LO 2.1)*
2. Apply the basic principles of projections in converting pictorial views into orthographic Views and draw using AUTOCAD. *(LO 2.1, LO 2.2, LO 2.3, LO 2.4, LO 2.5, LO 2.6, LO 5.1, LO 5.2)*
3. Apply the basic principles of projections in converting orthographic Views into isometric drawing using conventional method and AUTOCAD. (*LO 2.2, LO 3.1, LO 3.2, LO 3.3, LO 3.4, LO 3.5, LO 3.6)*
4. Represent the internal features of the objects by providing the sectional views of the object. *(LO 2.3, LO 2.4, LO 5.1, LO 5.2, LO 5.3, LO 5.4)*
5. Apply the basic principles of projections to draw the missing views using AUTOCAD. *(LO 4.1, LO 4.2, LO 4.3, LO 4.4, LO 4.5, LO 4.6)*

CO-PO Mapping Table with Correlation Level

CO ID	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
ESL204.1	2	3	-	-	3	-	-	-	2	-	-
ESL204.2	3	3	-	-	3	-	-	-	2	-	-
ESL204.3	3	3	-	-	3	-	-	-	3	-	-
ESL204.4	3	3	-	-		-	-	-	3	-	-
ESL204.5	3	3	-	-	3	-	-	-	3	-	-
Average	**3**	**3**	**-**	**-**	**3**	**-**	**-**	**-**	**3**	**-**	**-**

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 Mechanical Engineering, IIT Delhi :-

   Web link- https://onlinecourses.nptel.ac.in/noc21_me128

A. 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.

B. END SEMESTER EXAMINATION (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
ESL	ESL205	PROGRAMMING LABORATORY-II (JAVA)	02

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

Pre-requisite:

1. ESL103: Programming Laboratory-I (C)

Program Outcomes addressed:

1. PO1: Engineering knowledge
2. PO2: Problem analysis
3. PO3: Design/development of solutions
4. PO5: Engineering tool usage
5. PO11: 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 reusability for faster development.
4. To introduce usage of Exception Handling, Multithreading, Input Output streams in various applications.
5. To impart the knowledge of designing, implementing, testing, and debugging graphical user interfaces in Java using Swings and AWT components that can react to different user events.

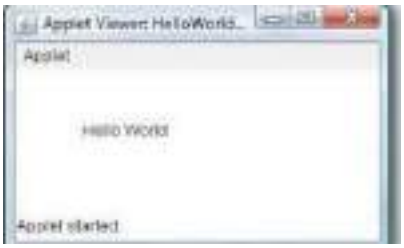
Module	Details	Hrs.
00.	**Course Introduction** Java is platform independent, open-source object-oriented programming language enriched with free and open source libraries. In current industrial scenario Java has the broad industry support and is prerequisite with many allied technologies like Advanced 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**
	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 multiple methods with different parameters.	
	Learning Outcomes: *A learner will be able to* *LO 1.1: Illustrate the concept of keywords, data types, variables, operators, and expressions (PI-1.1.1)* *LO 1.2: Apply the fundamental control structures to solve problem (PI-1.3.1)* *LO 1.3: Identify mathematical expression or formula to write and execute a program (PI-2.1.3)* *LO 1.4: 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)* *LO 1.5: Use modern JAVA IDE like eclipse, NetBeans (PI-5.1.1).* *LO 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:*** 1. *To investigate the functioning of various components of the given control systemas a team.* 2. *To grasp the fundamental concept of input output. Also expected to writeprogram using different input output constructs.*	**08**
	Contents: Classes, objects, data members, member functions, Constructors, methodoverloading. 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 basicoperations. **Task 4:** Practice encapsulation by defining private variables 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* *LO 2.1: Use print statement (PI-1.1.1)* *LO 2.2: Implement a program by taking input from user (PI-1.3.1)* *LO 2.3: Identify classes and objects for problem statement (PI-2.1.1)* *LO 2.4: Apply concept of constructors overloading to write java program (PI-2.3.1)* *LO 2.5: Explore the concept and write recursive function (PI-3.2.1)* *LO 2.6: Write static, non-static and recursive method in java program (PI-3.4.2)*	
03.	**Inheritance, Interfaces, Packages** ***Learning Objective:*** 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**
	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) inheritingfrom 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* *LO 3.1: Summarize the concept of polymorphism using inheritance, concept ofabstraction using interfaces, and packages in java (PI-2.4.1)* *LO 3.2: Show polymorphism by inheriting the features of one class to other class (PI-2.4.4)* *LO 3.3: Explore the single inheritance and multilevel inheritance (PI-3.2.1)* *LO 3.4: 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 Objectives:*** *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 toapply it for multitasking.*	**08**

	Contents: Exception handling using try, catch, finally, throw and throws, Multipletry and catch blocks, user defined exception. Thread lifecycle, thread class methods, creating threads using extends andimplements 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* *LO 4.1: Illustrate the concept the exception handling and threads in java (PI-1.1.1)* *LO 4.2: Apply the fundamentals of exception handling to handle error (PI-1.3.1)* *LO 4.3: Write a program to show exception handling in java (PI-2.1.3)* *LO 4.4: Create user-defined exception handling (PI-2.2.3)* *LO 4.5: Explore the multiple task handling with threads (PI-3.2.1).* *LO 4.6: 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 expectedto 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. Alsoexpected to apply it for retrieving and saving data.*	**16**
	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  	
	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* *LO 5.1: List all data and techniques to solve problem (PI-1.1.1)* *LO 5.2: Determine different layout manager to develop software (PI-1.4.1)* *LO 5.3: Examine layout managers for flexible window layouts while creating GUI (PI-3.1.6)* *LO 5.4: Write modules to handle events through components of GUI using applets and Abstract Window Toolkit (AWT) (PI-3.4.2)* *LO 5.5: Extend study on eclipse to solve problem (PI-5.1.1)* *LO 5.6: Adapt eclipse and HTML to create GUI using applet and AWT (PI-5.1.2)* *LO 5.7: Illustrate the path from CLI to GUI (PI-11.2.1)* *LO 5.8: Summarize the advantages of GUI of problem (PI-11.2.2)*	
	Course Conclusion	
		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.

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 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.
11.2.1	Identify historic points of technological advance in engineering that required practitioners toseek education in order to stay current
11.2.1	Recognize the need and be able to clearly explain why it is vitally important to keep currentregarding new developments in your field

Course Outcomes: A learner will be able to -

1. Install java environment and write a java program using fundamental concepts. *(LO 1.1, LO 1.2, LO 1.3, LO 1.4, LO 1.5, LO 1.6*)
2. Apply concepts of classes, objects, members of a class and the relationships among them needed for a finding the solution to specific problem*(LO 2.1, LO 2.2, LO 2.3, LO 2.4, LO 2.5, LO 2.6*)
3. Achieve reusability in programming by using concept of Inheritance, Interface and Packages. *(LO 3.1, LO 3.2, LO 3.3, LO 3.4*)
4. Implement concept of Multithreading, and exceptions to obtain robust and faster programmed solutions to problems. *(LO 4.1, LO 4.2, LO 4.3, LO 4.4, LO 4.5, LO 4.6*)
5. Design and develop application using Abstract Window Toolkit, Swings with database connectivity *(LO 5.1, LO 5.2, LO 5.3, LO 5.4, LO 5.5, LO 5.6, LO 5.7, LO 5.8*)

CO-PO Mapping Table with Correlation Level

CO ID	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
ESL205.1	3	3	-	-	3	-	-	-	-	-	-
ESL205.2	3	3	3	-	-	-	-	-	-	-	-
ESL205.3	-	3	3	-	-	-	-	-	-	-	-
ESL205.4	3	3	3	-	-	-	-	-	-	-	-
ESL205.5	3		3	-	3	-	-	-	-	-	3
Average	**3**	**3**	**3**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**3**

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

A. 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

B. 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
ESL	ESL206	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: Engineering tool usage
5 PO6: The engineer and the world
6 PO8: Individual and Collaborative Team work
7 PO9: Communication
8 P11: Life-long learning

Course Objectives:

1. To familiarize with electronics components, measuring devices, source devices for building and analysing 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	Details	Hrs.
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.	Name of the Module*:* Electronic Devices ***Learning Objective:*** *Analyze experimental results to validate theoretical concepts and understand practical implications. Evaluatecircuit parameters to achieve desired performancecharacteristics.*	**10**
	Contents: 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.	
	Self-Learning Topics: *Advanced Component Testing using LCR Meters*	
	Learning Outcomes: *A learner will be able to* *LO 1.1*: *Analyze an electronic device model by observing and plotting the response withvarious inputs and make a document in the form of report. (P.I.- 2.4.1, P.I.- 9.3.1).* *LO 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.- 8.3.1).*	
02.	**Name of the Module: Digital Circuits** ***Learning Objective:*** *Explore digital circuit fundamentals by understanding logic gates, Boolean expressions,universal gates, and their practical applications.*	**8**
	Contents: **Suggested List of Experiments: (Any Two)** 1. Introduction to Logic Gates – NOT, AND, OR, NAND NOR andXOR 2. For a given Boolean expression, design and verify the circuit usingUniversal 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* *LO 2.1*: *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.-8.3.1)* *LO 2.2: Devise an optimal design, verify a given Boolean expression and make a document in form of report. (P.I.- 3.3.3, P.I.- 9.3.1)*	
03.	Name of the Module*:* **Sensor/ Transducer Applications** Learning Objective: *To teach the fundamentals of sensor/transducer and model the basic data acquisitionsystem.*	**4**
	Suggested List of Experiments: (Any One) **Contents:** 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 thefield of data acquisition system.***	
	Learning Outcomes: *A learner will be able to* *LO 3.1*: *Identify and analyze various sensors/transducers required for a data acquisition system, use systematic techniques to test and verify same as a team.(P.I.- 2.4.1, P.I.-.8.3.1)* *LO 3.2*: *Design, a prototype of a simple Data Acquisition system, test and convey a document in report form. (P.I.- 3.3.3, P.I.- 9.3.1)*	
04.	**Name of the Module: Real Time Applications** ***Learning Objectives:*** ***Develop practical electronic skills through designing and implementing real-life applications.***	**6**
	Contents: 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 inchemical 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	
	Self-Learning Topics: *Smart sensors in the field of IoT.*	
	Learning Outcomes:	
	A learner will be able to *LO 4.1*: *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.- 9.3.1)* *LO 4.2*: *To design for real life scenarios and check for the sustainability and*	

	feasibility of the application (P.I.- 3.3.3, P.I.- 11.3.1). *LO 4.3: 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.- 8.3.1).* *LO 4.4: 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**
	Total	**30**

Performance Indicators:

P.I. No. P.I. Statement

2.4.1 Extract desired understanding and conclusions consistent with objectives and limitations ofthe 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.
8.3.1 Present results as a team, with smooth integration of contributions from all individual efforts
9.3.1 Create engineering-standard figures, reports and drawings to complement writing and presentations
11.3.1 Source and comprehend technical literature and other credible sources of information

Course Outcomes: A learner 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 (*LO 1.1, LO 1.2*)
2. Demonstrate and analyze the use of basic gates and apply it in various applications in digital domain. (*LO 2.1, LO 2.2*)
3. Analyse sensors/transducers and assemble a prototype for a basic data acquisition system. (*LO 3.1, LO 3.2*)
4. Design analyse, test, and ensure functionality of real-life electronic applications using acquired skills and electronic test instruments. (*LO 4.1, LO 4.2, LO 4.3, LO 4.4*)

CO-PO Mapping Table with Correlation Level

CO ID	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
ESL206.1	-	2	-	2	-	-	-	2	2	-	-
ESL206.2	-	2	2	-	-	-	-	2	2	-	-
ESL206.3	-	2	2	-	-	-	-	2	2	-	-
ESL206.4	-	2	2	-	2	2	-	2	2	-	2

Average	**-**	**2**	**2**	**2**	**2**	**2**	**-**	**2**	**2**	**-**	**2**

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).

A. IN-SEMESTER ASSESSMENT (50 MARKS)

1. Continuous Assessment - Theory-(25 Marks)

1. Lab Experiments: 10 Marks
2. Internal Assessment:
   i. Practical Test 1 (Based on 50% of the Practical list): 5
   ii. Practical Test 2 (Based on remaining 50% of the Practical list):5
3. Regularity and active participation: 5 marks

B. 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 Examination (ESE)**	**Total**
50	--	50

Pre-requisite:

1. SEC101: Basic Workshop Practice -I

Program Outcomes addressed :

1. PO1: Engineering knowledge
2. PO5: Engineering tool usage
3. PO6: The engineer and the world
4. PO8: Individual and collaborative team work
5. PO11: 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
00.	**Course Introduction** The Workshop Practice II course is intended to give students with the core information and abilities required for developing engineering skill sets and getting 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**
	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* *LO1.1: Accurately measure and layout components of carpentry projects using appropriate tools and techniques, ensuring precision and alignment. (P.I. - 1.3.1, 5.2.1, 11.3.1)* *LO1.2:Exhibit proficiency in the use of common carpentry hand tools and power tools, including accurate handling, operation, and maintenance. (P.I. - 1.4.1, 5.2.2, 11.3.2)*	
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**
	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* *LO2.1: Select appropriate electronic components based on design requirements and place them effectively on the PCB layout. (P.I. - 5.2.1, 5.2.2, 11.3.1)* *LO2.2: Demonstrate a clear understanding of what PCBs are, how they function, and their importance in electronic devices and systems. (P.I. - 8.2.1, 8.3.1)* *LO2.3: Comprehend the basic principles of PCB design, including component placement, routing, signal integrity, and manufacturability. (P.I. - 6.1.1, 6.4.2, 8.2.1, 8.3.1, 11.3.2)*	
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**
	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* *LO3.1: Use various sheet metal working tools and equipment proficiently. (P.I. - 5.2.2, 5.3.2, 11.1.1, 11.3.2)* *LO3.2: Demonstrate competence in operating forging equipment and tools, including heating furnaces, power hammers, presses, and hand tools, to manipulate metal effectively. (P.I. - 5.2.2, 8.1.1, 8.3.1, 11.1.1, 11.3.2)*	

Performance Indicators:

P.I. No.	P.I. Statement
1.3.1	Apply fundamental engineering concepts to solve engineering problems
1.4.1	Apply Mechanical engineering concepts to solve engineering problems.
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 of the public and public interest at the global, regional and local level.
6.4.2	Apply principles of preventive engineering and sustainable development to an engineering activity or product relevant to the discipline.
8.1.1	Recognize a variety of working and learning preferences; appreciate the value of diversity on a team.
8.2.1	Demonstrate effective communication, problem-solving, conflict resolution and leadership skills.
8.3.1	Present results as a team, with smooth integration of contributions from all individual efforts.
11.1.1	Describe the rationale for the requirement for continuing professional development.
11.3.1	Source and comprehend technical literature and other credible sources of information.
11.3.2	Analyse sourced technical and popular information for feasibility, viability, sustainability, etc.

Course Outcomes :

A learner will be able to

1. Develop the necessary skill required to handle/use different carpentry tools. (*LO 1.1, LO 1.2*)
2. Identify different electronic components to design, fabricate and assemble PCB. (*LO 2.1, LO 2.2, LO 2.3*)
3. Develop the necessary skill required to use different sheet metal and brazing tools. (*LO 3.1, LO 3.2*)
4. Demonstrate the forging operation with the help of a simple job. (*LO 3.1, LO 3.2*)

CO-PO Mapping Table with Correlation Level

CO ID	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
SEC202.1	3	-	-	-	3	-	-	-	-	-	3
SEC202.2	-	-	-	-	3	3	-	3	-	-	3
SEC202.3	-	-	-	-	3	-	-	3	-	-	3
SEC202.4	-	-	-	-	3	-	-	3	-	-	3
Average	**3**	**-**	**-**	**-**	**3**	**3**	**-**	**3**	**-**	**-**	**3**

Continuous Internal Assessment (CIA) - (50 Marks)

Job Work with complete workshop book: 40 Marks

Attendance 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 & The World
3. PO7: Ethics
4. PO11: Life-long learning

Course Objectives:

1. To introduce fundamentals of Ancient Indian Educations to understand the pattern and purpose of studying 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 Indian knowledge 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 human right, well-being and sustainable development.

Module	Details
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, and ethics, 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 their contributions to global knowledge and technological advancement.
4. Engage with interdisciplinary perspectives in Humanities and Social Sciences rooted in ancient Indian wisdom, fostering critical thinking and holistic development.
5. Apply insights from ancient Indian knowledge systems to contemporary challenges, promoting innovation and sustainable solutions.
6. Cultivate a deeper appreciation for Indian heritage while developing analytical skills and interdisciplinary insights for real-world application.

Text Books :

1. Exploring the Indian Knowledge System: Insights from Prof. B Mahadevan, Prof. B Mahadevan, IIM Bengaluru Press
2. Kapur K and Singh A. K (Eds) 2005). Indian Knowledge Systems, Vol. 1. Indian Institute of 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