Agnel Charities

Fr. C. Rodrigues Institute of Technology

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

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An Autonomous Institute Affiliated to the University of Mumbai

Curriculum Structure FY (common to all Programmes)

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

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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
PEL	Program Elective Lab
RPC	Research Project Coursework
RPR	Research Project
SBL	Skill Based Laboratory
SEC	Skill Enhancement Course
T	Tutorial
VEC	Value Education Course

B. Credit Structure

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	06	03	--	**42**	**53**	**44-56**
Laboratory Course (LBC)	--	--	02	03	01	03	02	--	**11**		
Program Elective (PEC)	--	--	--	--	06	03	06	03	**18**	**18**	**20**
Multidisciplinary Minor (MDM)	--	--	03	03	03	03	--	--	**12**	**12**	**14**
Multidisciplinary Laboratory Course (MDL)†	--	--	--	--	01	--	--	--	**01**	**01**	
Open Elective (OEC)	--	--	--	--	--	--	03	03	**06**	**06**	**08**
Skill Enhancement Course (SEC)	01	01	--	--	--	--	--	--	**02**	**10**	**08**
Skill Based Laboratory (SBL)	--	--	02	02	02	02	--	--	**08**		
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)	--	--	--	--	--	--	04	02	**06**		
Internship (INT)	--	--	--	--	--	--	--	10	**10**	**10**	**12**
Liberal Learning Course (LLC)	--	--	--	--	--	02	--	---	**02**	**02**	**04**
Total Credits	**21**	**22**	**24**	**24**	**24**	**22**	**20**	**18**	**174**	**175**	**160-176**

C Curriculum Structure and Examination Scheme

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
IKS101	Indian Knowledge System	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 1 to 8 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 8.

NOTE 2: Please note that during semesters 1 to 8 some of the non-technical courses such as Humanities Social Sciences and Management (HSSM), Open Electives (OE), Universal Human Values (VEC), Indian Knowledge System (IKS), and Liberal Learning Course (LLC) may be conducted either online synchronously or asynchronously. For more information, please consult the curriculum book of your respective 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
ESL103	Programming Laboratory-I (C)	50	--	50	--	--	100
SEC101	Basic Workshop Practice-I	50	--	--	--	--	50
IKS101	Indian Knowledge System	50	--	--	--	--	50
	Total	**360**	**120**	**270**	--	--	**750**

$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
VEC201	Universal Human Values	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
SEC202	Basic Workshop Practice-II	50	--	--	--	--	50
VEC201	Universal Human Values	50	--	--	--	--	50
	Total	**415**	**90**	**270**	--	--	**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.

D. First Year Syllabi

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

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

Tutorial

Pre-requisite :

1. Differentiation of function of a single variable.
2. Integration

Program Outcomes addressed :

1. PO1: Engineering knowledge
2. PO2: Problem analysis
3. PO8: Individual and Collaborative Teamwork
4. PO 11: Life-long learning

Course Objectives:

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

Module	Detailed Contents	Hrs
00.	**Course Introduction** Mathematics is the fundamental step which creates a solid foundation for all Applied fields of Engineering. Professional Engineering applications have Mathematics as an integral part of their evolution. For example: Formulation in Mathematics to various engineering field using case study, Introduction to function of several variables to apply in Marginal rate of technical substitution and Elasticity of substitution, Introduction to differential equations from Electrical circuit. Hence, Formulation Based Mathematics is a fundamental requisite to all fields of Engineering for analyzing their performances.	01

01.	**Differential Calculus of Several Variables-I** ***Learning Objectives:*** • *Analysis of the fundamentals of differentiations of functions of two or more independent variables* • *Application of this concept to determine differentiation of function of functions, composite functions and implicit functions.*	**6-8**
	Contents: Introduction to Partial differentiation through a discussion on how it is important for engineering students. As it helps analyze how systems change with respect to multiple variables, which is essential in fields like thermodynamics, fluid mechanics, and structural analysis. Introduction to Partial Differentiation, Geometrical meaning of 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*** ***Learning Outcomes:*** *A learner will be able to* *LO 1.1: Identify suitable procedures for finding partial derivatives of functions with several variables. (PI-2.2.3)* *LO 1.2: Apply the chain rule to differentiate a function of a function involving partial derivatives. (P I 1.1.1)* *LO 1.3: Apply the relevant concept to differentiate composite functions involving multiple variables and parameters using fundamentals laws of mathematics. (P I 1.2.1)* *LO 1.4: Compare direct and indirect methods of partial differentiation and select the most efficient one to solve a given problem. (PI 2.2.4, PI.11.1.3)* *LO 1.5: Analyze and state the need of how staying updated with current Partial Differentiation-based computational tools and methods contributes to lifelong learning and enhances problem-solving skills in professional engineering practice. (P I 11.2.1)*	
02.	**Differential Calculus of Several Variables-II** ***Learning Objective/s:*** • *Application of the concept of PD to solve problems by using Euler 's Theorem on Homogeneous functions with two independent variables.* • *Analysis of the learned concept of PD and apply it to find maxima and minima of functions of two variables.*	**6-8**
	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 2.1*: *Identify when Euler's Theorem and its deductions are applicable in a given partial differentiation problem and use them effectively to solve the problem. (P I 2.1.3)* *LO 2.2: Apply the method to find the maxima and minima of functions of two variables using the laws of partial derivatives (P I 1.2.1)* *LO 2.3: Identify the existing method of second derivative tests to determine whether a critical point is a maximum, minimum, or saddle point. (P I 2.2.3)* *LO 2.4: Apply the solution method of maxima & minima to solve a real-world optimization problem. in a collaborative work as a team. (P I 1.1.1, P I 8.2.1)* *LO 2.5: Formulate clear problem statements for optimization tasks involving functions of two variables and Present the final solution as a cohesive team, integrating individual findings into a unified explanation. (P I 2.1.1, P I 8.3.1)*	
03.	**Beta and Gamma Functions** *Learning Objective:* • ***Analysis and interpretation of the basic definition of Beta and Gamma Functions and their properties.*** • ***Application of the definition and properties of Beta and Gamma Functions to solve definite integrals.***	**5-7**
	Contents: 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: Identify the relevant process to e**valuate** Beta functions and Gamma functions for positive real numbers using standard formulas. (P I 2.2.3)* *LO 3.2: Apply the basic definition of beta and gamma function to solve the definite integral. (P.I.1.1.1)* *LO 3.3: Apply properties of Gamma and Beta functions to solve a definite integral problem by identifying the relevant concept. (P I 1.2.1)* *LO 3.4: Compare between duplication formula and relation between Beta and gamma functions to be used to solve a given definite integral problem and solve it. (P I 2.2.4)*	
04.	**Differential Equations of First Order and First Degree** ***Learning Objective/s:*** *Learner will be able to* 1. *Analysis and interpretation of the basic fundamentals of differential equations (D.E) of first order & first degree.* 2. *Determination of the solution of a first order D.E by applying the basic concepts of exact and linear DE.*	**6-8**

	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: *Applications of first-order, first-degree differential equations in real-world problems across engineering and applied sciences.*	
	Learning Outcomes: *A learner will be able to* *LO 4.1: Apply the differential techniques to identify and classify different differential equations including exact, linear and Bernoulli's equation. (PI:1.1.1, PI: 11.1.3)* *LO 4.2: Identify whether the given differential equation is exact and linear DE. (PI: 2.1.3).* *LO 4.3: Identify the process of reducing given DE into linear and / or exact DE and solve it. (PI: 2.2.3).* *LO 4.4: Apply the fundamental engineering concepts to model a first order DE and demonstrate solution process and results within a team or as an individual. (PI: 1.3.1, PI: 8.2.1)* *LO 4.5: Engage in a team-based project where members individually contribute to different aspects of solving and interpreting a first-order differential equation derived from a given engineering problem, culminating in a coordinated group presentation. (PI: 8.3.1)* *LO 4.6: Identify differential equations arising in engineering applications and recognize the need for continuous learning of evolving solution methods to keep pace with technological advancements. (PI: 11.2.1)*	
05.	**Linear Differential Equations with Constant Coefficients of Higher Order type f(D)y = X** ***Learning Objective:*** *Learner will be able to* • *Analysis and interpretation of the basic fundamentals of higher order differential equations (HODE).* • *Determination of the solution of a HODE by applying the basic concepts of complementary function and particular integral*	**6-8**
	Contents: Definition (Linear Differential Equations with constant coefficiets) Auxiliary equation, Rules for finding the Complementary Function Rules for finding the 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) Method of variation of parameters to find Particular integral	
	Self-Learning Topics: *Differential equations with Variable Coefficients (Cauchy's and Legendre's Linear Differential Equations)*	
	Learning Outcomes: *LO 5,1: Identify the correct type of non-homogeneous term (e.g., exponential, polynomial, trigonometric) and select the appropriate solution method. (PI :2.2.3)* *LO 5.2: Apply the method of variation of parameters to solve non-homogeneous second-order differential equations. (PI: 1.1.1)* *LO 5.3: Identify the appropriate method to determine the complementary function and particular integral for getting the general solution of HODE. (PI: 2.1.3)* *LO 5.4: Apply the appropriate method to determine the general solution of HODE. (PI: 1.2.1)*	

06.	**Numerical solution of ordinary differential equations of first order and first degree** ***Learning Objective/s:*** • Application of the concepts of numerical methods to solve the ordinary differential equation.	**5-7**
	Contents: Numerical solution of ordinary differential equation using (a) Taylor's series method (b) Euler 's method (c) Modified Euler method, (d) Runge-Kutta fourth order method	
	Self-Learning Topic: ***Learning Outcomes:*** *The learner will be able to* *LO 6.1: Identify numerical methods such as Taylor's series method, Euler's method, modified Euler's method and R K method of fourth order for solving ordinary differential equation. (PI: 2.1.3)* *LO 6.2: Apply appropriate method to solve the differential equation numerically. (PI: 1.1.1)* *LO 6.3: Apply ordinary differential equations to model real-life systems or problems and solve them using appropriate numerical methods. (PI: 1.3.1)* *LO 6.4: Compare analytical and numerical solutions for the same differential equation and evaluate* accuracy. (*PI:* 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 appropriate mathematical concepts, methods, and techniques to formulate and solve engineering-related problems systematically and accurately.
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.
8.2.1	Demonstrate effective communication, problem solving, conflict resolution and leadership skills.
8.3.1	Present result as a team, with smooth integration of contributions from all individual efforts.
11.1.3	Identify various mathematical concepts/theorems which can be utilized in the field of application based engineering
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. Implement the fundamentals of partial differentiation to evaluate the maxima and minima of functions of several variables to real life problems. *(LO 1.1, LO 1.2, LO 1.3, LO 1.4, LO 1.5, LO 2.1, LO 2.2, LO 2.3, LO 2.4, LO 2.5)*

2. Apply the fundamentals of first order Differential equation to analyse an Exact, Linear Differential Equation and solve it by applying the appropriate method for real life problems. (LO *3.1, LO 3.2, LO 3.3, LO 3.4, LO 3.5)*

3. Implement the fundamentals of Higher Order Differential Equation to analyse the procedure to find complementary function and particular integral of higher order differential equation in order to evaluate the general solution. (*LO 4.1, LO 4.2, LO 4.3, LO 4.4)*

4. Apply numerical methods to solve ordinary differential equations using conceptual and theoretical understanding. (*LO 5.1, LO 5.2, LO 5.3, LO 5.4)*

5. Apply the concepts of Beta and Gamma functions to evaluate definite integrals using conceptual and theory-based mathematical formulations. (*LO 6.1, LO6.2, LO6.3, LO6.4)*

CO-PO Mapping Table with Correlation Level

CO ID	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BSC101.1	3	3						3			3
BSC101.2	3	3						3			3
BSC101.3	3	3									
BSC101.4	3	3									
BSC101.5	3	3									
Average	3	3						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.
3. Advanced Engineering Mathematics, H.K.Das, S. Chand and Company Limited, Fourth Edition, 2018.

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 (50 MARKS)

1. Continuous Assessment (20 Marks)

a) MCQ Test + Class Test**:** 05+05 = 10 Marks

b) Team Pair Solo (TPS) activity**:** 05 Marks

c) Regularity and active participation**:** 05 Marks

2. Mid Semester Examination (30 Marks)

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

B. END SEMESTER EXAMINATION (50 MARKS)

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

C. CONTINUOUS ASSESSMENT OF TUTORIAL (25 Marks)

Suggested breakup of distribution

Students shall be evaluated based on attendance, active participation in tutorial sessions and activities, quality and completeness of work submitted, problem-solving skills demonstrated during practice and class tutorials, and performance in tutorial assessments/tests. The overall evaluation shall be carried out on a cumulative basis and awarded out of 25 marks.

a) 6 Activity-Based Sessions + Tutorial Tests: 2**:** 10+10 = 20 Marks
b) Regularity and active participation **:** 05 Marks

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

Program Outcomes addressed:

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

Sustainable Development Goals:

1. SDG 3: Good Health and Well-being
2. SDG7: Affordable and clean energy
3. SDG9: Industry, Innovation, and Infrastructure
4. SDG11: Sustainable cities and Communities
5. SDG12: Responsible Consumption and Production

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.
	Course Introduction	**01**
01.	**Interference in Thin Film** ***Learning Objective:*** *•To study the basic concept of interference and diffraction phenomena in various measurements* *•To recognize the principles of interference and diffraction to solve practical problems.*	**4-6**
	Contents: Interference: Interference by division of amplitude; Interference in thin film of constant thickness: Application in thin films. Wedge shaped film: Newton's rings - Diameters of dark Newton's rings; Applications in determination of refractive index of liquid.	

	Self-Learning Topics: *Origin of colours in thin film, Diameters of Bright Newton's rings, Determination of radius of curvature of the lens and wavelength of incident light using Newton's rings experiment.*	
	Learning Outcomes: *A learner will be able to* *LO 1.1: apply the concept of thin film interference to determine various parameters of real life problems. (P.I.- 1.2.1) SDG9* *LO 1.2: apply the concept of interference in developing thin films. (P.I.- 1.2.1) SDG3, SDG9* *LO 1.3: apply the concepts of thin film interference to solve problems. (P.I.- 1.3.1)* *LO 1.4: identify the parameters which affect the formation of Newton's Rings. (P.I.- 2.1.2)* *LO 1.5: identify the mathematical process and knowledge of interference to derive the conditions of maxima and minima for thin film interference and diameters of Newton's Rings. (P.I.- 2.1.3)*	
02.	**LASER** ***Learning Objective:*** • *To provide the knowledge of absorption and emission in production of laser.* • *To explore 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: construction and working; Nd:YAG laser: construction and working; Industrial and medical applications of LASER.	
	Self-Learning Topics: *Absorption, Spontaneous emission, Advantages, disadvantages of He-Ne and Nd:YAG laser.*	
	Learning Outcomes: *A learner will be able to* *LO 2.1: apply the knowledge of transitions of atoms within the material in the context of LASER production. (P.I.-1.2.1)* *LO2.2: apply the concepts of laser emission to solve problems. (P.I.- 1.3.1)* *LO2.3: identify various parameters which affect LASER emission. (P.I.-2.1.2)* *LO2.4: identify the working principle, components and medium to produce LASER of different wavelengths. (P.I-.2.2.3)* *LO 2.5: identify the role of LASER in industrial and medical fields.* *(P.I.-6.1.1) SDG3, SDG9* *LO 2.6: identify the risk and impact associated with the usage of LASER.* *(P.I.-6.1.2)*	
03.	***Fiber Optics*** ***Learning Objective:*** *•To build the knowledge of optical phenomena in optical fibre and analyze the role of optical fibre in fibre optics communication* *•To study the principle of fibre optics to solve engineering problem.*	**4-6**

	Contents: Optical Fibre; Numerical aperture; Angle of acceptance; V-number; Types of optical fibres; Numerical aperture for step index fibre; Fibre optic communication system. Light Sources for fibre optic system.	
	Self-Learning Topics: *Critical angle, Fractional index change, Modes of propagation.*	
	Learning Outcomes: *A learner will be able to* *LO 3.1: apply the knowledge of optical phenomena in propagation of light through optical fibre. (P.I.-1.2.1)* *LO 3.2: identify various parameters required for the fabrication of optical fibre. (P.I.- 2.1.2) SDG 9* *LO 3.3: apply the concepts of fibre optics to solve problems (P.I.- 1.3.1)* *LO3.4: identify various parameters to differentiate types of optical fibre. (P.I.- 2.1.2)* *LO 3.5: identify the mathematical process and knowledge of optical phenomena to determine numerical aperture and acceptance angle of an optical fibre (P.I.-2.1.3)* *LO 3.6: identify the importance and impact of fibre optic communication system to meet public need. (P.I.- 6.1.1, P.I.-6.1.2) SDG11*	
04.	***Semiconductor Physics and Fabrication Techniques***	**5-7**
	Learning Objectives: *•To provide the fundamental knowledge of band gap and fermi level in semiconductors for solving problems.* *•To study the fabrication techniques of semiconductor chip.*	
	Contents: Energy bands in semiconductor; Direct & indirect band gap semiconductor; Fermi level; Fermi Dirac distribution, Fermi level in intrinsic semiconductors, Determination of energy band gap in semiconductor. Fermi level in extrinsic semiconductors: Effect of temperature and impurity concentration on fermi level in extrinsic semiconductors, Significance of Fermi level. Semiconductor chip: Fabrication, Very Large Scale Integration (VLSI)	
	Self-Learning Topics: *Effect of temperature on fermi level in P-type semiconductor, Effect of impurity concentration on fermi level in N-type semiconductors.*	
	Learning Outcomes: *A learner will be able to* *LO 4.1: apply the knowledge of energy bands and Fermi levels to interpret semiconductors. (P.I.-1.2.1)* *LO 4.2: apply the knowledge of fermi level to solve the problems (P.I.-1.3.1)* *LO 4.3: identify various parameters to compare direct and indirect semiconductors to use them in light emitting devices. (P.I.-2.1.2) SDG9*	

	LO 4.4: analyze the effect of temperature and impurities on fermi level in extrinsic semiconductor. (P.I.-2.2.3) *LO4.5: apply semiconductor fabrication techniques to develop a basic semiconductor chip. (P.I.-2.1.2) SDG9*	
05.	**Semiconductor Devices** ***Learning Objective/s:*** *•To gain the fundamental knowledge of semiconductor in various semiconductor devices.* *•To recognize the impact of semiconductor devices in different societal issues.*	**3-5**
	Contents: Semiconductor Devices: Hall sensor: Principle, construction, working and application; Solar cell: Principle, construction, working and appllication; Application and its importance in society. Recent development in devices	
	Self-Learning Topics: *Light Emitting Diode (LED), Photodiode.*	
	Learning Outcomes : *A learner will be able to* *LO5.1: apply physics of semiconductors in semiconductor devices. (P.I.-1.2.1)* *LO 5.2: identify physical phenomena in semiconductors, components and process for making various semiconductor devices (P.I.-2.1.2) SDG 12* *LO5.3: identify the applications and recent development of semiconductor devices to meet the public need. (P.I.- 6.1.1) SDG 7, SDG 12*	
06.	**Superconductors** ***Learning Objective/s:*** *•To summarize the properties and applications of superconductors.* *•To familiarize the concept of superconductors to evaluate problems.*	**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: apply the knowledge of various parameters required to study superconductor. (P.I.-1.2.1)* *LO 6.2: apply the concepts of superconductor to solve problems (P.I.-1.3.1)*	

	LO 6.3: identify various parameters to differentiate the type of superconductors (P.I.-2.1.2) *LO 6.4: identify the application of superconductors in MAGLEV train for public transportation. (P.I.- 6.1.1) SDG11, SDG12* *LO 6.5: identify the impact of temperature in superconductor. (P.I.-6.1.2)*	
	Course Conclusion	**01**
	Total	**30**

Performance Indicators:

P.I. No.	**P.I. Statement**
1.2.1	Apply laws of physics to an engineering problem.
1.3.1	Apply fundamental engineering concepts to solve engineering problems.
2.1.2	Identify engineering systems, variables, and parameters to solve the problems.
2.1.3	Identify the mathematical, engineering and other relevant knowledge that applies to a given problem
2.2.3	Identify existing processes/solution methods for solving the problem, including forming justified approximations and assumptions.
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 risks/impact in the life-cycle of an engineering product or activity.

Course Outcomes:

1. A learner will be able to apply the fundamental knowledge of optical phenomena in real world problems that support healthcare and industrial technologies (SDG 3 & 9, *LO 1.1, LO 1.2, LO 1.3, LO 1.4, LO 1.5*)

2. A learner will be able to use Laser for the industrial and medical application by analysing its production. (SDG 3 & 9, *LO 2.1, LO2.2, LO 2.3, LO 2.4)*

3. A learner will be able to apply the knowledge of fiber optics for societal issues by developing solutions that support sustainable infrastructure in cities and communities. (SDG 9 & 11, *LO 3.1, LO 3.2, LO 3.3, LO 3.4, LO 3.5, LO 3.6*)

4. A learner will be able to apply the fundamental knowledge of semiconductor physics in the production of semiconductor components and devices. (SDG 9, *LO 4.1, LO 4.2, LO 4.3, LO 4.4, LO 4.5*)

5. A learner will be able to identify the role and impact of the semiconductor devices and superconductors by knowing their production technique and applications as sustainable energy. (SDG 7, 11 & 12, *LO 5.1, LO5.2, LO 5.3, LO 6.1, LO 6.2, LO 6.3, LO 6.4, LO 6.5*)

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				3					
BSC102.3	3	3				3					
BSC102.4	3	3									
BSC102.5	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. Optics, Ajoy Ghatak, Seventh Edition, 2020, Tata McGraw Hill
3. Introduction to solid state physics, Charles Kittel, Eighth Edition, 2005, Wiley
4. A textbook of Optics - N. Subramanyam, Brijlal and Avadhanulu, 23rd Edition, 2006, S.Chand Publishing.

Other Resources :

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

A. IN-SEMESTER ASSESSMENT (35 MARKS)

1. Continuous Assessment - Theory-(15 Marks)

a) MCQ test: 4 marks

b) Class test: 4 marks

c) Open book test/Open notes test: 4 marks

d) 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: Nil

Program Outcomes addressed:

1. PO1: Engineering knowledge
2. PO2: Problem analysis
3. PO6 :The engineer and the world
4. PO11:Life Long Learning

Sustainable Development Goals (SDG)

1. SDG 6: Clean water and sanitation
2. SDG 7: Affordable and clean energy
3. SDG 12: Responsible consumption and production
4. SDG 13: Climate action

Course Objectives:

1. To enable the students to apply the laws of chemistry to an engineering problem.
2. To provide the knowledge of various material properties and their engineering applications.
3. To facilitate the students for analysing and selecting the most appropriate engineering materials.
4. To study 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 apply the principles of green chemistry in the synthesis of various industrially important chemical substances and drugs in order to exhibit the social and*	**4-6**

	environmental impact of chemical industry practices for the sustainable design and development.	
	Contents: Introduction, 12 principles of green chemistry with examples as Conventional and green synthesis of carbaryl, adipic acid and Indigo. Numericals on atom economy. Carbon Sequestering and Carbon Credit. Green solvents: - water, supercritical solvents and DMC.	
	Self-Learning Topics: *12 principles of green chemistry, latest research areas in the field of green chemistry.*	
	Learning Outcomes: *A learner will be able to* *LO 1.1: Identify the hazards involved in traditional synthesis of carbaryl, adipic acid, and indigo for improving their benign nature. (2.2.3)* ***(SDG-12)*** *LO 1.2:Apply the principles of green chemistry for developing the safe green reactions in chemical industries. (1.3.1)* ***(SDG-12 and 13)*** *LO 1.3: Identify and analyze the case of chemical disaster in industry. (2.1.3) (11.3.2****(SDG-12))*** *LO 1.4: Identify the appropriate green solvents for chemical processes to assess the public health and safety. (6.1.1)* ***(SDG-12)*** *LO 1.5: Analyze the concepts of Carbon Sequestering and Carbon Credit for their impact on environmental sustainability. (6.1.2)* ***(SDG-13)*** *LO 1.6: Apply the concept of atom economy to solve the numerical problems. (1.2.2)* ***(SDG-12)***	
02.	**Water quality management**	**4-6**
	Learning Objective: *To classify water hardness into various types, state their causes and effects on industrial processes and use the modern methods of water treatment to improve the quality of water.* *To state the impact of water pollution in order to practice the sustainable water quality management.*	
	Self-Learning Topics: *Basic stoichiometry, mole concept, expression of concentration via normality, molarity, writing molecular formulae and calculation of molecular weights of common salts of heavy metal ions, Effect of hard water in industries.*	
	Contents: Quality of industrial water - Hardness and its types 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. Treatment of drinking water – disinfection by chlorination and ozone treatment.	
	Learning Outcomes: *A learner will be able to* *LO 2.1: Identify the various water samples to analyse different types of hardness. (2.1.3)* ***(SDG-6)*** *LO 2.2: Apply the knowledge of fundamental chemistry to solve the numerical*	

	problems based on hardness, ion exchange method and water quality indices. (1.2.2) ***(SDG-6)*** *LO 2.3: Identify various industrial and municipal water treatments for assessing the public health (6.1.1)* ***(SDG-6)*** *LO 2.4: Analyze the different water quality indices for controlling the pollution of water. (6.1.2)* ***(SDG-6)*** *LO 2.5: Apply the knowledge of membrane filtration technology to improve the quality of drinking water. (1.3.1)* ***(SDG-6)***	
03.	**Science of Corrosion**	**4-6**
	Learning Objective: *To state the mechanisms of different types of corrosion and suggest the corrosion control methods for the same in Industry.*	
	Contents: Introduction to corrosion, mechanism of dry corrosion – Oxidation corrosion, Pilling Bosworth rule. 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). **Real world case studies: -** deterioration of high-temperature super alloys in gas turbine blades, corrosion of ordinary iron piece in acid, rusting of iron, corrosion of metals used in statue of liberty, corrosion of steel pipes under water droplets, weld decay of stainless steel, caustic embrittlement, protection of underground steel pipelines, corrosion of submerged transmission tower in seawater. Alclad, tinned food cans, corrosion protection study of Bandra-Worli sea link and iron pillar of Delhi. **Teaching methodology: -** to correlate the concepts of corrosion with the real-world case study.	
	Self-Learning Topics: *Research extensively and prepare a report on the real-world corrosion problems and protection methods to present in the class.*	
	Learning Outcomes: *A learner will be able to* *LO 3.1: Identify the different types of corrosion, their mechanisms and control methods for analyzing real world case studies. (2.1.3) (11.3.1(11.3.2)* *LO 3.2: Apply the mechanism of oxidation corrosion to the real-world problem. (1.3.1)* ***(SDG-12)*** *LO 3.3: Apply the Pilling bed worth rule to assess the nature of oxide layers (1.2.1)* *LO 3.4: Identify the role of various metallic coatings in protection of public health and safety. (6.1.1)* ***(SDG- 12)***	
04.	**Introduction to Thermodynamics**	**4-6**
	Learning Objectives: *To state the fundamentals of thermodynamics and apply them in engineering.*	
	Contents: Thermodynamic processes, Path functions: -heat and work, Mechanical work. First law of thermodynamics – internal energy and enthalpy. Applications of thermodynamics in engineering, numericals based on first law, enthalpy and thermochemistry.	

	Self-Learning Topics: Concepts of system, types of systems, surroundings, Extensive and intensive properties.	
	Learning Outcomes: *A learner will be able to* *LO 4.1: Apply the knowledge of thermodynamic terms and processes to solve the real-life problems. (1.3.1)* *LO 4.2: Apply the first law of thermodynamics to* different types of systems. *(1.2.1)* *LO 4.3: Apply the formulae based on work, heat, internal energy, enthalpy and thermochemistry for solving the numerical problems. (1.2.2)* *LO 4.4: Identify the concepts of thermodynamics for analyzing engineering devices. (2.1.3)*	
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, Pattinson's process and numericals.	
	Self-Learning Topics: *Basic thermodynamics-concept of chemical system, equilibrium, Gibb's free energy, variable factors affecting the equilibrium of chemical systems.*	
	Learning Outcomes: *A learner will be able to* *LO 5.1: Apply Gibb's phase rule and reduced phase rule to the given system. (1.2.1)* *LO 5.2: Apply the phase rules to one and two component systems to determine the degrees of freedom at different phases of phase diagrams. (1.3.1)* *LO 5.3: Apply the phase rule equations and concept of eutectic for solving the numerical problems. (1.2.2)* *LO 5.4: Identify the concept of eutectic system for improving the operation of safety devices. (2.2.3)*	
06.	**Renewable and clean 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.	
	Self-Learning Topics: *Knowledge of conventional fuels and their types, problems associated with their use and need for renewable energy sources. Mission 2030.*	
	Learning Outcomes: *A learner will be able to*	

	LO 6.1: Apply the transesterification reaction for the production of biodiesel (1.3.1) ***(SDG-7 and 13)*** *LO 6.2: Analyze environmental aspects of biodiesel and electrolysis of water as green fuels for their impact on sustainability. (6.1.2)* ***(SDG-7 and 13)*** *LO 6.3: Identify the various chemical methods of hydrogen production to analyze its quality. (2.1.3)* ***(SDG- 7 and 13)*** *LO 6.4:-Identify and analyze challenges in hydrogen production, storage, and transport and assess public safety based on a review of scientific literature. (6.1.1)(11.3.1)(11.3.2)* ***(SDG-12).***	
	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.(New PI)
1.3.1	Apply fundamental engineering chemistry concepts to solve engineering problems.
2.1.3	Identify the engineering chemistry concepts to analyse the given problem
2.2.3	Identify the existing processes/ solution methods for solving the problems.(Modified PI)
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 materials or activities for their impact on sustainability. (Modified)
11.3.1	Source and comprehend technical literature and other credible sources of Information.
11.3.2	Analyze sourced technical and popular information for feasibility, viability, sustainability, etc.

Course Outcomes: A learner will be able to -

1. Apply laws of electrochemistry and concepts of corrosión for solving real world problems. *(LO-3.1, LO-3.2, LO-3.3, LO-3.4)*
2. Apply laws of thermodynamics and concepts of thermochemistry for analysing engineering problems..(LO- 4.1, LO- 4.2, LO-42.3, LO- 4.4)
3. Apply Gibbs' Phase Rule to interpret phase transformations depicted in phase diagrams and analyse their relevance in engineering materials, devices, and industrial processes. *(LO-5.1, LO- 5.2, LO-5.3,LO-5.4)*
4. Interpret the impact of modern chemical treatments and sanitation practices for responsible consumption and production of water. *(LO- 2.1, LO- 2.2, LO- 2.3, LO- 2.4, LO- 2.5)*
5. Apply green chemistry principles and renewable energy solutions to design sustainable processes that reduce carbon emissions and support climate action.(LO-1.1, LO- 1.2, LO-1.3 LO-1.4, LO-1.5, LO-1.6, 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
BSC103.1	3	2	-	-	-	2	-	-	-	-	3
BSC103.2	3	2	-	-	-	-	-	-	-	-	-
BSC103.3	3	2	-	-	-	-	-	-	-	-	-
BSC103.4	3	2	-	-	-	3	-	-	-	-	-
BSC103.5	3	3	-	-	-	3	-	-	-	-	3
Average	**3**	**2**	-	-	-	**3**	-	-	-	-	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

Oher 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 Assignments (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.

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

Program Outcomes addressed:

1. PO1: Engineering knowledge
2. PO2: Problem analysis
3. PO8: Individual and Collaborative Team work
4. PO9: Communication

Sustainable Development Goals:

1. SDG 4 Quality Education

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 recognize the parameters required to quantify the Kinematics of Particle and Rigid body.
4. To introduce the parameters required to quantify the Kinetics of rigid body.
5. To acquaint with basic principles of centroid and its application

Module	Details	Hrs.
	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.*	**06-09**
	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: Application of Varignon's Theorem	
	Learning Outcomes: *A learner will be able to* *LO 1.1: 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: Identify unknown forces in engineering systems due to application of load. (PI-2.1.2)* *LO 1.4: Identify the relevant mathematical, physical, and engineering principles required to determine the magnitude, direction, and line of action of the resultant force acting on a structural member. (P.I.-2.1.3).*	
02.	**Equilibrium of Rigid Bodies in Statics. Equilibrium of Coplanar Force System:**	**06-08**
	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: *Beam Reaction under Combined Loads*	
	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: Identify the key system variables and parameters such as coefficient of friction, normal reaction, and angle of repose required to analyze equilibrium of a rigid body under frictional forces. (P.I.-2.1.2)* *LO 2.4: Formulate mathematical models by applying scientific principles and engineering concepts to represent force and friction interactions in beams, inclined planes, and ladder problems. (P.I.-2.3.1)* *LO 2.5: Analyze real life engineering problems by using basic concepts such as equilibrium, force analysis and free body diagrams.(P.I.-8.1.2, 8.2.1, 9.1.2, 9.2.1) (SDG-4)*	

03.	**Kinematics of Particle**	**07-09**
	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 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 examine 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: Identify the mathematical relationships, physical laws, and key parameters (e.g., initial velocity, angle of projection, acceleration due to gravity) required to model and predict the motion of a particle in real-life scenarios. (P.I.-2.1.3).* *LO 3.5: Analyze a real-life projectile motion scenario, for a given application in terms of launch angle, initial velocity, launch height, distance to the target and type of launching mechanism. (P.I.-8.1.2, 8.2.1, 9.1.2, 9.2.1) (SDG-4)*	
04.	**Kinematics of Rigid Body**	**06-08**
	Learning Objectives: *To understand the parameters required to quantify the Kinematics of Particle and Rigid body.*	
	Contents: Rigid Body Motions: Translation, Rotation and General Plane motion. Kinematics of Rotation and related numerical. The concept of Instantaneous center of rotation (ICR) for the velocity. Location of ICR for 2 link mechanism. Velocity analysis of rigid body using ICR.	
	Self-Learning Topics: *Sine and Cosine Rule*	
	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: Identify the mathematical models, kinematic equations, and key parameters (e.g., velocities, accelerations, link geometry) required to formulate an analytical*	

	solution for general plane motion of a rigid body. (P.I.- 2.1.3).	
05.	**Kinetics of Particle: D'Alembert's** ***Learning Objective:*** *To understand the concept of kinetics of particle and the different methods to solve the engineering problems.*	**04-06**
	Contents:	
	Introduction to basic concepts of D'Alembert's 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 and 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: *Dynamic Equilibrium*	
	Learning Outcomes: *A learner will be able to*	
	LO 5.1: Apply D'Alembert's Principle to investigate 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: Identify the key mathematical relationships and physical principles such as the work–energy equation and the impulse–momentum theorem required to model and analyze dynamic particle systems. (P.I.-2.1.3).* *LO 5.4: Breakdown a multi-body collision scenario in a force system into sub-problems to facilitate structured problem-solving. (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.*	**04-06**
	Contents: First Moment of Area. Centroid of Composite Plane Lamina.	
	Self-Learning Topics: *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).	
	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.
2.3.1	Combine scientific principles and engineering concepts to formulate model(s) (mathematical or otherwise) of a system or process that is appropriate in terms of applicability and required accuracy.
8.1.2	Implement the norms of practice (e.g., rules, roles, charters, agendas, etc.) of effective teamwork to accomplish a goal.
8.2.1	Collaborate effectively as part of a team in laboratory or real-world engineering tasks.
9.1.2	Communicate effectively in writing using diagrams, logical structure, and engineering terminology.
9.2.1	Prepare and present engineering information effectively in written form such as technical reports, design documents, and project proposals using clear, concise language, correct grammar, appropriate structure, and professional formatting.

Course Outcomes:

A learner will be able to -

1. **Apply** principles of equilibrium and friction to determine support reactions and resultant forces in various mechanical systems, and **analyse** coplanar force systems while effectively collaborating in teams and presenting solutions in a structured technical format. *(LO 1.1, LO 1.2, LO 1.3, LO 1.4, LO 1.5, LO 2.1, LO 2.2, LO 2.3, LO 2.4)*
2. **Apply** mathematical and mechanical engineering principles to **analyse** and interpret linear and projectile motion of objects in real-life situations. *(LO 3.1, LO 3.2, LO 3.3, LO 3.4)*
3. **Apply** engineering and mathematical concepts to **analyse** the general plane motion of rigid

bodies and mechanisms both graphically and analytically. *(LO 4.1, LO 4.2, LO 4.3, LO 4.4)*

4. **Apply** principles of dynamics, work-energy, and impulse-momentum to **analyse** force systems in motion, including collisions and dynamic equilibrium. *(LO 5.1, LO 5.2, LO 5.3, LO 5.4)*
5. **Apply** principles of engineering mechanics to **determine** the centroid of composite bodies and communicate the results effectively in collaborative settings. *(LO 6.1, LO 6.2)*
6. **Analyse** real life engineering problem by using basic concepts which leads to quality learning eco system. *(LO 2.5, LO 3.5) (SDG-4)*

CO-PO Mapping Table with Correlation Level

CO ID	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
ESC101.1	3	3	-	-	-	-	-	3	3	-	-
ESC101.2	3	3	-	-	-	-	-	-	-	-	-
ESC101.3	3	3	-	-	-	-	-	-	-	-	-
ESC101.4	3	3	-	-	-	-	-	-	-	-	-
ESC101.5	3	-	-	-	-	-	-	3	3	-	-
ESC101.6	3	3	-	-	-	-	-	3	3	-	-
Average	**3**	**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 McGraw-Hill
2. Engineering Mechanics (Statics) by Meriam and Kraige, Fourth Edition, 1999 Wiley Books

Other Resources :

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

IN-SEMESTER ASSESSMENT (50 MARKS)

1. Continuous Assessment - Theory-(20 Marks)

1. Numerical Assignments (minimum 20 problems): 5 Marks
2. Class Test based on similar problem: 5 Marks
3. Collaborative Project: 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.

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

Program Outcomes addressed:

1. PO1: Engineering knowledge
2. PO2: Problem analysis
3. PO6: The engineer and the world
4. PO11: Life long learning

Sustainable Development Goals (SDG):

1. SDG12: Responsible Consumption & Production

Course Objectives:

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

Module	Detailed Content	Hrs
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: Structure of electrical power system, Role of each component of electrical power system, Step-up and Step down of AC voltage,	

	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 Apply fundamental engineering concepts to compare different sources of electrical energy. (P.I.-1.2.1, 11.3.1)*	

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: Simple sums on Ohm's Law and 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, Sums.	
	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 Apply concepts of star delta transformation to simplify DC circuits. (P.I.-1.3.1)* *LO2.3 Identify network theorems to analyze DC circuits. (P.I.- 2.1.3)* *LO2.4 Identify the impact of ideal and practical electrical sources on the analysis of DC circuits. (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, power factor. Series Resonance.	
	Self-Learning Topics: *Parallel AC circuits.* ***Learning Outcomes:*** *A learner will be able to* *LO3.1 Produce phasor expressions for sinusoidal quantities in AC circuits and validate AC circuit analysis by applying concepts of phasor algebra. (PI – 2.4.2)* *LO3.2 Identify the behavior of single-phase AC series circuits with R, L, C, RL,*	

	RC, and RLC combinations and impedance concepts. (P.I.-2.1.2) *LO3.3 Identify and distinguish between real, reactive, and apparent power in single-phase AC series circuits. (P.I.-2.4.1)* *LO3.4 Identify condition of resonance and calculate resonant in series AC circuits. (P.I.-2.1.3)*	
04.	**Introduction to Electrical Machines** ***Learning Objective/s:*** *To identify motors for given application using concepts of construction, working and characteristics of different machines.*	
	Contents: Basics of 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 from motor and load characteristics, comparison of BLDC fans and conventional fans based on performance, energy efficiency and economic considerations.	
	Self-Learning Topics: *Working principle of electric motor.* ***Learning Outcomes:*** *A learner will be able to* *LO4.1 Apply fundamental engineering concepts to differentiate various machines based on their construction, working principles and energy efficiency. (PI-1.3.1)* *LO4.2 Apply Electrical engineering concepts to understand the characteristics and applications of various machines. (PI-1.4.1)* *LO4.3 Identify suitable electrical motors for given applications based on load characteristics and motor type. (PI-2.2.4)* *LO4.4 Compare electrical motors based on their ratings and performance characteristics for specific applications. (P.I.-2.2.3)* *LO4.5 Compare BLDC and conventional fans in terms of performance, energy efficiency, and economic aspects and evaluate their suitability for responsible consumption. (P.I.-2.2.4)(SDG12)*	
05.	**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.*	
	Contents: Components of residential electrical system, Residential wiring System, load calculation, Electrical safety Devices, Fuse, MCB, ELCB, grounding issues, Safety precautions, Luminous flux, Luminous intensity, Lumination, Types of lamps in residential lighting and its comparison.	
	Learning Outcomes: *A learner will be able to* *LO5.1 Apply knowledge of basic system requirements to identify and understand components of a residential electrical system. (P.I.-1.3.1)* *LO5.2 Identify and explain the concepts of luminous flux, luminous intensity, and illumination, and differentiate between various types of lamps used in residential lighting. (P.I.-2.2.4)(SDG12)*	

	LO5.3 Identify variables and parameters required to select energy efficient lamps. (P.I-2.1.2) (SDG12) *LO5.4 Identify appropriate safety devices for protecting residential electrical systems based on the type and rating of the connected load. (P.I.- 1.4.1)*	
06.	**Residential Energy Measurements** ***Learning Objective/s:*** *To acquire knowledge on residential energy metering, energy tariff and understanding the residential electricity bill.* **Contents:** Measurement of Energy, Understanding of electricity bill, Energy tariff electricity bill calculation. Energy consumption with and without energy efficient fans, lamps. Energy Conservation practices at home. Basic comparison of consumption/ tariff with and without residential solar PV installation. ***Self-Learning Topics:*** *Energy consumption at own residence and conservation practices* ***Learning Outcomes:*** *A learner will be able to* *LO6.1 Apply principles of electrical engineering and tariff slabs to calculate energy consumed over a specified time. (P.I.-6.2.1, 11.3.1)* *LO6.2 Apply concepts of electrical engineering and natural science to compare energy consumption and tariff costs for systems with and without energy-efficient appliances and solar installations. (P.I.-1.3.1)* *LO6.3 Apply electrical engineering principles and tariff slabs to estimate energy consumption, promoting self-learning for efficient and responsible energy usage. (P.I.- 6.3.4)* *LO6.4 Analyze home energy conservation practices and compare electricity consumption and tariff with and without residential solar PV installation to promote sustainable energy usage. (P.I. 11.3.2)(SDG12)*	**4-6**

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 Electrical engineering concepts to solve engineering problems.
2.1.2	Identify engineering systems, variables, and parameters to solve the problems.
2.1.3	Identify the mathematical, engineering and other relevant knowledge that applies to a given problem.
2.2.3	Identify existing processes/solution methods for solving the problem, including forming justified approximations and assumptions
2.2.4	Compare and contrast alternative solution processes to select the best process.
2.4.1	Apply engineering mathematics and computations to solve mathematical models.
6.2.1	Interpret legislation, regulations, codes, and standards relevant to your discipline and explain its contribution to the protection of the public
6.3.4	Apply principles of preventive engineering and sustainable development to an engineering activity or product relevant to the discipline

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

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

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, LO5.1, LO6.1, LO6.3)*
2. Apply concepts of natural science and electrical engineering to solve problems on DC circuits and AC circuits. *(LO2.1, LO2.2, LO2.3, LO2.4, LO3.1, LO3.2, LO3.3, LO3.4)*
3. Identify electrical motors based on requirement of application and characteristics of motor. *(LO4.1, LO4.2, LO4.3, LO4.4)*
4. Interpret and identify safety devices for professional engineering practice and energy efficiency. (*LO5.4, LO6.2*)
5. Apply fundamental lighting engineering concepts and evaluate residential energy consumption systems to design energy-efficient solutions and promote responsible resource usage. *(LO4.5, LO5.2, LO5.3, LO6.4)*

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

IN-SEMESTER ASSESSMENT (35 Marks)

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

   Numerical Assignments (minimum 20 problems): 4 Marks

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

   Open book test/Open notes test: 4 Marks

   Regularity and active participation: 3 Marks

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

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

End Semester 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
BSC-LC	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

Program Outcomes addressed:

1. PO1:Engineering Knowledge
2. PO4: Conduct investigations of complex problems
3. PO8: Individual and collaborative team work
4. PO9: Communication
5. PO11: Life-Long Learning

Sustainable Development Goals:

1. SDG9: Industry, Innovation, and Infrastructure
2. SDG11: Sustainable cities and Communities

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.
	Course Introduction	**01**
01.	**Experiment 1** ***Learning Objective:*** ***To use Newton's rings for the determination of various physical quantities.***	
	Determination of the wavelength of a given light source using Newton's Rings	
	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 wavelength of a given light source. (SDG 9 P.I.1.2.1, P.I.1.3.1, P.I. 4.3.1, P.I..4.3.3)*	

02.	**Experiment 2** ***Learning Objective:*** ***To study He-Ne Laser.***	**02**
	Measurement of wavelength of He-Ne laser by using grating	
	Learning Outcome: *LO 2.1: A learner will be able to analyze the experimental data to calculate wavelength of the laser source using optical phenomena. (SDG 9, P.I.1.2.1, P.I.1.3.1, P.I. 4.3.1, P.I..4.3.3)*	
03.	**Experiment 3** ***Learning Objective:*** ***To determine the parameters which defines the characteristics of an optical fibre.***	**02**
	Measurement of Numerical aperture of an Optical Fibre.	
	Learning Outcome: *LO 3.1: A learner will be able to apply the knowledge of optical fibre and analyze the experimental data to calculate numerical aperture of the given fibre. (SDG 9, P.I.1.2.1, P.I.1.3.1, P.I. 4.3.1, P.I..4.3.3)*	
04.	**Experiment 4** ***Learning Objective:*** ***To determine various physical quantities by using Hall effect in semiconductors***	**02**
	Determination of magnetic field using Hall-effect setup.	
	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. (SDG 9, P.I.1.2.1, P.I.1.3.1, P.I. 4.3.1, P.I..4.3.3)*	
05.	**Experiment 5** ***Learning Objective:*** ***To study the spectral responsivities of photodiode sensor.***	**02**
	Determination of output current of photodiode for different wavelength of light source.	
	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.1.3.1, P.I. 4.3.1, P.I..4.3.3)*	
06.	**Course Project** ***Learning Objective/s:*** ***To explore the application of concept of physics in different fields by selecting a project.***	**03**
	Selection of a project based on physics concepts, Literature survey, and Topic presentation.	
	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. (SDG 9 & 11, P.I.1.2.1, P.I.1.3.1, P.I..8..1.2, P.I. 8.3.1, P.I. 9.1.1, P.I. 9.2.2, P.I.11.3.1, P.I.11.3.2)	
	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.
1.3.1	Apply fundamental engineering concepts to solve engineering problems.
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 required in industrial technologies through relevant experiments. (SDG 9, *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 for sensing technology through relevant experiments. (SDG 9, *LO4.1, LO5.1*)
3. A learner will be able to apply the fundamental knowledge of physics to present proposed project work with innovative ideas including sustainable development and write effective reports as a team. (SDG 9 & 11, *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		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

Program Outcomes addressed:

1. PO1: Engineering Knowledge
2. PO2: Problem Analysis
3. PO4:Conduct investigation of complex problems
5. PO8: Individual and collaborative teamwork
6. PO9: Communication
7. PO11: Life-Long Learning

Sustainable Development Goals (SDG)

SDG 6 Clean water and sanitation

SDG 7 Affordable and clean energy

SDG 12 Responsible consumption and production

SDG 13 Climate action

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.
	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:* *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. (1.2.1) (1.3.1) (2.1.3) (2.2.3) (4.3.1) (4.3.3)* **(SDG 6)**	
02.	**Experiment 2** *Learning Objective:* *To determine the chloride content of water to understand its suitability for domestic use.* 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. (1.2.1) (1.3.1) (2.1.3) (2.2.3) (4.3.1) (4.3.3)* **(SDG6)**	**02**
03.	**Experiment 3** *Learning Objective:* *To synthesize 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 and atom economy to interpret the nature of reaction. (1.2.1) (1.3.1) (2.2.3) (2.3.1) (4.3.1)* **(SDG12***)*	**02**
04.	**Experiment 4** *Learning Objective:* *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), (4.1.3) (4.3.1) (4.3.3)*	**02**
05.	**Experiment 5** ***Learning Objective:***	**02**

	To synthesize a renewable, eco-friendly alternative fuel from waste oil for developing effective waste management method.	
	Self-Learning Topics: Nil	
	Learning Outcomes: *A learner will be able to* *LO-5.1 synthesize biodiesel using transesterification reaction and calculate its percentage yield to demonstrate effective waste management. (1.2.1) (1.3.1) (2.2.3) (2.3.1) (4.3.1)* ***(SDG7,12,13)***	
06.	**Designing of experiment and presentation:** ***Learning Objective/s:*** *To develop the basic knowledge of analytical chemistry using titrimetric experiments*	**03**
	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. (1.2.1) (1.3.1), (4.2.1) (4.3.1) (4.3.3) (8.1.1), (8.3.1) (9.1.1), (9.1.2), (9.1.3) (11.3.1) (11.3.2).*	
	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.
1.3.1	Apply fundamental engineering chemistry concepts to solve engineering problems.
2.1.3	Identify the engineering chemistry concepts to analyse the given problem
2.2.3	Identify the existing processes/ solution methods for solving the problems
2.3.1	Combine the scientific principles and engineering chemistry concepts to formulate a drug
4.2.1	Design and develop an experimental approach, specify appropriate equipment and procedures.
4.1.3	Apply appropriate instrumentation to make measurements of physical and chemical quantities.
4.3.1	Use appropriate procedures, tools and techniques to conduct experiments and collect data.
4.3.3	Represent data in tabular/ graphical forms so as to facilitate analysis and explanation of the data and drawing of conclusions.
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.

9.1.1 Read, understand and interpret technical and non-technical information

9.1.2 Produce clear, well-constructed, and well-supported written project report.

9.1.3 Create flow in a document or presentation - a logical progression of ideas so that the main point is clear

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

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. Apply the laws of electrochemistry and thermodynamics for performing the practicals. *(LO-4.1)*
2. Apply principles of sustainable chemistry to synthesize drug and alternative fuel from waste sources for responsible consumption and production. *(LO-3.1,5.1)* **(SDG 12)**
3. Analyse the quality of water for promoting sustainable clean water and sanitation practices to assess public health.*(LO-1.1, LO-2.1)* **(SDG 6)**
4. Demonstrate an ability to work effectively in a team for project-based activity. *(LO-6.1)*

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

Program Outcomes addressed:

1. PO1: Engineering knowledge
2. PO2: Problem analysis
3. PO5: Engineering Tool Usage
4. PO8: Individual and team work
5. PO9: Communication

Sustainable Development Goals:

1. SDG 4 Quality Education

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.*	**08-10**
	Experiment 1: General Coplanar Force System	
	Learning Outcomes: *A learner will be able to* *LO 1.1: Apply fundamental engineering concepts to verify the conditions for general coplanar systems and solving for equilibrium conditions by identifying equilibrium equations in a team and document the results in a detailed report. (P.I.-1.3.1, P.I.-2.1.2, P.I.-8.2.1, P.I.-9.1.2)*	
	Experiment 2: To verify Lami's theorem using simple Jib Crane	
	Learning Outcomes: *A learner will be able to* *LO 1.2: Apply mechanical engineering concepts to verify Lami's theorem by identifying the equilibrium conditions and calculating forces both analytically and experimentally. Work*	

	Collaboratively to prepare a technical report with clear written analysis. (P.I.-1.4.1, P.I.-2.1.3, P.I.-8.2.1, P.I.-9.1.2)	
	Experiment 3: To determine the reactions of simply supported beam.	
	Learning Outcomes: *A learner will be able to* *LO 1.3: Apply fundamental engineering concepts to determine support reactions by using equilibrium conditions at various load positions. Discuss in to compare observed and calculated reactions, analyze discrepancies, and prepare a detailed report with clear explanations and annotated diagrams. (P.I.-1.3.1, P.I.-2.1.3, P.I.-8.2.2, P.I.-9.1.2, P.I.-9.3.1)*	
02.	**Principle of Moment**	**02-04**
	Learning Objective: *Learner will be able to apply mechanical engineering concepts to demonstrate the principle of Moments using the Bell Crank Lever apparatus.*	
	Experiment 4: To verify moment equilibrium condition using bell crank lever.	
	Learning Outcomes: *A learner will be able to* *LO 2.1: Apply fundamental and mechanical engineering concepts to verify the Principle of Moments by measuring spring tensions and hanger forces at various arm positions. Collaborate in teams to conduct repeated trials and compare experimental values with theoretical results, and prepare a detailed report. (P.I.-1.3.1, P.I.-1.4.1, P.I.-2.1.3, P, P.I.-8.2.1, P.I.-8.3.1, P.I.-9.1.2, P.I.-9.3.1)*	
03.	**Friction**	**04-06**
	Learning Objective: *Learner will be able to determine coefficient of friction between two different surfaces in contact.*	
	Experiment 5: To determine coefficient of friction using friction plane and angle of repose method.	
	Learning Outcomes: *A learner will be able to* *LO 3.1: Apply natural science laws and fundamental engineering concepts to measure static and kinetic friction coefficients by identify appropriate analytical approaches and justified assumptions. Collaborate in teams to conduct repeated trials and produce a clear written report with structured narrative and standard figures. (P.I.-1.2.1, P.I.-1.3.1, P.I.-2.1.3, P.I.-2.2.3, P.I.-8.2.1, P.I.-8.3.1, P.I.-9.1.2, P.I.-9.3.1)* *LO 3.2: Model and analyse frictional behaviour between contacting surfaces using simulation software, determine the forces required for impending and actual motion, and compare simulated results with theoretical calculations. (PI-2.1.2, PI-5.1.1, PI-8.2.1, PI-9.1.2) (SDG-4)*	
04.	**Kinematics of particles**	**08-10**
	Learning Objectives: *Learner will be able to analyze the motion of particle.*	
	Experiment 6: To study the motion of the projectile.	
	Learning Outcomes: *A learner will be able to*	

	LO 4.1: Apply the laws of natural science and fundamental engineering concepts to measure range and impact velocity at varied launch angle by identifying variables and parameters to apply kinematics relations, coordinate with team members and prepare a technical report. (P.I.-1.2.1, P.I.-1.3.1, P.I.-2.1.2, P.I.- 9.1.2)	
	Experiment 7: To measure and verify average speed of the vehicle.	
	Learning Outcomes: *A learner will be able to* *LO 4.2: Apply fundamental engineering concepts to identify necessary mathematical and engineering principles to calculate and verify the glider's average speed by positioning photogates at a known distance. Work in a team to process and interpret timing data in a logical manner to prepare a detailed written report. (P.I.-1.3.1, P.I.-2.1.3, P.I.-8.2.2, P.I.- 9.1.2)*	
	Experiment 8: Study of linear and curved motion under low friction and plot distance, velocity, and acceleration as a function of time.	
	Learning Outcomes: *A learner will be able to* *LO 4.3: Apply mechanical engineering concepts to conduct linear and curved-track experiments using a wireless motion encoding car and data acquisition software to verify the relationships among displacement, velocity, acceleration by collaborating effectively in team to prepare a technical report. (P.I.-1.4.1, P.I.-5.1.1, P.I.-5.2.2) (SDG-4)*	
	Course Conclusion	**01**
	Total	**30**

Performance Indicators:

P.I.	**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.
2.1.3	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.
5.1.1	Identify modern engineering tools, techniques, and resources
5.2.2	Demonstrate proficiency in using discipline-specific tools
8.2.1	Demonstrate effective communication, problem solving, conflict resolution and leadership skills.
8.2.2	Apply leadership and team-management skills to coordinate tasks, resolve conflicts, and uphold accountability among team members to achieve shared project objectives.
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.
9.3.1	Create engineering-standard figures, reports, and drawings to complement writing and presentations.

Course Outcomes:

A learner will be able to

1. Apply fundamental mechanics principles and analyze static equilibrium in coplanar force experiments by classifying force systems, constructing and resolving free-body diagrams, and calculating support reactions using both analytical equations and graphical methods. *(LO 1.1, LO 1.2, LO 1.3)*
2. Apply mechanical engineering concepts and analyze moments and couples through bell-crank lever experiments by formulating equilibrium equations, measuring spring tensions and hanger forces, and comparing theoretical and experimental results. *(LO 2.1)*
3. Apply laws of natural science and mechanical engineering principles to analyze frictional behaviour by measuring static and kinetic coefficients via friction-plane and angle-of-repose methods, evaluating multiple techniques, and interpreting surface and material effects. *(LO 3.1, LO 3.2)*
4. Apply kinematic principles using modern instrumentation and analyze by conducting projectile, photogate, and wireless motion encoding car experiments to collect real-time data, and deriving displacement, velocity and acceleration in clear technical reports. *(LO 4.1, LO 4.2, LO 4.3)*

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	3	-	-
ESL101.2	3	3	-	-	-	-	-	3	3	-	-
ESL101.3	3	3	-	-	-	-	-	3	3	-	-
ESL101.4	3	3	-	-	3	-	-	3	3	-	-
Average	**3**	**3**	-	-	**3**	-	-	**3**	**3**	-	-

Text Books :

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

Reference Books :

1. Engineering Mechanics by Beer &Johnston, Fourth Edition, 1987 ,Tata McGraw-Hill
2. Engineering Mechanics (Statics) by Meriam and Kraige, Fourth Edition, 1999 Wiley Books

IN-SEMESTER ASSESSMENT (25 MARKS)

Continuous Assessment – Lab Session

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 and Dynamics: 5 Marks
3. Group Project Presentation and Technical Discussion: 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	**Practical /Oral**	**Total**
25	-	25

Pre-requisite :

1. ESC102 : Basic Electrical Engineering

Program Outcomes addressed :

1. PO2: Problem analysis
2. PO4: Conduct investigations of complex problems
3. PO6: The engineer and society
4. PO8: Individual and teamwork

Sustainable Development Goal :

1. SDG7: Affordable and Clean Energy

Course Objectives :

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

Module	Detailed Contents	Hrs	CO
	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:*** *Develop practical skills in breadboard circuit assembly, use of measuring instruments, and analysis of DC circuit laws and theorems. .*	**08**	**CO- 1** **CO- 2**
	Theme for Designing Multiple Experiments : Verification of network theorems and laws by measurement of current and voltage in DC circuits. **Suggested Experiments:**		

	• To study and understand basic electrical components such as resistors, capacitors, and inductors, and to learn breadboard connections along with the use of measuring instruments and devices in the laboratory. (*LO1.1)* • Analyze DC circuit using mesh and nodal analysis by assembling the given circuit on a breadboard and verifying the results through manual calculations. (*LO1.2)* • Analyze the given DC circuit using Thevenin's, Power Transfer theorems through practical implementation and theoretical calculations. (*LO1.3)*		
	Self-Learning Topics: *Applications of Series and parallel networks in dc circuits.* ***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:*** *Develop practical skills in the experimental analysis of Alternating Current (AC) circuits in a laboratory environment.*	**08**	**CO- 1** **CO- 2**
	Theme for Designing Multiple Experiments : Analyze series and parallel-connected AC circuits by determining circuit elements and resonant conditions. **Suggested Experiments:** • Determine the inductance and resistance of the choke coil in series circuit and verify the results by manual calculation. (*LO2.1)* • Measure the resonant frequency in RLC series circuit and plot current vs frequency curve. (*LO2.2)* • Measure the resonant frequency in RLC parallel circuit and plot current vs frequency curve. (*LO2.3)*		
	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. (P.I. 4.1.3, 8.2.1)* *LO2.2 Measure the resonance frequency in RLC series circuit and plot resonance curve. ((P.I. 4.1.4,8.3.1)* *LO2.3 Measure the resonance frequency in RLC parallel circuit and plot resonance curve. ((P.I. 4.1.4,8.3.1)*		
03.	***Learning Objective/s:*** *Acquire hands-on experience in household electrical wiring, use of safety devices, and maintenance of common home appliances.*	**08**	**CO- 1** **CO- 3**

	Theme for Designing Multiple Experiments : Implementation of given residential electrical system incorporating safety devices and up keeping of home appliances. **Suggested Experiments:** • Prepare test boards / extension boards and mount accessories like lamp holders, various switches, sockets, fuses, MCB, ELCB, MCCB etc. Identify make and rating of above devices used in your house. (*LO3.1)* **SDG7: Affordable and Clean Energy** • Dismantle and assemble electrical parts of domestic electric appliances. (*LO3.2)* ***Learning Outcomes :*** *A learner will be able to* *LO3.1 Prepare test boards / extension boards and mount accessories like lamp holders, various switches, sockets, fuses, MCB, ELCB, MCCB etc. ((P.I. 2.1.2, 6.1.1, 9.3.1)* *LO3.2 Maintenance and up-keeping of household electrical appliances and submit a report. ((P.I. 4.1.3, 8.2.1)*		
04	***Learning Objective/s:*** ***To enable practical understanding of motor selection for given application, along with execution of transformer connections and testing*** **Theme for Designing Multiple Experiments :** • Identify electrical motors for given application. Analyze transformer by identifying nameplate details, transformation ratio, polarity and efficiency. **Suggested Experiments:** • Study experiment to identify electrical motors for given application. (*LO4.1)* • Verify terminals, polarity, identify components and calculate transformation ratio of single-phase transformers. (*LO4.2)* • Determine voltage regulation of single-phase transformer by conducting direct load test and summarize results in a report. (*LO4.3)* • Identify and understand the construction and function of various parts of electric motors through visual inspection and hands-on exploration. (*LO4.4)* ***Learning Outcomes :*** *A learner will be able to* *LO4.1 Identify electrical motors for various electrical appliances like Fan, mixer, Vacuum cleaner, Washing machine, Water pump etc. and submit a report. (P.I. 2.2.4, 8.2.1)* *LO4.2 Verify terminals, study the nameplate details and calculate transformation ratio of single-phase transformers. (P.I. 4.1.3, 8.3.1)* *LO4.3 Determine voltage regulation of single-phase transformer by conducting direct load test and summarize results in a report. (P.I. 4.2.1, 8.3.1)* *LO4.4 Recognize and differentiate the major components of electric motors and interpret their roles in motor operation by engaging in visual observation*	**05**	**CO- 4**

	and practical exploration. (P.I.6.1.1)		
	Minimum two experiments from each module and total eight experiments to be conducted.		

Course Outcomes :

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, LO2.3)*
3. Assemble simple residential electrical wiring incorporating safety devices. *(LO1.1, LO3.2)*
4. Select motor for household applications and test the transformer. (*LO4.1, LO4.2, LO4.3, LO4.4)*

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

CO ID	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
ESCLC102.1				3				3			
ESCLC102.2				3				3			
ESCLC102.3				3		2		3			
ESCLC102.4		3		3				3			
Average		3		3				3			

Books :

1. Electrical Power Systems, S.L. Uppal and Prof. Sunil S. Rao 15th Edition, Khanna Publishers

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

Reference Books :

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

Other Resources :

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

CONTINUOUS ASSESSMENT (25 Marks)

1. Practical Exercises – 10 Marks

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

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

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

4. Regularity and active participation – 5 Marks

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

Sustainable Development Goal (SDG):

1. SDG 4 : Quality Education

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.
	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*	**07**
	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. Structure of C program.	

	Task 1: Write an algorithm and draw a flowchart for calculating the total marks, percentage, and grade of a student. *LO 1.1: A learner will be able to apply algorithmic thinking to analyze problem statements and represent solutions using appropriate flowchart symbols. (P.I.- 1.1.1, 1.3.1)* **Task 2:** Write a C program to input marks of five subjects and calculate the percentage. *LO 1.2: A learner will be able to apply fundamental C programming constructs to develop and validate solutions for academic performance evaluation through total marks and percentage calculations. (P.I.- 2.1.2, 2.2.3, 5.1.2, 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.* **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. Logic building exercise on branching and looping statements. **Task 3:** Implement a C program to determine whether a student has passed or failed based on minimum passing criteria using if-else statements. *LO 2.1: A learner will be able to apply relational, logical, and conditional operators along with if-else statements in C to develop and validate programs for determining whether a student has passed or failed based on specified passing criteria. (P.I.- 2.1.2, 2.2.3, 5.1.2, 5.3.2)* **Task 4:** Write and execute a C program that calculates a student's percentage from marks obtained in five subjects and categorizes the result as Distinction (≥75%), First Class (≥60%), Second Class (≥40%), or Fail. *LO 2.2: A learner will be able to apply arithmetic operations and decision-making constructs in C to develop programs that calculate percentages and classify student performance according to specified grading criteria. (P.I.- 2.1.2, 2.2.3, 5.1.2, 5.3.2)* **Task 5:** Implement a C program using iterative control structures to generate and print results of 5 students after calculating percentage. *LO 2.3: A learner will be able to apply loops, arithmetic operations, and input/output functions in C to develop programs that compute and display the academic results of multiple students based on their percentage scores. (P.I.- 2.1.2, 2.2.3, 5.1.2, 5.3.2)..* ***Self-Learning Topics:*** *Differentiate between break and continue statements based on their usage in loops.*	**16**
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 and its types. Logic building exercise on user defined functions.	**12**

	Task 6: Create a C program that illustrates the working of user-defined functions to calculate the percentage of a student. *LO 3.1: A learner will be able to develop and validate structured C programs employing user-defined functions to compute and display student percentages effectively. (P.I.- 2.2.3, 5.1.2, 5.3.2). (SDG 4).* **Task 7:** Write a C program that uses a function to assign grades based on percentage. *LO 3.2: A learner will be able to apply user-defined functions in C to develop programs that evaluate percentages and assign grades according to specified grading criteria. (P.I.- 2.2.3, 5.1.2, 5.3.2) (SDG 4)* ***Self-Learning Topics:*** *Write two programs using functions which have been written using loops.*	
04.	***Arrays, Strings in C*** ***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. Logic building exercise on arrays and strings. **Task 8:** Write a C program to store marks of multiple students in a one-dimensional array and calculate class average. *LO 4.1: A learner will be able to apply array concepts and programming logic in C to organize and manipulate data by implementing sorting techniques for calculating class average. (P.I.- 2.2.3, 5.1.2, 5.3.2)* **Task 9:** Create a C program to store and manipulate student names using strings and perform operations such as searching a student by name. *LO 4.2: A learner will be able to apply string processing techniques in C to develop programs that store, manipulate, and retrieve student information based on name searches. (P.I.- 2.2.3, 5.1.2, 5.3.2)* ***Self-Learning Topics:*** *Write two-dimensional array programs for matrix addition and multiplication.*	**12**
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.* **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. Logic building exercise on pointers. **Task 10:** Create a C program to define a structure to store student information (Roll No., Name, Marks, Percentage, Grade). *LO 5.1: A learner will be able to use structures in C to store, access, and manage student records efficiently while developing programming and lifelong learning skills. (P.I.- 1.1.1, 11.1.1, 11.2.1) (SDG 4)* **Task 11:** Create a C program to use pointers to access and modify structure	**12**

	members of a student record. *LO 5.2: A learner will be able to apply pointers with structures in C to access and modify student records efficiently, enhancing programming proficiency and problem-solving skills. (P.I.- 1.3.1, 11.1.1, 11.2.1) (SDG 4)* **Task 12:** Develop a menu-driven integrated application that performs record entry, display, search, update, topper identification, and result generation using structures, arrays, functions, and pointers.	
	LO 5.3: Develop integrated C applications utilizing structures, arrays, pointers, functions to solve real-world student data management problems while promoting professional programming practices and lifelong learning. (P.I.- 1.3.1, 11.1.1, 11.2.1) (SDG 4)	
	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. Apply the basic terminology used in computer programming concept of data types, variables and operators using C. (*LO 1.1, LO 1.2*)
2. Use control structure concepts in C programming (*LO 2.1, LO 2.2, LO2.3*)
3. Develop functions and use it to solve problems in C using modern tools. (*LO 3.1, LO 3.2*) *(SDG 4)*
4. Apply arrays and strings to solve problems in C. (*LO 4.1, LO 4.2*)
5. Demonstrate the use of structures, dynamic memory allocation and pointers in C. (*LO 5.1, LO 5.2, LO 5.3*) *(SDG 4)*

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, 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.

Refer the sample task given below.

Example: Write a menu driven 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.

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)
3. Well-structured and organized program (02 marks)
4. Verification of experiment output for different inputs (02 marks)

b) Oral: 05 Marks

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

1. Task Execution: 30 Marks

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

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

Program Outcomes addressed:

1. 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

Sustainable Development Goals:

1. SDG 4 – Quality Education
2. SDG 9 – Industry, Innovation and Infrastructure
3. SDG 12 - Responsible Consumption and Production

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) SDG 4* *LO1.2: Demonstrate proficiency in fitting techniques to develop usable product. (P.I.- 5.3.1) SDG 12* *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) SDG 9*	
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) SDG 9* *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) SDG 4* *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) SDG 9, SDG 12*	

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)*	
	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 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 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
IKS	IKS101	INDIAN KNOWLEDGE SYSTEM	02

Program Outcomes addressed:

1. PO1: Engineering knowledge
2. PO2: Problem Analysis
3. PO11: Life-long learning

Sustainable Development Goals:

1. SDG4 Quality Education

Course Objectives:

2. To introduce fundamentals of Ancient Indian Educations to understand the pattern and purpose of studying vedas, vedangas, upangas, upveda, purana & Itihasa
3. To help students to trace, identify and develop the ancient knowledge systems.
4. 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
5. To build in the learners a deep-rooted pride in Indian knowledge, committed to universal human right, well-being and sustainable development.

Module	Detailed Content
01.	**Indian Knowledge System** What is IKS? Need of IKS, Organization of IKS, Historicity of IKS and some salient aspects of IKS. Introduction to Vedas, Synopsis of 4 Vedas Messages in Vedas, Introduction to Vedangas, Prologue on Siksha and Vyakarana, Basics of Nirukta and Chandas, Introduction to Kalpa and Jyotisa, A Vedic Life: A Distinctive Features.
02.	**Foundation concept for Science & Technology** 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, Linguistics & Phonetics in Sanskrit (panini's), Computational concepts in Astadhyayi Importance of Verbs, Role of Sanskrit in Natural Language Processing

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, Binary mathematics and combinational problems in Chanda Sastra, magic squares in India. 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.	**Engineering & 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.	**Knowledge Framework and Classifications:** Indian Scheme of Knowledge, The knowledge triangle, Prameya, Dravyas, Attributes, Samanya, Vishesa samavaya, pramana, Framework of establishing valid knowledge, Deductive or inductive logic framework, Potential fallacies in the reasoning process, Siddhanta established tenets in a field of study.
	Total no. of hours: **30**

Course Outcomes:

1. Analyse the contributions of Indian philosophy, literature, and ethical traditions in shaping the holistic educational framework of the Indian Knowledge System.
2. Examine the scientific and technological concepts embedded in ancient Indian traditions and evaluate their significance in the fields of linguistics and mathematics.
3. Realize the rich heritage of Indian Mathematics, Astronomy, and Science, exploring their contributions to global knowledge and technological advancement.
4. Examine and apply concepts from ancient Indian knowledge systems to address contemporary societal, technological, and environmental challenges.
5. Develop a deeper appreciation for Indian heritage while developing analytical skills and interdisciplinary insights for real-world application.

CO-PO Mapping Table with Correlation Level

CO ID	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
IKS 101.1	3	3									3
IKS 101.2	3	3									3
IKS 101.3	3	3									3
IKS 101.4	3	3									3
IKS 101.5	3	3									3
Average	3	3									3

Text Books:

1. Mahadevan, B., Bhat Vinayak Rajat, Nagendra Pavana R.N. (2022). "Introduction to Indian Knowledge System: Concepts and Applications", PHI Learning Private Ltd. Delhi.Advanced Study, Shimla. Tatvabodh of sankaracharya, Central chinmay mission trust,Bombay,1995.
2. Nair, Shantha N. Echoes of Ancient Indian Wisdom. New Delhi: Hindology Books, 2008
3. Kapur K and Singh A.K, Indian Knowledge Systems, Vol 1, Indian Institute of Advanced Study, Shimla .

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

IN-SEMESTER ASSESSMENT (50 MARKS)

1. Continuous Assessment - Theory-(50 Marks)

1. Poster Presentation: 10 Marks
2. MCQs: 5 Marks
3. Reel Making: 10 Marks
4. Problem Solving Assignment: 10 Marks
5. Regularity and active participation: 5 marks
6. Group Presentation: 10 Marks

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

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

Pre-requisite :

1. Differentiation of several variable I & II
2. Integration
3. Beta and Gamma Function

Program Outcomes addressed:

1. PO1: Engineering knowledge
2. PO2: Problem analysis
3. PO8: Individual and Collaborative Teamwork
4. PO 11: Life Long Learning

Course Objectives:

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

Module	Detailed Contents	Hrs
00.	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 Multiple Integration from real life application. Hence, Formulation Based Mathematics is a fundamental requisite to all fields of Engineering for analyzing their performances.	**01**
01.	**Matrices - I** ***Learning Objective:*** • *Analysis and interpretation of the basic fundamentals of matrices.* *Determination of the rank of a matrix by applying the concepts of elementary transformation of a matrix.*	**6-8**

	Contents: Introduction of Matrices through a discussion on the need to study matrices as they are essential tools for solving systems of equations, analyzing electrical circuits, performing structural analysis, and modeling complex systems in various engineering fields. 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: Coding Theory	
	Learning Outcomes: ***A learner will be able to*** ***LO 1.1:*** *Apply mathematical techniques to identify and classify different types of matrices such as symmetric, skew-symmetric, Hermitian, and unitary matrices. (PI 1.1.1)* *LO 1.2: Apply appropriate mathematical procedures to determine the rank of a matrix using elementary transformations. (PI 1.2.1)* ***LO 1.3:*** *Identify the structural properties of complex and real matrices by verifying conditions for symmetry, orthogonality, and unitarily***.** *(P I 2.1.3)* ***LO 1.4:*** *Apply properties of special matrices such as orthogonal and Hermitian matrices to solve application-based problems. (PI 11.1.3)* ***LO 1.5:*** *Articulate the importance of staying updated with current matrix-based computational tools and methods, highlighting how this continuous learning fosters lifelong learning and enhances problem-solving skills in professional engineering practice. (PI 2.1.1, P I 11.2.1)*	
02.	**Matrices – II** ***Learning Objective:*** 1. *Analysis of the differences between homogeneous and non-homogeneous simultaneous equations* 2. *Application of 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: *Case studies based on application of linearly dependent and independent vectors in* solving engineering-related problems. ***Learning Outcomes:*** *A learner will be able to* *LO.2.1: Identify using relevant mathematical knowledge if the system of homogeneous / non-homogeneous linear equation is consistent and determine its type of solution (P I 2.1.3)* *LO.2.2*: *Identify the most appropriate method for solving a given system of linear equations and state if the system has one solution, no solution, or infinite solutions. (P I 2.2.3)* *LO 2.3: Apply the algebraic technique to solve a given system of equation. (P I 1.1.1)* *LO 2.4 Identify using relevant mathematical knowledge whether a set of vectors is linearly dependent or independent. (P I 2.1.3)* *LO 2.5: Apply relevant process to express a vector as a linear combination of other vectors by applying basic laws of mathematics (P I 1.2.1,)* *LO 2.6: Communicate clearly with team members while working as a team analyzing a problem on linearly dependent or independent vectors and resolve differences in approach during group work by listening and finding common solutions. (P I 8.2.1)* *LO 2.7: Collaboratively solve problems on linear combinations and linearly dependent / independent vectors using appropriate methods and present it with precision. (PI 8.3.1)*	
03.	**Matrices – III** ***Learning Objective:*** 1. *Analysis and computation of Eigen Values and Eigen Vectors.* 2. *Enumeration and application of the concept of Eigen value and Eigen vector to Engineering Models.* 3. *Application of the concepts of Eigen values and Eigen Vectors for finding the function of matrix using Cayley-Hamilton Theorem.*	**7-9**
	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	
	Self-Learning Topics: *Function of square matrix as an application of Eigen values and Eigen vectors.*	
	Learning Outcomes: *A learner will be able to* *LO 3.1 Apply mathematical knowledge to form the characteristic equation of a square matrix to find its eigenvalues using basic algebraic operations. (P I 1.1.1)* *LO 3.2: Identi**fy** appropriate matrix operations to solve problems involving eigenvalues and eigenvectors (P I 2.1.3)*	

	LO 3.3: Identify relevant solution method to calculate eigenvalues and eigenvectors for a given matrix. (P I 2.2.3) *LO 3.4: Apply the Cayley-Hamilton theorem effectively to express matrix functions by using basic laws of mathematics. (P I 1.2.1)*	
04.	**Double Integration in Cartesian coordinate** ***Learning Objectives:*** 1. *Analysis of the fundamentals of Double integration in Cartesian coordinate system and apply it to solve problem.* 2. *Application of the concepts of double integration in Cartesian co-ordinate to evaluate area and mass of the Lamina*	**6-8**
	Contents: Tracing of standard curve Definition, Evaluation of Double Integrals, Change the order of integration, Evaluation of double integrals by changing the order of Integration, Evaluation of integrals over the given region.	
	Self-Learning Topics: Double integration in Elliptical polar coordinate **Learning Outcomes**: *A learner will be able to* *LO 4.1: Compare the efficiency of solving double integrals by direct evaluation versus changing the order of integration and select the best one to solve the given problem. (P.I.-2.2.4)* *LO 4.2: Reframe a complex region of integration into sub-regions to simplify the evaluation of a double integral. (P.I.-2.2.1).* *LO 4.3: Apply the fundamentals of integration of a function of single variable to solve problem in double integration in Cartesian coordinate system. (P.I.-1.1.1)* *LO 4.4: Apply the appropriate method to evaluate a double integral in Cartesian coordinate system by using the law of integration. (PI :1.2.1)* *LO 4.5: Identify the need of double integration in Cartesian coordinates and utilise the relevant concepts to solve real-world problems. (PI: 11.1.3)* *LO 4.6: Analyze and state the need of how staying updated with current double integral in Cartesian coordinates-based computational tools and methods contributes to lifelong learning and enhances problem-solving skills in professional engineering practice. (P I 11.2.1)*	
05.	**Double Integration in Polar coordinate** ***Learning Objectives:*** 1. *Analysis of the fundamentals of Double integration in polar-coordinate system and apply it to solve problem.* 2. *Application of the concepts of double integrations in polar-coordinate to evaluate area and mass of the Lamina*	**6-8**
	Content: Tracing of standard curve(Polar) Evaluation, Evaluation of double integrals by changing to polar Co-ordinates, Evaluation of integrals over the given region. Application of double integrals to compute Area, Mass of a lamina.	
	Self-Learning Topics: Moment of inertia of a plane lamina.	
	Learning Outcomes:	

	A learner will be able to *LO 5.1: Apply the fundamentals of integration of a function of single variable to solve problem in double integration in polar coordinate system. (P.I.-1.1.1)* *LO 5.2: Apply the knowledge of Jacobian when changing from Cartesian to polar coordinates in order to evaluate a double integral. (PI: 1.2.1)* *LO 5.3: Compare the efficiency of solving double integrals by direct evaluation versus changing into polar coordinate system of integration and select the best one to solve the given problem. (P.I.-2.2.4)* *LO 5.4: Reframe a complex region of integration into sub-regions to simplify the evaluation of a double integral in polar coordinate system. (P.I.-2.2.1).* *LO 5.5: Lead a group project or presentation on the applications of double integrals (area and Mass of Lamina**)** by demonstrating problem solving and analytical thinking, (PI: 8.2.1)* *LO 5.6: Collaborate in teams to present solution involving area under curves and mass of a Lamina using double integral, showcasing effective communication and individual contribution. (PI: 8.3.1)*	
06.	**Triple integration** ***Learning Objective/s:*** 1. *Analysis of the fundamentals of Triple integration in different coordinate systems and apply it to solve problem.* 2. *Application of the concepts of triple integrations to evaluate volume of a solid.*	**5-6**
	Contents: Definition, Evaluation of Triple Integral using Cartesian coordinates, Evaluation of Triple Integral using cylindrical coordinates, Evaluation of Triple Integral using Spherical coordinates. Application of triple integrals to compute Volume and Mass of solid.	
	Learning Outcomes: *A learner will be able to* *LO 6.1: Apply the fundamentals of integration of a function of single variable to solve problem in triple integration in different coordinate system. (P.I.:1.1.1)* *LO 6.2: Apply the knowledge of Jacobian when changing from Cartesian to spherical polar and cylindrical polar coordinates in order to evaluate a triple integral (PI: 1.2.1)* *LO 6.3*: *Compare alternative integration approaches (evaluation in different coordinate systems) and select the optimal solution path to evaluate the integral. (PI 2.2.4)* *LO 6.4: Identify the appropriate mathematical knowledge of triple integrals and different coordinate systems needed to solve problems involving three-dimensional solids. (PI: 2.1.3)*	
	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 appropriate mathematical concepts, methods, and techniques to formulate and solve engineering-related problems systematically and accurately
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.
8.2.1 Demonstrate effective communication, problem solving, and conflict resolution and leadership skills.
8.3.1 Present result as a team, with smooth integration of contributions from all individual efforts.

11.1.3 Identify various mathematical concepts/theorems which can be utilized in the field of application based engineering.
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. Apply the concept of rank of a matrix to determine the consistency and solve homogeneous and non-homogeneous systems of equations arising in real-life problems. *(LO 1.1, LO1.2, LO1.3, LO1.4, LO 1.5, LO 1.6, LO 2.1, LO2.2, LO2.3, LO2.4, LO 2.5, LO 2.6, LO 2.7)*

2. Analyse characteristic equations to determine eigenvalues and eigenvectors, and apply the Cayley–Hamilton theorem to evaluate functions of matrices for real-life applications. (*LO 3.1, LO3.2, LO3.3, LO3.4)*

3. Apply the fundamentals of double integration to analyse and evaluate the area and mass of a lamina. *(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)*
4. Apply the fundamentals of triple integration to analyse and evaluate the volume and mass of a solid. *(LO 6.1 , LO 6.2, LO 6.3, LO 6.4)*

5. Analyse and apply mathematical tools acquired throughout the course to solve real-life problems through individual and team-based activities. *(LO 1.5, LO 1.6, LO 2.6, LO 2.7, LO 4.5, LO 4.6, LO 5.5, LO 5.6)*

CO-PO Mapping Table with Correlation Level

CO ID	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BSC204.1	3	3	--	--	--	--	--	3	--	--	3
BSC204.2	3	3	--	--	--	--	--	--	--	--	--
BSC204.3	3	3	--	--	--	--	--	3	--	--	3
BSC204.4	3	3	--	--	--	--	--	--	--	--	--
BSC204.5	3	3	--	--	--	--	--	3	--	--	3
Average	3	3	--	--	--	--	--	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.
3. Advanced Engineering Mathematics, H.K.Das, S. Chand and Company Limited, Fourth Edition, 2018.

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
3. Applied Numerical Methods with MATLAB for Engineers and Scientists by Steven Chapra, McGraw Hill,2017

A. IN-SEMESTER ASSESSMENT (50 MARKS)

1. Continuous Assessment (20 Marks)

a) One MCQ Test + One Class Test: 05+05 = 10 Marks
b) One Team Pair Solo (TPS) activity: 05 Marks
c) Regularity and active participation :05 Marks

3.Mid Semester Examination (30 Marks)

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

B. END SEMESTER EXAMINATION (50 MARKS)

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

C. Continuous Assessment of Tutorial (25 Marks)

Suggested breakup of distribution

Students shall be evaluated based on attendance, active participation in tutorial sessions and activities, quality and completeness of work submitted, problem-solving skills demonstrated during practice and class tutorials, and performance in tutorial assessments/tests. The overall evaluation shall be carried out on a cumulative basis and awarded out of 25 marks.

a) 6 Activity-Based Sessions + Tutorial Tests: 2**:** 10+10 = 20 Marks
b) Regularity and active participation **:** 05 Marks

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

Sustainable Development Goals:

1. SDG 3: Good Health and Well-being
2. SDG11: Sustainable Communities
3. SDG12: Responsible Consumption and Production

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.
	Course Introduction	**01**
01.	**Crystals and Non-crystalline solids** ***Learning Objective:*** • *To provide the fundamental knowledge of crystal structures.* • *To study the unit cell characteristics of a simple cubic structure* • *To gain the basic knowledge of non-crystalline solids.*	**6-8**

	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. Non-crystalline materials: Structures, properties and classes.	
	Self-Learning Topics: *Crystals: Lattice parameters. Application of non-crystalline materials.*	
	Learning Outcomes: *A learner will be able to* *LO1.1: apply the knowledge of lattice parameters of unit cell and various models to interpret the structure of a crystalline and non- crystalline materials, respectively. (P.I.- 1.2.1)* *LO1.2: apply the knowledge of unit cell characteristics to solve problems. (P.I.1.3.1)* *LO1.3: identify various parameters to study simple cubic structure, order and disorder to study the properties of non-crystalline material and differentiate them from crystalline material. (P.I.- 2.1.2)* *LO 1.4: identify the mathematical process to derive the unit cell characteristics of a simple cubic structure. (P.I.- 2.1.3)* *LO1.5: identify the applications of non-crystalline materials for various products. (P.I.- 2.1.2) SDG 12*	
02.	**Analysis of Crystal Structure**	**4-6**
	Learning Objective: • *To familiarize the concept of Miller Indices to represent the crystal planes.* • *To provide the knowledge of X-ray diffraction in analysis of crystal structure.*	
	Contents: Crystal planes and Miller indices; Interplanar spacing: Relation between interplanar spacing and Miller indices for cubic unit cell. Diffraction of X-ray and Bragg's law; Bragg's spectrometer: Principle, Construction and working; Determination of crystal structure using Bragg's spectrometer.	
	Self-Learning Topics: *- Diffraction of light, diffraction grating*	
	Learning Outcomes:	

	A learner will be able to *LO2.1: apply the knowledge of miller indices to identify various planes in a crystal. (P.I.- 1.2.1)* *LO2.2: apply the knowledge of miller indices, crystal planes and Bragg's law to solve the problems. (P.I.- 1.3.1)* *LO2.3: identify the mathematical process and knowledge of miller indices and crystal planes to derive the interplanar distance in a simple cubic structure and Bragg's law. (P.I.- 2.1.3)* *LO2.4: identify physical phenomena, components and process to analyse the crystal structure by using Bragg's spectrometer. (P.I.- 2.2.3)*	
03.	**Magnetic Materials**	**3-5**
	Learning Objectives: • *To explore the properties of magnetic materials.* • *To enhance the knowledge of magnetic materials for practical applications.*	
	Contents: Magnetic materials: Ferromagnetism: Magnetization of ferromagnetic materials, Hysteresis loop: soft and hard magnetic materials, Hysteresis loss, Magnetoresistive materials, Applications of magnetic materials.	
	Self-Learning Topics: *Magnetization of materials.*	
	LO3.1: apply the knowledge of physics of materials to study the magnetic materials (P.I.- 1.2.1). *LO3.2: apply the concept of magnetic phenomena in materials to solve the problems. (P.I.- 1.3.1)* *LO3.3: identify various parameters to differentiate types of ferromagnetic materials. (P.I.- 2.1.2)* *LO3.4: identify the method to analyze the variation of magnetic flux density with magnetizing force in ferromagnetic materials. (P.I.-2.2.3)* *LO3.5: identify the applications of magnetic materials to meet the public need. (P.I.- 6.1.1) SDG 11, SDG 12* *LO3.6: identify the impact of retentivity and coercivity in soft and hard magnetic materials. (P.I.-6.1.2)*	
04.	**Dielectric Materials**	**3-5**
	Learning Objectives: • *To provide the basics of dielectric materials.* • *To enhance the knowledge of dielectric materials for practical applications.*	
	Contents: Dielectric materials: Dielectric constant; Dielectric polarization; Dielectric susceptibility; Dielectric loss; Dipoles; Nonpolar and polar dielectric, Applications of dielectric materials.	

	Self-Learning Topics: *Ferroelectric Hysteresis loop*	
	Learning Outcomes: *A learner will be able to* *LO4.1: apply the knowledge of physics of materials to study the dielectric materials (P.I.- 1.2.1).* *LO4.2: apply the concept of dielectric phenomena in materials to solve the problems. (P.I.- 1.3.1)* *LO4.3: identify the differentiate types of dielectric materials based upon their polarization. (P.I.- 2.1.2)* *LO 4.4: identify the methods to analyze the dielectric loss in ferroelectric materials. (P.I. -2.2.3)* *LO4.5: identify the applications of dielectric materials to meet the public need. (P.I.- 6.1.1) SDG 11, SDG 12* *LO4.6: identify the impact of dielectric materials in life-cycle of a capacitors. (P.I.- 6.1.2)*	
05.	**Nanomaterials** ***Learning Objective/s:*** • *To explore the basics of nanomaterials.* • *To recognize 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* *LO5.1: apply the knowledge of physics of materials to study the properties and applications of nanomaterials. (P.I.- 1.2.1) SDG 11* *LO5.2. apply the concept of surface area to volume ratio in nanomaterials to solve the problems. (P.I.- 1.3.1)* *LO5.3: identify top-down and bottom-up approaches to classify various synthesis methods of nanomaterials. (P.I.2.1.2).* *LO5.4: identify the components, process in various methods for the preparation of different nanomaterials. (P.I.-2.2.3)*	
06.	**Characterization Techniques of Nanomaterials**	**3-5**
	Learning Objective/s: • *To familiarize the tools for specific characterization of nanomaterials.*	

	Contents: Tools for characterization of Nanomaterials: Scanning Electron Microscope (SEM): Principle, construction, working and application; Transmission Electron Microscope (TEM): Principle, construction, working and application; Atomic Force Microscope (AFM) Principle, construction, working and application.	
	Self-Learning Topics: *Difference between optical and electron microscope*	
	Learning Outcomes: *A learner will be able to* *LO6.1: apply the knowledge of propagation of electrons to construct electron microscope. (P.I.1.3.1)* *LO6.2: identify the components, process and the physical phenomena involved in different characterizing tools (SEM, TEM and AFM) of nanomaterials. (P.I.-2.2.3)* *LO 6.3: identify the resolution of a device using light and electron beam to differentiate optical and electron microscope (P.I.2.1.2)* *LO6.4: identify the application of SEM, TEM and AFM for public use. (P.I.- 6.1.1) SDG 3* *LO6.5: identify the impact environmental conditions which affect life cycles of SEM and TEM. (P.I.-6.1.2)*	
	Course Conclusion	**01**
	Total	**30**

Performance Indicators:

P.I. No.	**P.I. Statement**
1.2.1	Apply laws of physics to an engineering problem.
1.3.1	Apply fundamental engineering concepts to solve engineering problems.
2.1.2	Identify engineering systems, variables, and parameters to solve the problems
2.1.3	Identify the mathematical, engineering and other relevant knowledge that applies to a given problem
2.2.3	Identify existing processes/solution methods for solving the problem, including forming justified approximations and assumptions.
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 risks/impact in the life-cycle of an engineering product or activity.

Course Outcomes:

1. Learner will be able to apply the knowledge of various parameters to study crystalline and non-crystalline solids that support production of various component in real-life. (*SDG 12, LO1.1, LO1.2, LO1.3, LO1.4, LO1.5*)
2. Learner will be able to apply the fundamental knowledge of x-ray diffraction to analyse crystal structure (*LO2.1, LO2.2, LO2.3, LO2.4)*
3. Learner will be able to apply the fundamental knowledge of magnetic materials for various technical productions by analyzing their intrinsic behaviours. (*SDG 11 & 12, LO 3.1, LO 3.2, LO 3.3, LO 3.4, LO 3.5, LO 3.6)*
4. Learner will be able to promote sustainable production by selecting and analyzing dielectric materials based on their properties in technical applications. (*SDG 11 & 12, LO 4.1, LO 4.2, LO 4.3, LO 4.4, LO 4.5, LO 4.6)*
5. Learner will be able to use the basic knowledge of nanomaterials and their characterization techniques to identify their applications in well-being and sustainable development of mankind. (*SDG 3 & 11, LO 5.1, LO 5.2, LO 5.3, LO 5.4, LO 6.1, LO 6.2, LO 6.3, LO 6.4, LO6.5*)

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					
BSC205.5	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
4. Theory of the structure of Non-Crystalline Solids. Jozef Bicerano et al.
5. 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.

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.

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
4. PO11: Life Long Learning

Sustainable Development Goals (SDG)

SDG 3: Good health and well being

SDG 12: Responsible consumption and production

Course Objectives:

1. To enable the students to apply the laws of chemistry to an engineering problem.
2. To identify the most appropriate engineering material and analyse its properties and applications for the benefits of engineering industries and real world.
3. To study the current developments in the field of nanotechnology, energy storage systems and polymer chemistry for sustainable development.

Module	Details	Hrs.
	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 and Powder Metallurgy** ***Learning Objective:*** *To classify the different types of alloys and interpret their properties and applications in industry and to comprehend the concept of powder metallurgy.*	**4-6**

	Contents: Introduction, Significance of alloying, Ferrous Alloys-classification, Plain carbon steels and special steels - Role of special elements in alloy steels. Shape memory alloys: definition, properties and uses, Powder metallurgy – introduction, steps, methods of metal powder production: - atomization, compacting by cold powder extrusion, sintering and its applications, Numericals based on alloys	
	Self-Learning Topics: *Applications of ferrous alloys in various industries. Applications of powder metallurgy.*	
	Learning Outcomes: *A learner will be able to* *LO-1.1 Apply the knowledge of alloy steels in improving the quality of surgical instruments used in medical field. (1.3.1)* ***(SDG 3).*** *LO- 1.2 Identify the role of Carbon and special elements in improving the properties of plain carbon steels and alloy steels. - (2.1.3)* *LO- 1.3 Identify and use the concept of shape memory effect for developing vascular stents for improved societal health. (1.3.1 and 6.1.1)* ***(SDG 3).*** *LO- 1.4 Identify the steps in powder metallurgy for improving the quality of metallic tools and equipment used in industries. (2.2.3)* *LO-1.5 Apply the concept of stoichiometry to solve the numericals based on alloy composition. (1.2.2)* *LO 1.6 Identify and analyze different types of alloys, their properties and industrial applications and the steps in powder metallurgy and effectively present them through a poster presentation. (11.3.1)*	
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 fundamental engineering chemistry concepts to classify different types of polymers. (1.3.1)* *LO -2.2 Identify the properties, uses and apply the knowledge of synthesis reactions of PMMA, Kevlar, Bakelite, PHBV and PPV to various engineering industries.* (2.2.3) *LO-2.3 Apply the formulae for number and weight average m o l e c u l a r weight and polydispersity index for solving the numerical problems. (1.2.2)* *LO-2.4 Identify the polymeric material for the protection of public health. (6.1.1)* *LO-2.5 Identify the factors affecting the glass transition temperature for analyzing the polymers for industrial use. (2.1.3)* *LO-2.6 Apply the knowledge of biodegradable polymer for responsible consumption*	

	*and production. **(1.3.1)(SDG12)***	
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: Nil	
	Learning Outcomes: *A learner will be able to* *LO-3.1 Identify the role of constituents of composites for analyzing their suitability for industrial use. (2.1.3)* *LO-3.2 Identify and classify composites for improving the quality of engineering materials (2.2.3)* *LO- 3.3 Apply the knowledge of various types of composite materials and their properties for further advancements in automobile and aeronautical industries. (1.3.1**)*** *LO-3.4 Identify and classify different types of composite materials for industrial applications, and present their findings through a poster presentation. (11.3.1)*	
04.	**Carbon Nanomaterials**	**3-5**
	Learning Objectives: *To use carbon nanomaterials on the basis of their mechanical and electrical properties in various industrial applications and modern devices.*	
	Contents: Introduction to nanomaterials, comparison between nanomaterials and their bulk counter parts. structure and properties of graphite as a precursor for carbon nanomaterials. structure, electrical and mechanical properties of Carbon Nanomaterials like graphene, CNTs and Fullerenes. Application of Nanomaterials in various industries: CNT as electrode in battery	
	Self-Learning Topics: *Inorganic nanomaterials like metals, metal oxides etc.*	
	Learning Outcomes:	
	A learner will be able to *LO-4.1 Apply and compare the properties of bulk materials with those of nanomaterials to improve the quality of materials in various industries (1.3.1)* *LO-4.2 Identify and analyse the structure and properties of graphite as a precursor of nanoforms of carbon (2.1.3)* *LO-4.3 Identify the structure of CNTs, classify them and analyse their properties for*	

	application in industries. (2.2.3) *LO-4.4 Identify the structure and properties of fullerene for their applications in protecting public health. (6.1.1)*	
05.	**Batteries**	**4-6**
	Contents: Introduction and Characteristics of batteries. Construction, working and applications of Lithium-ion batteries, Hydrogen oxygen alkaline fuel cells, E-waste Management, Battery e-waste management.	
	Self-Learning Topics: *Classification of batteries.*	
	Learning Outcomes: *A learner will be able to* *LO-5.1 Identify the concepts of electrochemistry for analyzing the types of batteries. (2.1.3)* *LO-5.2 Apply the knowledge of construction and working of Li ion and fuel cell batteries to solve the real-world problems (1.3.1) and (2.2.3)* *LO-5.3 Identify the impact of disposal of toxic components of batteries for the public safety.(6.1.1)* ***(SDG 3, and 12)*** *LO-5.4 Apply the steps in e-waste management for responsible consumption and recycling for sustainable development. (6.1.2)* ***(SDG 3,* 12)** *LO-5.5 Apply the formulae based on theories of electrochemistry to solve the numerical problems. (1.2.2)*	
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. Numericals based on Beer Lambert's Law.	
	Self-Learning Topics: *Electromagnetic radiations, characteristics of electromagnetic radiation, electromagnetic spectrum.*	
	Learning Outcomes: *A learner will be able to* *LO-6.1 Apply the concept of interaction of radiations with materials for the absorption and emission spectroscopy analysis. (1.2.1)* *LO-6.2 Identify a type of spectroscopic technique by analyzing the transitions occurring in a compound. (2.1.3)* *LO-6.3 Apply Beer Lambert's law to identify absorption spectroscopic techniques (1.2.1)* *LO-6.2 Identify the allowed and forbidden transitions for the feasibility of a spectroscopic technique. (2.2.3)* *LO-6.4. Apply the formulae based on Beer Lambert's law to solve numerical problems (1.2.2)*	

	LO-6.5 Identify the various radiative and non-radiative transitions occurring in a photo excited electron to analyze Jablonsky diagram for use in various spectroscopic techniques. (2.1.3) *LO-6.6 Identify various energy levels of the matter to differentiate between molecular and atomic spectra. (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 analyse 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.
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 knowledge of metallurgy and composites to identify the industrial materials of improved quality for solving the real-world problems. *(LO-1.1,1.2,1.3,1.4,1.5,1.6,1.7, 3.1,3.2,3.3 and 3.4).* **(SDG 3)**
2) Apply the principles of electrochemistry to analyse the construction and working of batteries of commercial importance as the clean energy sources and identify the role of e-waste management for responsible consumption and production. *(LO-5.1,5.2,5.3,5.4,5.5)* **(SDG 3 and 12)**
3) Identify the role of polymers in promoting the public safety and responsible consumption and production of materials in engineering industry. *(LO-2.1,2.2,2.3,2.4,2.5, 2.6).* **(SDG 12)**
4) Apply the concepts of spectroscopy to identify the suitable characterisation techniques for studying the material properties that are important from the industrial point of view. *(LO 6.1,6.2,6.3,6.4,6.5and 6.6)*
5) Analysing the structure and properties of carbon nanomaterials to engineer smart materials for applications in electronics, healthcare, clean energy, and water resource management. *(LO-4.1,4.2,4.3,4.4)*

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					3
BSC206.2	3	3				3					
BSC206.3	3	3				3					
BSC206.4	3	3				3					
BSC206.5	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 :

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

IN-SEMESTER ASSESSMENT (35 MARKS)

1. Continuous Assessment - Theory-(15 Marks)

1. MCQ test strictly as per GATE exam pattern / level) + 01 Class test: 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.

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

Sustainable Development Goals addressed :
SDG 4- Quality Education

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	
	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	**01**

	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	***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.* **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 Role of Engineers in society: Case Studies a) Corporate Communication - Case Studies b) Short Group Presentations on Business Plans c) Selecting Effective Communication Channels 1.5 Professional Etiquette and Ethics a) Formal Dress Code b) Cubicle Etiquette c) Formal Dining Etiquette 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 offices 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.*	**7**
	Learning Outcomes: *A learner will be able to* *LO1.1: Demonstrate competence in verbal and non-verbal communication and apply suitable cues to communicate effectively as an individual or in a group. (7.2.2, 8.2.1, 8.2.3, 9.2.3/SDG4)* *LO1.2: Exhibit ethical use of social media, flexibility and empathy in the professional space. (7.2.2, 8.2.2 ,8.2.3, 11.1.1)*	

	LO1.3: State the need for and implement appropriate grooming and ethical way of presenting oneself. (11.1.1) *LO1.4: Exhibit awareness about professional responsibility towards society and demonstrate diverse and inclusive mindset through individual and Team presentations (7.3.1/SDG4)* ***Activities:*** ***1. Participate in Group Discussion and Debate rounds on various Socio- cultural and ethical topics. The topics for Group Discussion and Debate rounds will cover suggested areas like Gender equality, climate action, quality education, good health and well-being, sustainable communities etc. Minimum three rounds to be conducted for facilitating enough practice.*** ***2. Ethical Case Study project: Analyse a real life case study based on Socio-Technical problems, study the core ethical dilemma and present alternate solutions for the same.***	
02.	***Verbal Aptitude for Employment*** ***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 2.3 Application: a) Comprehend and proofread academic essays for grammatical correctness. b) Structured quizzes for language learning with increased difficulty levels. ***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, 9.1.2)* *LO2.2: Apply appropriate words and parts of speech such as prefixes, suffixes, synonyms, antonyms, idioms, proverbs and clichés in the written and oral form of professional communication (9.1.1,9.2.2/SDG4)* *LO2.3: Listen to grammatically correct input, understand & analyse the same (11.3.1)* ***Activities****:* ***1. Solving two verbal Aptitude Tests as assignment work. Solving grammar practice tests based on the module.*** ***2. Write an academic essay on the role of quality education in generating socially and professionally ethical global citizenry.***	**3**

03.	***Developing Basic Language Skills-LSRW Skills***	**5**

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 generate and deliver a speech and/or presentation using both rational and out of the box thinking.

Contents:

3.1 Listening Skill-

Listening to recordings of Formal and Informal communication situations.

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's *Malgudi Days*, Ruskin Bond's *Celestial Omnibus* and similar.

Writing Movie reviews- *A Friend's House, Sabar Bonda ,Dangal, Taare Zameen Par, Masan and such.*

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.

Self-Learning Topics:
Read, either, an autobiography or biography of Dr. A. P.J. Kalam, Dr. 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 in various formal, informal situations. (8.2.2, 8.2.3, 9.2.1, 9.2.3)
LO3.2: Create and deliver effective formal/ informal speeches in a professional set up. (8.2.4, 9.2.2, 9.3.2, 11.1.1/SDG4)
LO3.3 Read and comprehend long/short, technical/non-technical passages along with summarising it in paragraph format / graphical organisers. (9.1.1, 9.1.3, 9.2.1/SDG4)

Activities:

1. Listening skill - Listening to audio and video content of various types like monologues, dialogues, formal talk and discussion about the same.

2. Self-Introduction and introducing others - Learning formal self-introduction and introducing colleagues through practice activity.

	3. Reading of short stories/ watching movies and writing summaries, learning to critically evaluate them – Critically analyse and write a brief review of a short story / movie (The select story/movie is based on the themes of social and ethical issues.) Further Summarise and graphically organise (mind mapping) the selected short story/ movie. ***4. Deliver a formal welcome note/ joining speech/ introductory speech/ valedictory speech/ farewell speech.***	
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.* **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 Format 1) Parts/Elements of a Formal Letter i. Letterhead 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 Email 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)	**7**

	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 correspondence to basic official correspondence. (7.1.1, 7.2.2 /SDG4)* *LO 4.2: Draft an Enquiry /Request/Permission letter in both written and Email format for various professional situations.(9.3.2, 11.1.1/ SDG4)* ***Activities:*** ***1. Assignment on Business Correspondence- practice for drafting various business Letters*** ***2. Drafting of official emails within the scope of internal official correspondence.***	
05.	***Basic Technical Writing*** ***Learning Objectives*:** *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.* *To comprehend the need for ethical concepts such as Plagiarism checks and Copyright in professional writing.* **Contents:** 5.1. Introduction 1) What is Technical Writing? 2) Importance and Principles of Technical Writing 3) Difference between Technical Writing & Literary Writing 5.2. Basics of Research 1) Importance of Research 2) Types of research 3) How to select a topic 4) Structure of a Technical Research Paper 5) Referencing styles (APA, IEEE) 5.3. Intellectual Property Rights - 1)Understanding the importance of Copyrights 2) Paraphrasing, referencing and In-text citations 3) Running a Plagiarism Check on Paraphrased Passages 4) Ethical behavior: Case Studies ***Self-Learning Topics:*** *Collect samples of technical writing like a User Manual and study them for language and tone.* ***Learning Outcomes :*** *A learner will be able to* *LO5.1: Critically choose a research topic and write the problem statement and Hypothesis (11.3.1/ SDG4)* *LO5.2: Identify the utility and importance of Copyright. (7.2.2, 9.3.1, 11.1.1/SDG4)* *LO5.3: Generate plagiarism reports by running a plagiarism check on the select document. (7.2.2, 9.3.2, 11.3.1/SDG4)* ***Activities:*** ***1. Read, analyse and evaluate up to two research papers on the topic of 'Climate change and***	**6**

	Sustainable development', Summarise and present in the APA format. ***2. Assignment - Generate a review paper on a topic from Sustainable Development Goals.***	
	Activities during Practical sessions : *1. Listening skill - Listening to audio and video content of various types like Monologues, dialogues, formal talk and discussion about the same.* **2 Hrs.** *2. Self-Introduction and introducing others - Learning formal self-introduction and introducing colleagues through practice activity.* **2Hrs.** *3. Group Discussion on various Socio- cultural and Ethical topics - Minimum three rounds to be conducted for facilitating enough practice.* **6 Hrs.** *4. Debates on several Socio-cultural and Ethical issues- Two rounds to be conducted.* **4 Hrs.** *5. Selection of Ethical Case Study, Analysis, discussion and report documentation followed by a presentation .* **3 Hrs.** *6. Reading of short stories/ watching movies - writing summaries and learning to critically evaluate them – Students will be given a selected list of short stories/ movies with social messages and guided for writing summaries after critical evaluation of the same. Further they would present it using a graphical organizer like mind -map .* **3 Hrs.** *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 a technical paper will be held. Students will create a short research paper using the given template followed by a presentation.* **2Hrs.** *8. Assignment on Barriers to communication - Students will document their observations about the barriers faced during the self-learning activity and present the possible solutions for the same.* **2 Hrs.** *9. Assignment on Business Correspondence- practice for drafting various business letters. Students will refer to the various sample business letters collected as self learning activity.* **2 Hrs.** *10. Assignment on creating a speech on the topic- 'Sustainable Development' , in the APA format with proper citations.* **2 Hrs.** *11. Assignment on Verbal Aptitude Test - Two verbal Aptitude Tests will be conducted.* **2 Hrs.**	

	Course Conclusion	**01**
	Total	**60**

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.
7.3.1	Apply and exhibit universal human values and a diverse and inclusive mindset, free of discrimination.
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
9.2.3	Apply efficient and effective communication, keeping in mind the diversity and uniqueness in the team.
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: The learner will be able to-

1. Listen attentively, interpret objectively and evaluate effectively any given technical and non-technical information (LOs 1.2, 1.3, 2.1, 3.1, 3.2)

2. Read and analyse written information such as reports, research articles and other such business documents, paraphrase ethically and summarise effectively. (LOs 2.1, 2.2, 3.3/ SDG-4)

3. Articulate ethically and effectively in a professional setting with the knowledge of channels of communication within an organisation, thus exhibiting a holistic and professional personality (LOs 1.1, 1.3, 3.2, 4.1, 4.2)

4. Apply verbal, written, and digital communication skills effectively in diverse professional contexts to facilitate knowledge sharing and inclusive learning (LOs 1.1, 1.3, 2.2, 4.1, 4.2, 5.1, 5.3/ SDG-4)

5. Advocate ethical and inclusive communication practices that support equitable access to quality education and continuous professional development through praxis of socio-technical research & IPR. (LOs 1.2, 1.4, 5.1, 5.2, 5.3/ SDG-4)

CO-PO Mapping Table with Correlation Level

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

Text Books

1. Sanjay Kumar, Pushp Lata (2018). *Communication Skills*, New Delhi: Oxford University Press

2. Rizvi, A. M. (2010). *Effective Technical Communication: A guide for Scientists and Engineers.*

3. Raman and Sharma. *Technical Communication: Principles and Practices*, Oxford University Press

4. Dahl, R. (1953), "Lamb to the Slaughter". *Harper's Magazine*. Harpers, *"*The Green Leaves*", Land without Thunder, Short Story* by Grace Ogot, East African Publishing House, Kenya, 106

5. Munshi Premchand, *"Stories of Munshi Premchand"/ https://archive.org/details/premchand_201909*

6. Mahashweta Devi*, "Stories of Mahashweta Devi"* Seagull Books */ https://archive.org/details/dli.ernet.287720/page/n1/mode/2up*

7. Ruskin Bond*, " Stories of Ruskin Bond"* Rupa Publications/*https://www.arvindguptatoys.com/arvindgupta/ruskin-stories.pdf*

Reference Books:

1. Dr. K. Alex. Soft Skills , S. Chand Publication , 2009
2. S. C. Gupta. English Grammar and Composition, Arihant Publication, 2014
3. A. Ashley .Oxford Handbook of Commercial Correspondence
4. Lewis N. Word Power made easy. Random House USA

Web Sources:

1. https://bbclearningenglish.org
2. https://www.bbc.co.uk/learningenglish
3. NPTEL course: Technical Communication for Engineers by Prof. Arun K. Saraf, IIT- Roorkee
4. NPTEL course: Speaking Effectively by Prof. Anjali Gera Roy, IIT-Kharagpur
5. NPTEL course: Developing Soft Skills and Personality by Prof. T. Ravichandran, IIT Kanpur

CONTINUOUS INTERNAL EVALUATION (50 Marks)

1. **Listening, Speaking**
   GD/Debating Skills + Group Dynamics (10)
   (Participate in Group Discussion and Debate rounds on various Socio- cultural and ethical topics followed by creating the summary document of the same. The topics for Group Discussion and Debate rounds will cover suggested areas like Gender equality, climate action, quality education, good health and well-being, sustainable communities etc.)

2. **Ethical Case Study Project - Documentation and Presentation (10)**
   Continuous work as an individual with a set due date.
   (Analyse a real life case study based on Socio-Technical problems, study the core ethical dilemma and present alternate solutions for the same.)

3. **Critical Analysis of a Short Story/ Movie and Presentation (10)**
   Continuous work as a team with a set due date.
   (The selected story/movie is based on the themes of social and ethical issues. Summarise and graphically organise (mind mapping) the selected short story/ movie)

4. **Short Technical Paper on any Socio-Technical problem and PPT Presentation OR A Speech on - Sustainable Development Goals (10)**
   Continuous work as an individual with a set due date.
   (Read, analyse and evaluate up to two research papers on the topic of Climate change and Sustainable development and present them in the APA format/ Create a speech on 'Sustainable Development Goals' in APA format with proper citations.

5. **Assignments (05)**
   a) Assignment on Communication Theory- Application questions on Barriers and Methods of communication.
   b) Assignment on Business Correspondence- Drafting 03 practice letters and 03 E-mails.
   c) Solving two verbal aptitude tests.

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

Sustainable Development Goals:

1. SDG9: Industry, Innovation, and Infrastructure

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 in industry regarding the new developments.

Module	Details	Hrs.
	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,	**01**

	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.	**Introduction to Basic Electronic system** ***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.*	**5-7**
	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** ***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.*	**6-8**
	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, 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 identify and describe the components of a generalized measurement system and explain key performance characteristics of measurement 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 fundamental engineering concepts to comprehend generalized measurement system (P.I.-1.3.1)* *LO 4.2: Apply concepts of electronics and communication engineering and allied disciplines to explain key performance characteristics of measurement instruments. (P.I.-1.4.1)* *LO 4.3: 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.*	**2-4**
	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)*	
06.	**Introduction to Sensors** ***Learning Objective/s:*** *To demonstrate competence in engineering fundamentals to comprehend the concepts of sensor as per the application.*	**3-5**
	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, Sensors used in industrial applications.	
	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) SDG9 *LO 6.2: Apply concepts of electronics and communication engineering and allied disciplines to comprehend the types of sensors used in industry and innovation. (P.I.-1.4.1) SDG9*	
	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, LO 4.3*)
5. Apply the fundamentals of engineering to introduce various transducers and sensors to adapt to the current technologies in industry regarding the new developments. *(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	3										2
ESC203.5	3										
Average	3	3	3								2

Text Books :

1. Electronic Devices and Circuit Theory (11th Edition), Robert Boylestad, Pearson Education Limited 2014.
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. Modern Digital Electronics (4th Edition), R. P. Jain, Tata McGraw Hill Education Private Limited.
5. Sensors and Transducers (3rd Edition), Ian Sinclair, BSP Professional Books, 2001.

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-(15 Marks)

1. *Numerical Assignment/s (min 20 problems) – 04 Marks*

2. *Class test based on above numerical assignment – 04 Marks*
3. *Open book test/ Open notes test: 04 Marks*
4. *Regularity and active participation:03 Marks*

2. Mid Semester Exam (20 Marks)

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

END SEMESTER EXAMINATION (40 MARKS)

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

Course Type	Course Code	Course Name	Credits
BSC-LC	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
5. PO11: Life-Long Learning

Sustainable Development Goals:

1. SDG 9: Industry, Innovation, and Infrastructure
2. SDG 11: Sustainable cities and Communities

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.
	Course Introduction	**01**
01.	**Experiment 1** ***Learning Objective:*** *To use the concept of miller indices to identify principal crystal planes in simple cubic structure.*	**02**
	Determination of interplanar distance for principal planes in simple cubic structure.	

	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, 1.3.1, 4.3.1, 4.3.3)*	
02.	**Experiment 2** ***Learning Objective:*** *To simulate XRD pattern for a given crystal system.*	**02**
	Simulation of X-ray Diffraction (XRD) pattern of cubic structure to find lattice parameters.	
	Learning Outcome: *LO2.1. A learner will be able to apply the knowledge of x-ray diffraction and analyze the crystal structure of sodium chloride by simulating XRD pattern using software and write the result. (SDG 9, P.I.- 1.2.1, 1.3.1, 4.1.3, 4.3.3)*	
03.	**Experiment 3** ***Learning Objective:*** *To study the hysteresis loop of a ferromagnetic material.*	**02**
	Determination of area of hysteresis curve (B-H curve) of a ferromagnetic material.	
	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 and write the result. (SDG 9, P.I.- 1.2.1, 1.3.1, 4.3.1, 4.3.3).*	
04.	**Experiment 4** ***Learning Objectives:*** *To determine the parameters which characterize a dielectric material.*	**02**
	Determination of dielectric constant of Bakelite material.	
	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. (SDG 9, P.I.- 1.2.1, 1.3.1, 4.3.1, 4.3.3)*	
05.	**Experiment 5** ***Learning Objective/s:*** *To simulate and visualize structures of various nanomaterials.*	**02**
	Simulation of structures of carbon nanomaterials to find C-C bond length.	
	Learning Outcome :	

	LO5.1: *A learner will be able to apply the knowledge of nanomaterials and analyse the structure using simulation software and write the result. (SDG 9, P.I.- 1.2.1, 1.3.1, 4.1.3, 4.3.3)*	
06.	**Course Project** ***Learning Objective/s:*** *To explore the application of concept of physics in different fields by demonstrating a chosen project.* 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, 1.3.1, 4.2.1, 4.3.1, 8.1.2, 8.3.1,9.1.2, 9.2.2, 11.6.1, 11.6.2)*	**03**
	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 required in industrial technologies through relevant experiments. (SDG 9, *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 that supports materials research and innovation in industries. (SDG 9, *LO 2.1, LO5.1*)

3. Learners will be able to apply fundamental knowledge of physics for the execution, presentation of the chosen project with innovative ideas including sustainable development as a team and write effective report. (SDG 9 & 11, *LO 6.1*)

CO-PO Mapping Table with Correlation Level

CO ID	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BSL203.1	3			3							
BSL203.2	3			3							
BSL203.3	3			3				3	3		3
Average	3			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)

Lab Performance: 10 marks

1. Project (Final Report and Demonstration): 10 marks
2. 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

Program Outcomes addressed:

1. PO1: Engineering Knowledge:
2. PO2: Problem Analysis
3. PO4:Conduct investigation of complex problems
4. PO8: Individual and collaborative teamwork
5. PO9:Communication.
6. PO11: Life-Long Learning.

Sustainable Development Goals (SDG)

SDG 6: Clean water and sanitation

SDG 12: Responsible consumption and production

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 gain experimental skills.
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), (4.2.1), (4.3.1), (4.3.3)	
02.	**Experiment 2** *Learning Objective/s:* *To synthesize thermosetting resin by condensation polymerization and calculate its percent yield and atom economy to determine the nature of reaction.* Synthesis of Urea formaldehyde. ***Self-Learning Topics: Nil*** ***Learning Outcomes:*** *LO-2.1 A learner will be able to synthesize urea formaldehyde resin using condensation polymerization reaction and calculate its yield and atom economy to interpret the nature of reaction.(1.2.1) (1.3.1), (2.2.3), (4.2.1),(4.3.1)).*	**02**
03.	**Experiment 3** *Learning Objective/s:* *To synthesize biodegradable plastic from plant based starch for developing the effective sustainable method.* To synthesize bioplastic from starch based renewable sources. ***Self-Learning Topics: Nil*** ***Learning Outcomes:*** *LO-3.1 A learner will be able to synthesize bioplastic from plant based starch and calculate its yield to demonstrate the sustainable practice.* (1.2.1), (1.3.1), (2.2.3),(2.3.1) (4.3.1) **(SDG12)**	**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), (4.1.3), (4.2.1), (4.3.1), (4.3.3).*	**02**
05.	**Experiment 5** *Learning Objective/s:* *To determine the concentration of iron from given sample using UV-Visible spectrophotometer.* To determine the concentration of iron from water sample using UV-Visiblespectrophotometer. ***(SDG 6)*** ***Self-Learning Topics: Nil*** ***Learning Outcomes:*** *LO-5.1 A learner will be able to measure the absorbance of standard solutions and unknown concentration of water sample to determine its quality using UV-Visible spectrophotometer (1.2.1), (1.3.1), (2.2.3), (4.1.3),(4.2.1),(4.3.1),(4.3.3**).(SDG6)***	**02**
06.	***Demonstration***	**04**

	Learning Objective:	
	To develop the basic knowledge of analytical chemistry using titrimetric experiment.	
	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), (1.3.1), (2.1.3),(2.2.3),(4.2.1),(4.3.1),(4.3.3), (8.1.1), (8.3.1),(9.1.2), (9.1.3), (11.3.2), (11.3.3)*	
	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 numericalproblems.
1.3.1	Apply fundamental engineering chemistry concepts to solve engineering problems.
2.1.3	Identify the engineering chemistry concepts to analyse the given problem
2.2.3	Identify the existing processes/ solution methods for solving the problems
4.1.3	Apply appropriate instrumentation to make measurement of physical and chemical quantity. (modified)
4.2.1	Design and develop an experiment 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/ graphical forms so as to facilitate analysis and explanation of the data and drawing of conclusions.
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.
9.1.1	Read, understand and interpret technical and non-technical information.
9.1.2	Produce clear, well-constructed, and well-supported written project report.
9.1.3	Create flow in a document or presentation - a logical progression of ideas so that the main point is clear
9.2.2	Deliver effective oral presentations to technical and non-technical audiences.
11.3.2	Analyze sourced technical and popular information for feasibility, viability, sustainability, etc.
11.3.3	Demonstrate an ability to identify and analyse new chemical processes and analytical skills in open ended experiments.(New)

Course Outcomes: A learner will be able to -

1. Apply the concepts of electrochemistry and Volumetric analysis for performing the practicals.(*LO- 1.1, LO-4.1)*
2. Analyse the quality of water by spectroscopic technique for promoting sustainable clean water and sanitation practices. (*LO-5.1)* **(SDG 6)**
3. Synthesize polymeric materials to support sustainable development, responsible consumption and production. (*LO-2.1,3.1)* **(SDG 12)**
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			3							
BSL204.2	3			3							
BSL204.3	3			3							
BSL204.4	3	3		3				3	3		3
Average	3	3						3	3		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: Modern tool usage
4. PO9: Communication

Sustainable Development Goals:

1. SDG 4 Quality Education

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.
	Course Introduction This is foundation course which deals with fundamental concepts oftechnical 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.*	**06-08**
	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 AutoCADsoftware to make simple drawings.	
	Lab Activity: To demonstrate the basic commands in AutoCAD software.	
	Learning Outcomes: *A learner will be able to*	

	LO 1.1: Apply mathematical and engineering principles and CAD tools to produce precise 2D engineering drawings by selecting appropriate scales, line types, dimensioning practices, and IS-standard conventions; utilizing AutoCAD commands to generate professional-quality figures. (P.I.-1.1.1, P.I.-1.3.1, P.I.-5.1.1, P.I.-5.2.2, P.I.-9.3.1)	
02.	**Orthographic and Sectional Orthographic Projections**	**18-20**
	Learning Objective: *To develop the imagination in creating the orthogonal and sectional orthographic views for communicating the features in the product.*	
	Contents: **Projection of Points and Lines:** Projection of points in differentquadrants. Projection of lines keeping the ends in different quadrants. **Orthographic Projections:** Concept of First Angle and Third Angle Projection. Fundamentals of Orthographic Projections. Different views ofa simple machine part as per the first angle projection method recommended by I.S. Multi view drawing from pictorial views using CADSoftware (AutoCAD) **Sectional Orthographic Projections:** Full or Half Sectional views of the Simple Machine parts. Sectional view using CAD Software (AutoCAD).	
	Lab Activity 1: To demonstrate the ability to project points and lines located in all four quadrants onto the principal planes by constructing accurate front and top views of each point and line segment ensuring correct reference lines and quadrantal positions.	
	Learning Outcomes: *A learner will be able to* *LO 2.1: Apply fundamental and mechanical engineering concepts to produce accurate orthographic and sectional projections, classifying true and apparent line lengths in quadrants, constructing first angle front, top, and side views, interpreting full and half sections, and applying justified corrections to projection errors. (P.I.-1.3.1, P.I.-1.4.1, P.I.-2.1.3, P.I.-2.2.3)*	
	Lab Activity 2: To demonstrate the ability to convert the isometric drawings into orthogonal and sectional orthographic drawings.	
	Learning Outcomes: *A learner will be able to* *LO 2.2: Apply essential AutoCAD commands to reproduce orthographic and sectional drawings by applying layers, snaps, object tracking, dimensioning, section lines, hatch patterns, and legends to create clear, IS-compliant visuals that support technical reports and presentations. (P.I.-5.1.1, P.I.-5.2.2, P.I.-9.3.1)*	
03.	**Isometric Views**	**10-12**
	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)	
	Lab Activity: To demonstrate the principles of isometric projection by manually constructing an accurate isometric drawing from given orthographic views	
	Learning Outcomes: *A learner will be able to*	

	LO 3.1: Apply fundamental engineering principles to interpret two-dimensional orthographic projections and manually construct precise isometric drawings that accurately convert orthographic views into three-dimensional representations (P.I.-1.3.1, P.I.-2.2.1, P.I.-9.3.1). *LO 3.2: Create 3D model (physical form) from the given orthographic projection. Generate orthographic projection of created model, compare and justify the results. (SDG-4)*	
	Lab Activity: To demonstrate the ability to convert the orthographic views into isometric drawings using Auto CAD.	
	Learning Outcomes: *A learner will be able to* *LO 3.2: Apply mechanical engineering principles to interpret and construct accurate isometric projections by identifying geometric features of components, selecting and justifying manual construction methods, and using AutoCAD commands to generate precise isometric views. (P.I.-1.4.1, P.I.-2.1.3, P.I.-2.2.3, P.I.-5.1.1, P.I.-5.2.2)*	
04.	**Reading of Orthographic Views**	**05-06**
	Learning Objectives: *To develop the ability of the students to read the orthographic and sectional orthographic projections to draw the missing views.*	
	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).	
	Lab Activity: To interpret orthographic and sectional projections, identify any missing views, and manually construct the third view from two given projections to fully represent all features of the object.	
	A learner will be able to *LO 4.1: Apply fundamental engineering concepts to analyze and reconstruct complete orthographic and sectional projections by breaking down two-view drawings to locate missing views, drafting sectional views that expose internal details, and generating sectional projections using projection theory. (P.I.-1.3.1, P.I.-2.2.1)*	
	Lab Activity: To demonstrate the ability to visualize and interpret the missing views of Orthographic projections.	
	Learning Outcomes: *A learner will be able to* *LO 4.2: Apply mechanical engineering principles and leverage AutoCAD drafting commands to interpret two-view projections, generate missing elevations, and produce accurate orthographic and sectional drawings that fully reveal internal features. (P.I.-1.4.1, P.I.-2.2.3, P.I.-9.3.1)*	
05.	**Projection of Planes, Solids and section of solids** ***Learning Objective:*** *To develop the ability to imagine the planes, solid geometries and represent the views in a two dimensional space.*	

	Contents: **Projection of Planes:** Projection of Triangular, Square, Rectangular, Pentagonal, Hexagonal or Circular planes inclined to either HP or VP only. **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). **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)	**12-14**
	Task 1: Projection of Planes: Draw the projection of plane of basic shapes such as triangle, pentagon, hexagon or circle inclined to one of the reference plane (HP or VP)	
	Learning Outcomes: *A learner will be able to* *LO 5.1: Construct and interpret the projections of planes inclined to the HP or VP using standard engineering drawing conventions. (P.I.-1.3.1, P.I.-2.2.3)*	
	Task 2: Projection of Solids: Draw the orthographic projection of three-dimensional objects like prisms, pyramids, cylinders, and cones whose features (axes, surfaces, edges) are inclined to the reference planes to capture their true orientations.	
	Learning Outcomes: *A learner will be able to* *LO 5.2: Apply fundamental engineering concepts to generate orthographic projections of prisms, pyramids, cylinders, and cones whose features (axes, surfaces, edges) inclined to HP or VP. (P.I.-1.3.1, P.I.-1.4.1)*	
	Task 3: Section of Solids: Draw sectional orthographic projections of solid (e.g., prism, pyramid, cylinder, or cone) with a plane perpendicular to one reference plane and inclined to another and then illustrating the front view, top view and true shape of section to expose its internal features, and then illustrating the cut surface in an orthographic section view with appropriate hatching.	
	Learning Outcomes: *A learner will be able to* *LO 5.3: Apply mechanical engineering concepts to produce sectional projections of solids cut by planes inclined to reference planes with correct hatching, annotations, and dimensions. (P.I.-1.4.1, P.I.-2.2.3, P.I.-9.3.1)*	
	Total	**60**

Performance Indicators:

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

2.2.1 Identify standard procedures and justified assumptions applicable to problem-solving.

2.2.3 Identify existing processes/solution methods for solving the problem, including forming justified approximations and assumptions.

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.

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

Course Outcomes: A learner will be able to -

1. Apply engineering principles and CAD software tools to produce, annotate, and document precise 2D engineering drawings by selecting correct line types, scales, dimensioning practices, and IS-standard conventions to generate professional-quality figures. *(LO1.1)*
2. Apply projection principles and CAD techniques to produce accurate orthographic and sectional views by converting isometric drawings into orthographic and sectional projections with appropriate hatching, and annotations per IS standards. *(LO2.1, LO2.2)*
3. Apply engineering principles to interpret orthographic projections and develop isometric views from orthographic projections by applying geometric visualization and CAD commands. *(LO3.1, LO3.2)*
4. Apply fundamental and natural science principles and analyze orthographic and sectional projections to identify and reconstruct missing views by decomposing drawings into sub-problems and employing CAD tools to generate accurate third and sectional projections. *(LO4.1)*
5. Apply natural science and engineering principles to create true-shape auxiliary views of inclined planes, orthographic projections of solids with inclined axes, and sectional views with correct hatching and annotations using auxiliary-plane and change-of-position methods to ensure accuracy. *(LO5.1, LO5.2, LO5.3)*
6. To enable students to improve visualization of basic engineering drawing concepts; through activity based learning which leads to provide quality leaning environment *(LO3.2) (SDG-4)*

CO-PO Mapping Table with Correlation Level

CO ID	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
ESL204.1	3	-	-	-	3	-	-	-	3	-	-
ESL204.2	3	3	-	-	3	-	-	-	3	-	-
ESL204.3	3	3	-	-	3	-	-	-	3	-	-
ESL204.4	3	3	-	-	3	-	-	-	3	-	-
ESL204.5	3	3	-	-	-	-	-	-	3	-	-
ESL204.6	3	3	-	-	-	-	-	-	3		
Average	**3**	**3**	-	-	**3**	-	-	-	**3**	-	-

Text Books :

1. Engineering Drawing (Plane and solid geometry), N.D. Bhatt, 54th Edition, 2023, Charotar Publishing 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 House Pvt. 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

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. Orthographic Projections (2 Problems)
    2. Sectional Orthographic Projections (2 Problems)
    3. Reading of Orthographic Projections (1 Problems)
    4. Isometric Projections (2 Problems)
    5. Projection of Lines (2 Problems)

6. Projection of Planes (2 Problems)
7. Projections of Solids (2 Problems)
8. Section of Solids (1 Problems)

3. Regularity and active participation: 5 marks

4. Laboratory Tests (20 Marks):

A. AutoCAD Exam (10 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.

B. Manual Drawing Lab 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.

5. Collaborative activity on model based visualization and technical Drawing (5 Marks)

End Semester Examination (50 Marks)

Topics for the End Semester Practical Examination (AutoCAD) (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 object will be given as an orthographic views and the task will be to draw the missing view of the given object.

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

Sustainable Development Goals (SDG)

1. SDG 4: Quality Education

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 the concepts of exception handling and multithreading for developing reliable and efficient Java applications.
5. To introduce learners to graphical user interface development using Java Swing components and event handling techniques for creating simple interactive applications.

Module	Details	Hrs.
	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: Java Architecture, Language Basics: Path, class path, command line argument, keywords, basic data types and types of operators, Flow control Statements: if, if-else, nested if, switch, while, do-while, for, enhanced for, break and continue, Arrays: one- and two-dimensional array. **Task 1:** Write a Java program that accepts Store Name and Location as command-line arguments and generate the output in the required format**.** Example: If the command line arguments are **ABC** and **Mumbai** then the output generated should be: Welcome to **ABC** Inventory Store**, Mumbai** [Note: It is mandatory to pass two arguments in command line] *LO 1.1: A learner will be able to develop Java programs using command-line arguments and language fundamentals to create basic inventory management applications. (P.I.-1.3.1, 1.4.1, 5.1.1, 5.1.2)* **Task 2:** Write a program to accept product stock quantity and display: • Out of Stock (0) • Low Stock (<10) • Available Stock (≥10) using conditional statements. *LO 1.2: A learner will be able to apply decision-making constructs to evaluate inventory stock conditions and support operational decision-making. (P.I.-1.3.1, 1.4.1, 2.1.2, 2.4.1, 5.1.1, 5.1.2)* **Task 3:** Write a program to store stock quantities of five products in an array and calculate : Total Stock, Average Stock *LO 1.3: A learner will be able to use arrays to organize and analyze inventory data for efficient resource management and operational planning. (P.I.-1.3.1, 1.4.1, 2.1.2, 2.4.1, 5.1.1, 5.1.2)*	
02.	**Class and object** ***Learning Objective:*** 1. *Learner is expected to gain knowledge of class, object. Also expected to write program using class and object.* 2. *To grasp the fundamental concept of input output. Also expected to writeprogram using different input output constructs.* **Contents:** Classes, objects, Abstraction, Encapsulation, Polymorphism, Input and output functions in Java, scanner class **Task 4:** Create a simple Java class representing an entity Product with: Product ID, Product Name, Product Price, Instantiate and display product objects. *LO 2.1: A learner will be able to design classes and objects to represent inventory entities and support structured software development. (P.I.-1.3.1, 1.4.1, 2.1.2, 2.4.1, 5.1.1, 5.1.2)* **Task 5:** Create a Product class with private attributes such as Product ID, Product Name, and Product Price. Implement getter and setter methods to access and modify product information.	**08**

	LO 2.2: A learner will be able to implement encapsulation to securely manage product information and develop reliable software components. (P.I.-1.3.1, 1.4.1, 2.1.2, 2.4.1, 5.1.1, 5.1.2) **Task 6:** Create a Product class and initialize product details such as Product ID, Product Name, and Product Price using constructors. Display the product information. *LO 2.3: A learner will be able to apply constructor concepts to initialize product attributes and manage inventory records effectively.(P.I.-1.3.1, 1.4.1, 2.1.2, 2.4.1, 5.1.1, 5.1.2)*	
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 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. **Task 7:** Develop a Java program for an Inventory Management System where the base class **Product** stores Product ID and Product Name, and the derived class **ElectronicProduct** stores Brand and Warranty Period. Display the complete product details. *LO 3.1: A learner will be able to design inheritance-based class structures to represent product categories and support efficient inventory management.(P.I.-1.3.1, 1.4.1, 2.1.2, 2.4.1, 5.1.1, 5.1.2)* **Task 8:** Develop a Java program for an Inventory Management System to perform stock management operations. Create an interface Inventory Operations with methods **addStock()** and **removeStock(),** and implement the interface in a **ProductInventory** class to manage product stock levels. *LO 3.2: A learner will be able to implement interfaces to develop reusable inventory operation modules and promote modular software design. (P.I.-1.3.1, 1.4.1, 2.1.2, 2.4.1, 5.1.1, 5.1.2)* **Task 9:** Create a user-defined package **inventory. Management** and store a Product class in the package. Import the package into another Java program and display product information. *LO 3.3: A learner will be able to create and use user-defined packages to organize inventory-related classes and improve code modularity. (P.I.-1.3.1, 1.4.1, 2.1.2, 2.4.1, 5.1.1, 5.1.2)*	

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, Multiple tryand catch blocks, user defined exception. Thread lifecycle, thread class methods, creating threads using extends andimplements keyword. **Task 10:** Develop a Java program to validate inventory data by handling invalid Product ID, negative price, and negative stock quantity using try, catch, finally, throw, and throws. *LO 4.1: A learner will be able to apply exception handling techniques using try, catch, finally, throw, and throws to validate inventory data and improve the reliability of inventory management applications. (P.I.-1.3.1, 1.4.1, 5.1.1, 5.1.2)* **Task 11:** Develop a Java program using multithreading to perform concurrent inventory operations, where one thread updates product stock and another generates an inventory report. *LO 4.2: A learner will be able to apply multithreading techniques to perform concurrent inventory operations and enhance the efficiency and responsiveness of inventory management applications (P.I.-1.3.1, 1.4.1, 5.1.1, 5.1.2)*	
05.	**Graphical User Interface** ***Learning Objective/s:*** 1. *Learner is expected to develop proficiency in the concepts of Swing and GUI components. Also expected to apply them for developing simple graphical user interface applications.* 2. *Learner will gain knowledge of event handling in GUI applications and apply it to develop interactive Java applications using Swing..*	**16**
	Contents: Introduction to GUI, JFrame, JLabel,JTextField,JButton, JTextArea. Event Handling using ActionListener, Developing Simple GUI Applications using Swing. **Task 12:** Develop a Swing-based GUI application to capture and display product information, including Product ID, Product Name, Price, and Quantity, for an Inventory Management System. *LO 5.1: A learner will be able to develop simple Swing-based graphical user interfaces to enter and display product information in an Inventory Management System. (P.I.-1.3.1, 1.4.1, 5.1.1, 5.1.2,11.2.2)**(SDG-4)***	

	Course Conclusion	
	Total	**60**

Performance Indicators:

P.I. No.	P.I. Statement
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 engineering problem.
2.1.2	Identify processes/modules/algorithms of a computer-based system and parameters to solve a problem
2.4.1	Applies engineering mathematics to implement the solution.
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
11.2.2	Recognize the need and be able to clearly explain why it is vitally important to keep current regarding 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.*(LO1.1,LO1.2, LO1.3)*
2. Apply concepts of classes, objects, members of a class and the relationships among them needed for a finding the solution to specific problem.*(LO2.1, LO2.2, LO2.3)*
3. Achieve reusability in programming by using concept of Inheritance, Interface and Packages.*(LO3.1, LO3.2, LO3.3)*
4. Implement concept of Multithreading, and exceptions to obtain robust and faster programmed solutions to problems.*(LO4.1, LO 4.2)*
5. Design and implement simple interactive Java applications using Swing components and event handling techniques for graphical user interface development.*(LO5.1) (SDG-4)*

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			3						
ESL205.4	3				3						
ESL205.5	3		3		3						3
Average	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://nptel.ac.in/courses/106105191
2. Web link- www.w3schools.com
3. Web link- www.tutorialspoint.com
4. Web link-https://starcertification.org/Certifications/Certificate/securejava

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

1. Task Execution (20 Marks)

Students will be given minimum 12 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 (03 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 (03 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 (03 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 (03 marks)

2. Continuous In-semester Assessment (CIA) (10 Marks)

3. Regularity and active Participation (05 Marks)

4. Course Project Evaluation (15 Marks)

Course Project:

- Minimum 3-4 members in a group.
- A suggestive list of course-projects is given here. Similar course-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

Course Project assessment is based on project work demonstration followed by question and answers with following rubrics

1. **Application Design and Implementation** – Problem understanding, solution design, and implementation of Java concepts (03 marks)
2. **Functionality and Output** – Correct working of the application and achievement of intended objectives. (03 marks)
3. **Demonstration and Viva** – Ability to explain program logic, concepts used, and answer questions. (02 marks)
4. **Innovation and User Interface** – Creativity, usability, GUI, and additional features implemented. (02 marks)

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

1. Task Execution: (**20 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. MCQ: **(15 Marks)**
3. Oral: (**15 Marks)**

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

Course Type	Course Code	Course Name	Credits
ESL	ESL 206	BASIC ELECTRONICS ENGINEERING LABORATORY	02

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

Pre-requisite:

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

Program Outcomes addressed:

1 PO2: Problem Analysis
2 PO3: Design / Development of Solutions
3 PO4: Conduct investigations of complex problems
4 PO5: Modern tool usage
5 PO6: The engineer and society
6 PO8: Individual and Team work
7 P09: Communication
8 P11: Life-long learning

Sustainable Development Goals:

1. SDG9 Industry, Innovation and Infrastructure

Course Objectives:

1. To familiarize with electronics components, measuring devices, source devices for building and analyse analog/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.
	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.	**Electronic Devices (Expected to perform all)** ***Learning Objective:*** ***Learner is expected to analyze experimental results to validate theoretical concepts and understand practical implications. Evaluate circuit parameters to achieve desired performance characteristics.***	**8**
	Contents: **Task 1: Study of CRO & Measurement of Voltage Amplitude &**	

	Frequency. *LO 1.1: A learner will be able to identify the features of CRO and able to measure the amplitude and frequency for a specific signal source and extract desired understanding and conclusions consistent with objectives in a team. (P.I. - 1.3.1, P.I-2.4.4, P.I-8.3.1, P.I-11.1.3)* **Task 2: Testing of Components using Instruments and fault detection.** *LO 1.2: A learner will be able to identify the components, apply the relevant knowledge, measure the values manually and validate it with the help of instruments. (P.I. – 1.4.1, P.I. - 2.1.3, P.I.-2.4.2)* **Task 3: V.I Characteristics of Si or Ge and Zener Diode** *LO 1.3: A learner will be able to identify the important features of the electronic device through data sheets and interpret the VI graph to determine the diode parameters like knee voltage, saturation current etc.in a team to access new source of information. (P.I. – 1.4.1, P.I.-2.3.2, P.I. – 4.1.4, P.I-8.1.1, P.I-11.3.1)* **Task 4: Applications of Diode: Clipper/Clamper/Rectifiers for industrial applications** *LO 1.4: A learner will be able to identify the working principles of diode-based clipper, clamper, and rectifier circuits, correctly interprets results and relates them to circuit structure uses CRO/multimeter to take accurate measurements and documents the results in the form of waveforms. (P.I. – 1.4.1, P.I.-2.3.2, P.I. – 4.1.4, P.I-8.1.1, P.I-11.3.1).* **Task 5: Characteristics of BJT in Common Emitter Configuration.** LO 1.5: *A learner will able to identify the proper choice of devices with given specifications, uses voltmeter/ammeter/CRO to take correct readings at various bias levels and accurately plot graph in a team. (P.I. – 1.4.1, P.I.-2.3.2, P.I. – 4.1.4, P.I-8.1.1, P.I-11.3.1).*	
02.	**Digital Circuits (Any 3)**	**8**
	Learning Objective: *Learner is expected to recall basics of Digital Circuit Design. Also expected to apply it to solve any Boolean expression.*	
	Contents: **Task 6: Introduction to Logic Gates – NOT, AND, OR, NAND NOR andXOR.** *LO 2.1: A learner will be able to 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- 1.3.P.I.-2.4.1, P.I.-8.3.1)* **Task 7: For a given Boolean expression, design and verify the circuit using Universal Gates.** *LO 2.2: A learner will be able to identify the ICs required for the design for given specifications, devise a best fitting design solution, verify a given Boolean expression and validate the theoretical results with hardware in a team or make an attempt to independently tackle the problem with the help of instructor materials. (P.I- 1.4.1, P.I-2.4.2, P.I.- 3.3.3, P.I.- 9.3.1, P.I-11.1.3)* **Task 8: Application of basic gates in fire/burglar alarms.** **Task 9: Clock Generator using NAND gate.** *LO 2.3: A learner will be able to identify the ICs required for the above given application, devise a best fitting design solution, verify a given Boolean expression and validate the theoretical results with hardware in a team or find the gap on using the particular IC and close the gap. (P.I- 1.4.1, P.I-2.4.2, P.I.- 3.3.3, P.I.- 9.3.1, P.I-11.1.2)*	
03.	**Sensor/ Transducer Applications (Any one)**	

	Learning Objective: *Learner is expected to know* ***the fundamentals of sensor/transducer and model or trouble shoot the basic data acquisitionsystem.***	
	Sample Task List 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 *LO 3.1: A learner will be able to identify and analyze various sensors required for a particular application, breakdown the problem into sub parts collect the data, test, check/troubleshoot for the working, sustainability and verify with the help of equipment's ((CRO, multimeter) as a team. (P.I- 1.3.P.I.-2.2.1, P.I-4.3.1, P.I-6.3.1, P.I.-8.3.1, , P.I.-9.3.1, P.I-11.1.3)*	**4**
04.	**Real Time Applications (Any one)** ***Learning Objectives:*** *Learner is expected to* develop practical electronic skills through designing and implementing real-lifeapplications..	**8**
	Sample Task List 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 *LO 4.1: The learner will be able to recognize any real time application which can be one of the above or of own interest, that is only to test with software/hardware, their troubleshooting skills in implementing the simple real-life applications in a team. (P.I- 1.4.1,.P.I.-2.2.1, P.I-4.3.1, P.I-5.3.3,P.I-6.3.1, P.I.-8.3.1,P.I.- 9.3.1, P.I-11.3.1)*	
	Course Conclusion	**01**
	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 concepts of electronics and communication engineering and accepted practice areas to solve engineering problems.
2.1.3	Identify the mathematical, engineering and other relevant knowledge that applies to a given problem.
2.2.1	Breakdown complex problem into interconnected sub parts and analyse by proper assumptions/ justification from information and resources.
2.3.2	Identify assumptions (mathematical and physical) necessary to allow modelling of a system at the level of accuracy required.
2.4.1	Apply engineering mathematics and computations to solve mathematical models
2.4.2	Produce and validate results through skilful use of contemporary engineering techniques.
2.4.4	Extract desired understanding and conclusions consistent with objectives and limitations of the analysis
3.3.3	Identify relevant data from the given resources and arrive at a best fitting design solution for particular specifications.
4.1.4	Establish a relationship between measured data and underlying physical principles.
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.
6.1.1	Recognize sources of error in measurements, modelling or simulations and verify credibility of results.
6.3.1	Understand the relationship between the technical, socio-economic and environmental dimensions of sustainability
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
9.3.1	Create engineering-standard figures, reports and drawings to complement writing and presentations
11.1.2	Identify deficiencies or gaps in knowledge and demonstrate an ability to source information to close this gap
11.1.3	Develop ability to learn independently through methods distinct from instructor provided materials.
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, LO1.3, LO1.4, LO1.5*)
2. Demonstrate and analyze the use of basic gates and apply it in various applications in digital domain. (*LO 2.1, LO 2.2, LO 2.3*)
3. Analyse sensors/transducers and assemble a prototype for a basic industrial acquisition system. (*LO 3.1*)
4. Design analyse, test, and ensure functionality of real-life electronic industrial applications using acquired skills and electronic test instruments. (*LO 4.1)*

CO-PO Mapping Table with Correlation Level

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

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).

IN-SEMESTER ASSESSMENT (50 MARKS)

1. Continuous Assessment - Lab-(25 Marks)

1. Lab Experiments: 10 Marks
2. Internal Assessment:
   i. Practical Test 1 (Based on Course Project): 5
   ii. Practical Test 2 (Based on remaining 100% of the Practical list):5
3. Regularity and active participation: 5 marks

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

Examination Scheme		
Term Work	**Practical /Oral**	**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

Sustainable Development Goals:

1. SDG 4 – Quality Education
2. SDG 9 – Industry, Innovation and Infrastructure
3. SDG 12 - Responsible Consumption and Production

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) SDG 4* *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) SDG 9* *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) SDG 9, SDG 12*	
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) SDG 9, SDG 12*	

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*)
4. Demonstrate the forging operation with the help of a simple job. (*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
VEC	VEC201	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

CO-PO Mapping Table with Correlation Level

CO ID	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
VEC101.1	-	-	-	-	-	3	3	-	-	-	3
VEC101.2	-	-	-	-	-	3	3	-	-	-	3
VEC101.3	-	-	-	-	-	3	3	-	-	-	3
VEC101.4	-	-	-	-	-	3	3	-	-	-	3
VEC101.5	-	-	-	-	-	3	3	-	-	-	3
Average	-	-	-	-	-	**3**	**3**	-	-	-	**3**

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

IN-SEMESTER ASSESSMENT (50 MARKS)

Continuous Assessment - Theory-(50 Marks)

Suggested breakup of distribution

a. MCQ-1: 20 Marks
b. MCQ-2: 20 Marks
c. Assignment: 05 Marks
d. Regularity and active participation: 05 Marks