PPSU

P P SAVANI UNIVERSITY

SCHOOL OF ENGINEERING

B. TECH. (CHEMICAL ENGINEERING)

SYLLABUS BOOK

AY 2025-26

INSTITUTE VISION
To emerge as an Institute of Excellence by imparting value-based education aided with Research, Innovation and Entrepreneurial skills.

INSTITUTE MISSION	
1.	To impart the holistic engineering education of highest quality & prepare socially responsible professionals with entrepreneurial skills.
2.	To prepare value-aided engineering professionals to meet up global industry requirements by imparting cutting edge professional education.
3.	To inculcate the attitude of research and innovation among the stake holders through experiential and project-based teaching-learning pedagogy.
4.	To acquire global talent pool by providing world class amenities for teaching, learning & research.

Graduates will demonstrate ability to:

PEO No	PROGRAMME EUCATIONAL OBJECTIVES
PEO 1	Solve real-world engineering problems, design and develop innovative and cost-effective solutions exhibiting engineering skills/fundamentals to cater needs of society.
PEO 2	Excel in Industry/technical profession, higher studies, and entrepreneurship exhibiting comprehensive competitiveness.
PEO 3	Exhibit professional ethics & values, effective communication, teamwork, multidisciplinary approach, and ability to relate engineering issues to broader societal framework.

PO No	PROGRAMME OUTCOMES
PO 1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
PO 2	Problem analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first-principles of mathematics, natural sciences and engineering sciences.
PO 3	Design/development of solutions: Design solutions for complex engineering problems and design system-components or processes that meet specified needs with appropriate consideration for public health & safety, cultural, societal and environmental considerations.
PO 4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis & interpretation of data, and synthesis of information to provide valid conclusions for complex problems.
PO 5	Engineering Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering & IT tools including prediction and modelling to engineering activities, with an understanding of their limitations.
PO 6	The Engineer and The World: Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice; understand the impact of engineering solutions in societal and environmental contexts, and demonstrate knowledge of, and need for, sustainable development.
PO 7	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.
PO 8	Individual and Collaborative Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 9	Communication: Communicate effectively on engineering activities with the engineering community and with society at large—such as being able to write reports, design documentation, make effective presentations and give/receive instructions.
PO 10	Project Management and Finance: Demonstrate knowledge and understanding of engineering and management principles and apply these to one's work, as a member or leader in a team in a multidisciplinary environment to manage projects.
PO 11	Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Credit Guidelines (General)			
Component	**Hour/Week**	**Credit**	**Total Hours/Semester**
Theory	1	1	15
Practical	2	1	30
Tutorial	1	1	15
Note: In specific cases; extra credits can be granted for specific/important subjects.			

CO-PO Mapping Guidelines		
Mapping Level	**% age Mapping**	**Indicator**
0 / -	0	No Mapping
1	0-33	Low Level (Slightly Mapped)
2	33-66	Medium Level (Moderately Mapped)
3	>66	High Level (Strongly Mapped)

Syllabus Book

B. Tech.
(Chemical Engineering)

P P Savani University

School of Engineering

Effective From: 2025-26

Authored by: P P Savani University

CONTENT

FIRST YEAR B. TECH.

P P SAVANI UNIVERSITY

SCHOOL OF ENGINEERING

TEACHING & EXAMINATION SCHEME FOR FIRST YEAR B.TECH. (ALL PROGRAMME) AY: 2025-26

Sem	Course Code	Course Title	Offered By	Teaching Scheme					Examination Scheme						
				Contact Hours				Credit	Theory		Practical		Tutorial		Total
				Theory	Practical	Tutorial	Total		CE	ESE	CE	ESE	CE	ESE	
1 OR 2	SESH1110	Calculus	SH	3	0	2	5	5	40	60	0	0	100	0	200
	SEME1210	Basics of Mechanical Engineering	ME	3	0	2	5	5	40	60	0	0	40	60	200
	SEIT1210	Python for Engineers	CE	3	2	0	5	4	40	60	40	60	0	0	200
	SESH1130	Experimental Physics	SH	3	2	0	5	4	40	60	40	60	0	0	200
	CFLS2130	Intermediate Communicative English	CFLS	3	0	0	3	3	40	60	0	0	0	0	100
	SESH1120	Linear Algebra	SH	3	0	2	5	5	40	60	0	0	100	0	200
	SECV1210	Basics of Civil Engineering	CV	3	0	2	5	5	40	60	0	0	40	60	200
	SECE1210	Programming with C Essentials	CE	3	2	0	5	4	40	60	40	60	0	0	200
	SEEC1210	Basics of Electrical and Electronics	EC	3	2	0	5	4	40	60	40	60	0	0	200
	SEME1220	Engineering Workshop	ME	0	2	0	2	2	0	0	100	0	0	0	100
	SECE1220	Digital Proficiency	CE	3	0	0	3	3	40	60	0	0	0	0	100
						Total	**48**	**44**							**1900**

Group 1	SESH1110	Calculus	SH	3	0	2	5	5	40	60	0	0	100	0	200
	SEME1210	Basics of Mechanical Engineering	ME	3	0	2	5	5	40	60	0	0	40	60	200
	SEIT1210	Python for Engineers	CE	3	2	0	5	4	40	60	40	60	0	0	200
	SESH1130	Experimental Physics	SH	3	2	0	5	4	40	60	40	60	0	0	200
	CFLS2130	Intermediate Communicative English	CFLS	3	0	0	3	3	40	60	0	0	0	0	100
						Total	**23**	**21**							**900**
Group 2	SESH1120	Linear Algebra	SH	3	0	2	5	5	40	60	0	0	100	0	200
	SECV1210	Basics of Civil Engineering	CV	3	0	2	5	5	40	60	0	0	40	60	200
	SECE1210	Programming with C Essentials	CE	3	2	0	5	4	40	60	40	60	0	0	200
	SEEC1210	Basics of Electrical and Electronics	EC	3	2	0	5	4	40	60	40	60	0	0	200
	SEME1220	Engineering Workshop	ME	0	2	0	2	2	0	0	100	0	0	0	100
	SECE1220	Digital Proficiency	CE	3	0	0	3	3	40	60	0	0	0	0	100
						Total	**25**	**23**							**1000**

P P Savani University
School of Engineering

Department of Science and Humanities

Course Code: SESH1110
Course Name: Calculus
Prerequisite Course/s: Algebra, Geometry, Trigonometry & Pre-Calculus till 12th Standard level

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
03	-	02	05	40	60	-	-	100	-	200

CE: Continuous Evaluation, ESE: End Semester Exam

Objective(s) of the course:

To help learners to

- summarize concept of calculus to enhance ability of analysing mathematical problems.
- acquire knowledge and ability to work with differentiation and integration for applications of mathematical techniques in engineering.
- develop the tool of convergence or divergence of any infinite series and power series for learning advanced Engineering Mathematics.
- acquire knowledge of partial differentiation and ability to work with applications to advancedEngineering Mathematics.
- application of concavity of graph and find out points of inflection.

Course Content:

Module No.	Content	Hours	Weightage in %
1.	**Calculus** Limits, Continuity, Types of Discontinuity, Successive Differentiation,Rolle's Theorem, LMVT, CMVT, Maxima and Minima.	09	20
2.	**Sequence and Series-I** Convergence and Divergence, Comparison Test, Integral Test, RatioTest, Root Test, Alternating Series, Absolute and Conditional Convergence.	09	20
3.	**Sequence and Series-II** Power series, Taylor and Maclaurin series, Indeterminate forms andL'Hospital's Rule.	05	10
4.	**Partial Derivatives** Function of several variables, Partial differentiation, Applications, Chain rule, Linear approximations, Maxima and Minima, Euler's theorem, Lagrange multiplier.	11	30
5.	**Curve tracing** Tracing of Cartesian Curves, Polar Coordinates, Polar and ParametricForm of Standard Curves, Areas and Length in Polar co-ordinates	11	20
	TOTAL	45	100

List of Tutorials:

Sr. No.	Name of Tutorial	Hours
1.	Calculus-1	04
2.	Calculus-2	04
3.	Calculus-3	02
4.	Sequence and Series-1	04
5.	Sequence and Series-2	02
6.	Sequence and Series-3	02
7.	Partial Derivatives-1	04
8.	Partial Derivatives-2	02
9.	Curve tracing-1	04
10.	Curve tracing-2	02
	TOTAL	30

Text Book:

Title	Author(s)	Publication
Thomas' Calculus	George B. Thomas, Maurice D. Weir and Joel Hass	Pearson
Elementary linear Algebra	Howard Anton and Chrish Rorres	Wiley

Reference Book:

Title	Author(s)	Publication
Advanced Engineering Mathematics	E Kreyszig	John Wiley and Sons
A textbook of Engineering Mathematics	N P Bali and Manish Goyal	Laxmi
Higher Engineering Mathematics	B S Grewal	Khanna
Engineering Mathematics	T Veerarajan	Tata Mc Graw Hill
Engineering Mathematics-1 (Calculus)	H. K. Dass and Dr. Rama Verma	S. Chand

Course Evaluation:

Theory:

- Continuous Evaluation consists of two tests, each of 30 marks and 1 hour of duration and average ofthe same will be converted to 30 marks.
- Faculty evaluation consists of 10 marks as per the guidelines provided by the Course Coordinator.
- End Semester Examination consists of 60 marks.

Tutorial:

- Continuous Evaluation consists of performance of tutorial which will be evaluated out of 10 marks for each tutorial and average of the same will be converted to 50 marks
- Continuous Evaluation consists of self-performance assignment to 20 marks.
- Internal Viva consists of 30 marks.

Course Outcome(s):

After the completion of the course, the student will be able to

SESH1110	CALCULUS
CO 1	Recall the concepts of limit, continuity and differentiability for analysing mathematical problems.
CO 2	Analyze the series for its convergence and divergence to solve real world problems.
CO 3	Evaluate various limit problems using L' Hospital's rule.
CO 4	Identify the ordinary differentials and partial differentials and solve the maximum and minimum value of function.
CO 5	Construct the graphs for function with intervals and identify more application for function.

Mapping of CO with PO

SESH1110	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO 1	2	3	1	1							1
CO 2	3	2	1								1
CO 3	2	2	1								
CO 4	2	2	1	1							1
CO 5	2	2	1								1

Mapping of CO with PSO

SESH1110	PSO1	PSO2	PSO3
CO 1	1	1	3
CO 2	2	3	2
CO 3	2	2	2
CO 4	1	1	
CO 5	1	3	1

Level of Bloom's Revised Bloom's Taxonomy in Assessment

1: Remember	2: Understand	3: Apply
4: Analyze	5: Evaluate	6: Create

Module No	Content	RBT Level
1	Calculus	1, 2, 3, 4, 5
2	Sequence and Series – I	1, 2, 3, 4, 6
3	Sequence and Series – II	1, 2, 3, 4, 6
4	Partial Derivatives	1, 2, 3, 4, 5
5	Curve tracing	1, 2, 3, 4, 5, 6

P P Savani University
School of Engineering

Department of Mechanical Engineering

Course Code: SEME1210
Course Name: Basics of Mechanical Engineering
Prerequisite Course(s): -- None

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
03	-	02	05	40	60	-	-	40	60	200

CE: Continuous Evaluation, ESE: End Semester Exam

Objective(s) of the Course:
To help learners to

- study the fundamentals of mechanical systems.
- study and appreciate significance of mechanical engineering in different fields of engineering.
- carry out simple land survey and recent trends in civil engineering.
- understand components of building, building terminology and construction materials.

Course Content:

Module No.	Content	Hours	Weightage in %
1.	**Introduction to Boiler:** Introduction, Fundamental Principles, Classification	07	15
2.	**Classification of Engineering Materials:** Classification of engineering material, composition of cast iron, mechanical properties and uses; Alloy steel and their applications; Stress-Strain diagram, Hooks law and modulus of elasticity. Tensile, shear and hardness.	10	20
3.	**Fluids:** Fluid properties, pressure, density and viscosity; pressure variation with depth, static and kinetic energy; Bernoulli's equation for incompressible fluids, viscous and turbulent flow and Metacentric height.	04	08
4.	**Measurement:** Temperature, pressure, velocity, flow, strain, force and torque measurement, concept of measurement error & uncertainty analysis, measurement by Vernier caliper, micrometer, dial gauges, slip gauges, sine-bar and combination set.	06	12
6.	**Basic Concepts of Thermodynamics:** Prime Movers - Meaning and Classification; the Concept of Force, Pressure, Energy, Work, Power, System, Heat, Temperature, Specific Heat Capacity, Internal Energy, Specific Volume; Thermodynamic Systems, All Laws of Thermodynamics	04	09
7.	**Basics of I.C Engines:** Construction and Working of 2 Stroke & 4 Stroke Petrol andDiesel Engines, Difference Between 2-Stroke - 4 Stroke Engine & Petrol-Diesel Engine, Efficiency of I. C. Engines	08	18

8.	**Power Transmission Elements:** Construction and Applications of Couplings, Clutches and Brakes, Difference Between Clutch and Coupling, Types ofBelt Drive and Gear Drive	06	18
	TOTAL	**45**	**100**

List of Tutorials:

Sr. No.	Name of Tutorials	Hours
1.	To understand construction and working of various types of boilers	04
2.	To understand construction and working of mountings	04
3.	To understand construction and working of accessories	04
4.	To understand construction and working 2 –stroke & 4 –stroke Petrol Engines	04
5.	To understand construction and working 2 –stroke & 4 –stroke Diesel Engines	04
6.	To understand the types of hardness test	04
7.	To understand the stress-strain curve for ductile and brittle material	04
8.	To understand the basic concept of metacentric height	02
	TOTAL	**30**

Text Book(s):

Title	Author(s)	Publication
Elements of Mechanical Engineering	S. B. Mathur, S. Domkundwar	Dhanpat Rai & Sons Publications
Material Science	Narula	TMH
Basic Mechanical Engineering	Agrawal B & CM	TMH
Instrumentation and Measurement	Nakra and Chaudhary	TMH
Combustion Engines	Ganesan	TMH.

Reference Book(s):

Title	Author(s)	Publication
Thermal Engineering	R. K. Rajput	Laxmi Publications
Basic Mechanical Engineering	T.S. Rajan	Wiley Eastern Ltd., 1996.

Web Material Link(s):

- http://nptel.ac.in/course.php
- http://nptel.ac.in/courses/105107157/
- http://nptel.ac.in/courses/105101087/
- http://nptel.ac.in/courses/105107121/
- http://nptel.ac.in/courses/105104100/

Course Evaluation:

Theory:

- Continuous evaluation consists of two tests each of 30 marks and 1 hour of duration and average of the same will be converted to 30 marks.
- Faculty evaluation consists of 10 marks as per the guidelines provided by Course Coordinator.
- End Semester Examination will consist of 60 marks.

Tutorial

- Continuous Evaluation consists of performance of tutorial which will be evaluated out of 10 marks for each tutorial and average of the same will be converted to 40 marks.

- External Practical viva consists of 60 marks.

Course Outcome(s):

After the completion of the course, the following course outcomes will be able to:

SEME1210	BASICS OF MECHANICAL ENGINEERING
CO 1	Understand the concept of Boiler, Material types and its application.
CO 2	Understand the Fluid properties and measurement process.
CO 3	Understand the concept of basic thermodynamics
CO 4	Comprehend the importance of mechanical engineering equipments like IC engine and power transmission elements.
CO 5	Analyze mechanical properties of materials and apply concepts of stress–strain relationships and elasticity in engineering problems.

Mapping of CO with PO

SEME1210	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO 1	2	3	1	3	2	2					2
CO 2	2	3	1	3	2	2					2
CO 3	1	3	1	3	2	2					2
CO 4	1	3	1	3	2	2					2
CO 5	1	3	1	1	2	2					2

Mapping of CO with PSO

SEME1210	PSO1	PSO2	PSO3
CO 1	2	2	2
CO 2	2	2	2
CO 3	3	2	2
CO 4	3	2	2
CO 5	2	2	2

Level of Bloom's Revised Bloom's Taxonomy in Assessment

1: Remember	2: Understand	3: Apply
4: Analyze	5: Evaluate	6: Create

Module No	Content	RBT Level
1	Introduction to Boiler	1, 2, 3
2	Classification of Engineering Materials	1, 2
3	Fluids	1, 2
4	Measurement	1, 2
5	Basics Concept of Thermodynamics	1, 2, 3
6	Basics of I.C. Engines	1, 2
7	Power Transmission Elements	1, 2
8	Power Transmission Elements	1, 2, 3

P P Savani University
School of Engineering
Department of Computer Engineering

Course Code: SEIT1210
Course Name: Python for Engineers
Prerequisite Course(s): --

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
03	02	-	04	40	60	40	60	-	-	200

CE: Continuous Evaluation, ESE: End Semester Exam

Objective(s) of the Course:
To help learners to

- understand the basic object-oriented programming.
- identify an appropriate approach to solve computational problems.
- develop logic building and problem-solving skills.

Course Content:

Module No.	Content	Hours	Weightage in %
1.	**Introduction to Python** History, Features of Python, Applications of Python, Working with Python, Input and Output Functions in Python, Variable, Assignment, Types, Basic Operators, Expressions and Types of Data Int, Float, Complex, String, List, Tuple, Set, Dictionary and its Methods, Type Conversions, Comments, Input Processing and output.	04	07
2.	**Decision Structures in Python** Conditional Blocks Using if, Else and Else If, Simple for Loops in Python, For Loop Using Ranges, String, List and Dictionaries Use of While Loops in Python, Loop Manipulation Using Pass, Continue, Break and Else	04	07
3.	**Array and Strings in Python** Arrays, Basic Strings, Accessing Strings, Basic Operations, String Slicing, Testing, Searching and Manipulating Strings, Function and Methods.	03	08
4.	**Dictionary, List, Tuples and Sets** Dictionaries, Accessing Values in Dictionaries, Working with Dictionaries, Properties, Functions and Methods. Sets, Accessing Values in Set, Working with Set Properties, Functions and Methods, Tuple, Accessing Tuples, Operations, Working, Functions and Methods. List, Accessing List, Operations, Working With Lists, Function and methods, two-dimensional lists.	05	10
5.	**Functions, Modules and Packages in Python** Introduction to Functions, defining a Function, Calling a Function, Types of Functions, Function Arguments, Anonymous Functions, Global and Local Variables, Importing Module, Math Module, Random Module, Introduction to Packages: Numpy, Pandas, Matplotlib.	07	14
6.	**Python Object Oriented Programming** OOP Concept of Class, Object and Instances, Constructor, Class, Attributes, Methods, Using Properties to Control Attribute Access, and Destructors, Inheritance, Overloading Operators. Objects in Python: Creating Python Classes, Modules and Packages, Inheritance in Python, Polymorphism in Python.	08	16
7.	**Files & Regular Expression in Python** Introduction to File Input and Output, Writing Data to a File, Reading Data from	05	15

	a File, Additional File Methods, Using Loops to Process Files, Processing Records, RE Module, Basic Patterns, Regular Expression Syntax, Regular Expression Object, Search Object, Findall method, Split method, Sub Method.		
8.	**Exception Handling in Python** Handling IO Exceptions, Working with Directories, Metadata, Errors, Run Time Errors, The Exception Model, Exception Hierarchy, Handling Multiple Exceptions, Throwing Mechanism, Catching Mechanism	05	09
9.	**Building Desktop Application** Exploring the Tkinter Library in Python, Creating basic Desktop application using Tkinter	04	14
	TOTAL	**45**	**100**

List of Practical:

Sr. No.	Name of Practical	Hours
1.	Introduction to Python (Introduction to IDLE, different data types, Input Output in Python, Operators, Operator precedence).	04
2.	Manipulation of Strings.	04
3.	Implementation of Dictionaries, Sets in Python.	03
4.	Implementation of Tuples and Lists in Python.	03
5.	Working with decision structures in Python	04
6.	Working with functions and modules in Python	02
7.	Working with Object-oriented paradigms in Python	04
8.	Implementation of file handling in Python.	02
9.	Exception handling in Python	02
10.	Building desktop application of your own calculator in Python.	02
	TOTAL	**30**

Text Book(s):

Title	Author/s	Publication
Python approach Programming: A modular	Sheetal Taneja, Naveen Kumar	Pearson

Reference Book(s):

Title	Author(s)	Publication
Think Python: How to Think Like a Computer Scientist	Allen Downey	Green Tea Press
Python Cookbook	David Ascher, Alex Martelli Oreilly	O Reilly Media

Web Material Link(s):

- https://www.tutorialspoint.com/python/
- https://www.w3schools.com/python/
- https://onlinecourses.nptel.ac.in/noc20_cs83/preview

Course Evaluation:

Theory:

- Continuous Evaluation consists of two tests, each of 30 marks and 1 hour of duration and average of the same will be converted to 30 marks.
- Faculty evaluation consists of 10 marks as per the guidelines provided by the Course Coordinator.
- End Semester Examination consists of 60 marks.

Practical:

- Continuous Evaluation consists of practical performance which should be evaluated out of 10 for each practical and average of the same will be converted to 20 marks.
- Internal viva consists of 20 marks.
- Practical performance/quiz/test consists of 30 marks during End Semester Exam.
- Viva-voce consists of 30 marks during End Semester Exam.

Course Outcome(s):

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

SEIT1210	PYTHON FOR ENGINEERS
CO 1	Interpret the fundamental python syntax, semantics and fluent in the use of python control flow statements.
CO 2	Determine the methods to create and manipulate python programs by utilizing the data structures like lists, dictionaries, tuples and sets.
CO 3	Articulate the object-oriented programming concepts such as encapsulation, inheritance and polymorphism as used in python.
CO 4	Identify the commonly used operations involving file systems and regular expressions.
CO 5	Design object-oriented and GUI-based Python applications.

Mapping of CO with PO

SEIT1210	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P010	PO11
CO 1	2	2			2				1		1
CO 2	3	3	1		3				1		2
CO 3	2	3	2		2				1		2
CO 4	2	2	1	1	3				1		2
CO 5	2	2	3	1	3	1		1	2	1	2

Mapping of CO with PSO

SEIT1210	PSO1	PSO2	PSO3
CO 1	2	3	1
CO 2	2	1	2
CO 3	2	3	3
CO 4	3	3	3
CO 5	2	2	2

Level of Revised Bloom's Taxonomy in Assessment

1: Remember	2: Understand	3: Apply
4: Analyze	5: Evaluate	6: Create

Module No	Content	RBT Level
1.	Introduction to Python	1,2,4
2.	Decision Structures in Python	1,2,3
3.	Array and Strings in Python	1,2,3
4.	Dictionary, List, Tuples and Sets	2,3,4
5.	Functions, Modules and Packages in Python	2,3,4
6.	Python Object Oriented Programming	3,4,6
7.	Files & Regular Expression in Python	3,4.6
8.	Exception Handling in Python	3,4,5
9.	Building Desktop Application	2,3,4

P P Savani University
School of Engineering

Department of Science and Humanities

Course Code: SESH1130
Course Name: Experimental Physics
Prerequisite Course(s): --

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
03	02	00	04	40	60	40	60	00	00	200

CE: Continuous Evaluation, ESE: End Semester Exam

Objective(s) of the Course:
To help learners to
- Prepare students for career in engineering where physics principles can be applied for the advancement of technology.
- Think in core concept of engineering application by studying various topics involved in branch specific application.

Course Content:

Module No.	Content	Hours	Weightage in %
1	**QUANTUM PHYSICS** (Prerequisites: Dual nature of radiation, Photoelectric effect Matter waves, wave nature of particles, de-Broglie relation, Davisson-Germer experiment). Introduction; De Broglie hypothesis of matter waves; Properties of matter waves; Wave function; Physical interpretation of wave function; Phase velocity and group velocity and their relation; Heisenberg uncertainty principle; non-existence of electron in nucleus; Schrodinger's time dependent wave equation; time independent wave equation; Quantum Computing (overview).	07	16
2	**Acoustic and Ultrasonic** (Prerequisites: Sound, propagation of sound, concept of frequency and wave length). Acoustic – Introduction, Classification and Characterization of Sound, Sabine's formula for reverberation (without derivation), Absorption Coefficients, Sound Absorbing Materials, factors affecting the acoustics of buildings and remedies, Sound Insulation. Ultrasonic – Introduction, Properties of Ultrasonic, Generation of Ultrasonic sound: Piezoelectric & Magnetostriction effect, Applications of Ultrasonic.	07	16
3	**LASER AND FIBRE OPTICS** (Prerequisites: Absorption, recombination, Valance and conduction bands, refractive index of a material, Snell's law) LASER – Introduction, Characteristics, Absorption, Spontaneous and stimulated emission; metastable state, population inversion, Pumping mechanism, components of LASER; Nd:YAG Laser, Applications of LASER, Interference, Diffraction, Diffraction grating. FIBRE OPTICS – Introduction, Optical Fiber construction, working principle and types, Numerical Aperture, Acceptance angle and Attenuation, Fiber optic communication system, Applications of Optical Fiber.	09	18

4	**NANOSCIENCE AND NANOTECHNOLOGY** (Prerequisites: Nano scale and structures, general purpose of nano technology, method of formation of nano structure, fullerenes, carbon nanotubes). Nanomaterials : Properties (Physical, Mechanical, Optical, Electrical, Magnetic); Surface to Volume Ratio; Synthesis of Nanomaterials: Bottom up and Top down technique; Methods to synthesize nanomaterials: PVD & Sol-gel, Applications.	06	14
5	**SUPERCONDUCTORS** (Prerequisites: Electric current, flow of electric charges in a metallic conductor, drift velocity, mobility and their relation with electric current, Ohm's law, electrical resistance, V-I characteristics (linear and non-linear), electrical resistivity and conductivity temperature dependence of resistance). Superconductors: Introduction, Critical temperature, Properties of superconductors, Type of superconductors: Type I and Type II and high Tc superconductors, Applications: Magnets, Josephson effect, SQUID, Maglev, other.	07	18
6	**SEMICONDUCTORS** (Prerequisites: Intrinsic and extrinsic semiconductors, Energy bands in conductors, semiconductors and insulators, Semiconductor diode, I-V characteristics in forward and reverse bias) Direct & indirect band gap semiconductor; Classification of Conductors, Semiconductors and Insulators on the basis of energy band, Intrinsic & Extrinsic Semiconductors, Diodes, p-n junction (unbiased, forward bias, reverse bias); Applications of semiconductors: LED, Zener diode, Photovoltaic cell, Advantages of Semiconductror Devices, Transistors (working and characteristics)	09	18
	TOTAL	**45**	**100**

List of Practical:

Sr. No	Name of Practical	Hours
1.	To understand some basic aspects of the graph drawing.	04
2.	To understand some basic aspects of error analysis.	02
3.	To study the series and parallel connections of resistors.	02
4.	To study the series and parallel connections of capacitors.	04
5.	To study the energy band gap of semiconductor materials of a P-N junction of diode.	02
6.	To study the I-V characteristic of LED and dynamic resistance of a given LED.	02
7.	To study the I-V characteristic of ZENER diode and measurement of dynamic resistance.	02
8.	To determine the Numerical Aperture and acceptance angle of an optical fiber	04
9.	To determine wavelength of laser using diffraction grating.	04
10.	To determine the velocity of ultrasonic waves in a given liquid and also to determine the compressibility of the liquid.	04
	TOTAL	**30**

Text Book(s):

Title	Author/s	Publication
Concept of the Modern Physics	A. Beiser	Tata McGraw-Hill Education
Basic electrical engineering	Kothari and Nagrath	Tata McGraw-Hill Education
Quantum Mechanics	P.M. Mathew, K. Venkatesan	Tata McGraw-Hill Education
Waves and Acoustics	Pradipkumar Chakrabarti Satyabrata Chawdhary	New Central Book Agency
Lasers and Nonlinear Optics	G.D. Baruah	Pragati Prakashan
Engineering Physics	G Vijayakumari	Vikas Publishing house PVT LTD
Basic Electronics for Scientists and Engineers	Dennis L. Eggleston	Cambridge University Press

Web Material Link(s):

- http:/nptel.ac.in/course.php

Course Evaluation:

Theory:

- Continuous Evaluation consists of two tests each of 30 marks and 1 hour of duration and average of the same will be converted to 30 marks.
- Faculty evaluation consists of 10 marks as per the guidelines provided by Course Coordinator.
- End Semester Examination will consist of 60 marks.

Practical:

- Continuous Evaluation consists of Performance and regular manual writing, checking of the practical throughout the semester.
- Internal viva or practical performance consist of 20 Marks.
- Practical performance/test of 30 marks during End Semester Exam.
- Viva/Oral performance of 30 marks during End Semester Exam.

Course Outcome(s):

After the completion of the course, the following course outcomes will be able to:

SESH1130	EXPERIMENTAL PHYSICS
CO 1	Understand the framework of quantum mechanics and apply the knowledge of basic quantum mechanics to construct one dimensional Schrodinger's wave equation.
CO 2	Classify the phenomenon of acoustics and ultrasonic in various engineering field and apply it for various engineering and medical fields.
CO 3	Describe the laser and articulate the idea of optical fiber communications and apply the concepts of lasers and optical fiber communications in every possible sector.
CO 4	Interpret the concept of Nanotechnology and understand the synthesis and applications of Nanomaterials from technological prospect. Discover the types and properties of Superconductors. Relate the behavior of superconductors at high temperatures
CO 5	Distinguish pure, impure semiconductors and characteristics of semiconductor devices. Thus, will be able to use basic concepts to analyze and design a wide range of semiconductor devices.

Mapping of CO with PO

SESH1130	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO 1	3	2	1	2	1	0	0	0	0	1	2
CO 2	2	3	2	3	2	1	1	0	1	1	2
CO 3	2	2	2	2	2	0	1	0	1	2	2

CO 4	3	2	2	2	1	1	2	1	1	1	3
CO 5	2	2	3	2	2	1	1	0	1	1	2

Mapping of CO with PSO

SESH1130	PSO1	PSO2	PSO3
CO 1	2	2	
CO 2	1	1	1
CO 3		2	2
CO 4	2	1	3
CO 5	1		2

Level of Bloom's Revised Bloom's Taxonomy in Assessment

1: Remember	2: Understand	3: Apply
4: Analyze	5: Evaluate	6: Create

Module No	**Content**	**RBT Level**
1	Quantum Physics	2
2	Acoustic and Ultrasonic	3
3	Laser and Fibre Optics	2,3
4	Nanoscience and Nanotechnology	2,3,6
5	Superconductors and Supercapacitors	1, 2,3
6	Semiconductor Physics and Technology	1,6

P P Savani University
School of Engineering

Department of Science & Humanities

Course Code: SESH1120
Course Name: Linear Algebra
Prerequisite Course/s: -- Algebra, Geometry, Trigonometry &Pre-Calculus till 12^{th} Standard level

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
03	-	02	05	40	60	-	-	100	-	200

CE: Continuous Evaluation, ESE: End Semester Exam

Objective(s) of the Course:
To help learners to

- Analyses and solve system of linear equations and understand characteristics of Matrices.
- Learn about and work with vector space, linear transformation and inner product space.
- Apply concepts of linear algebra for solving science and engineering problems.
- Introduce the concept of improper integral and Beta-Gamma Function.

Course Content:

Module No.	Content	Hours	Weightage in %
1	**Matrix Algebra** Elementary Row and Column operations, Inverse of matrix, Rank of matrix, System of Linear Equations, Characteristic Equation, Eigen values and Eigen vector, Diagonalization, Cayley Hamilton Theorem.	12	30
2	**Vector Space** Concept of vector space, Subspace, Linear Combination, Linear Dependence and Independence, Span, Basis and Dimension, RowSpace, Column Space and Null Space, Rank and Nullity.	11	20
3	**Linear Transformation** Introduction of Linear Transformation, Kernal and Range, Rank andNullity, Inverse of Linear Transformation, Rank Nullity Theorem, Composition of Linear Maps.	09	20
4	**Inner Product Space** Inner Product, Angle and Orthogonality, Orthogonal projection, Gram-Schmidt process and QR Decomposition, least square decomposition.	08	20
5	**Beta and Gamma function** Improper Integrals, Convergence, Properties of Beta and Gamma Function, Duplication Formula (without proof)	05	10
	TOTAL	**45**	**100**

List of Tutorial:

Sr. No.	Name of Tutorial	Hours
1.	Matrix Algebra-1	04
2.	Matrix Algebra-2	02
3.	Vector Space-1	04
4.	Vector Space-2	02
5.	Linear Transformation-1	04
6.	Linear Transformation-2	02
7.	Inner Product Space-1	04
8.	Inner Product Space-2	02
9.	Beta and Gamma function-1	04
10.	Beta and Gamma function-2	02
	TOTAL	**30**

Text Book(s):

Title	Author/s	Publication
Thomas' Calculus	George B. Thomas, Maurice D. Weir and Joel Hass	Pearson
Elementary Linear Algebra	Howard Anton and Chrish Rorres	Wiley

Reference Book(s):

Title	Author(s)	Publication
Advanced Engineering Mathematics	E Kreyszig	John Wiley & Sons
A textbook of Engineering Mathematics	N P Bali and Manish Goyal	Laxmi
Higher Engineering Mathematics	B S Grewal	Khanna
Engineering Mathematics for First Year	T Veerarajan	Tata Mc Graw Hill
Engineering Mathematics-1 (Calculus)	H. K. Dass and Dr. Rama Verma	S. Chand

Course Evaluation:

Theory:

- Continuous Evaluation consists of two tests, each of 30 marks and 1 hour of duration and average ofthe same will be converted to 30 marks.
- Faculty evaluation consists of 10 marks as per the guidelines provided by the Course Coordinator.
- End Semester Examination consists of 60 marks.

Tutorial:

- Continuous evaluation consists of performance of tutorial which will be evaluated out of 10 Marks for each tutorial and average of the same will be converted to 50 marks.
- Continuous Evaluation consists of self-performance assignment to 20 marks.
- Internal Viva consists of 30 marks.

Course Outcome(s):

After the completion of the course, the following course outcomes will be able to:

SESH1120	LINEAR ALGEBRA
CO 1	Evaluate linear system using matrices and the knowledge of eigenvalues and eigenvectors for matrix diagonalization
CO 2	Determine the basis and dimension of vector spaces and subspaces.
CO 3	Discuss the matrix representation of a linear transformation given bases of the relevant vector space.
CO 4	Apply vectors, inner products, and linear transformations to real world situations.
CO 5	Classify gamma, beta functions & their relation which is helpful to evaluate some definite integral arising in various branch of engineering.

Mapping of CO with PO

SESH1120	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO 1	3	3	1	1							3
CO 2	3	2	1								2
CO 3	2	2	1								3
CO 4	2	2	1	1							1
CO 5	2	1	1								1

Mapping of CO with PSO

SESH1120	PSO1	PSO2	PSO3
CO 1	3	2	1
CO 2	1	1	
CO 3	2	2	2
CO 4	2	2	
CO 5	3		3

Level of Bloom's Revised Bloom's Taxonomy in Assessment

1: Remember	2: Understand	3: Apply
4: Analyze	5: Evaluate	6: Create

Module No	Content	RBT Level
1	Matrix Algebra	1, 2, 3, 4, 5, 6
2	Vector Space	1, 2, 3, 4, 6
3	Linear Transformation	1, 2, 3, 4, 6
4	Inner Product Space	1, 2, 3, 4, 5, 6
5	Beta and Gamma Function	1, 2, 3, 4, 5

P P Savani University
School of Engineering

Department of Civil Engineering

Course Code: SECV1210
Course Name: Basics of Civil Engineering
Prerequisite Course/s: -

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
3	0	2	5	40	60	00	00	40	60	200

CE: Continuous Evaluation, ESE: End Semester Exam

Objective of the Course:
To help learners to

- Understand components of building, building terminology and construction materials.
- Understand building layout plan.
- Understand latest trends in civil engineering.
- Understand importance of various construction equipment.

Course Content:

Module No.	Content	Hours	Weightage in %
1.	**CIVIL ENGINEERING**: **AN OVERVIEW** Introduction, Branches, Scope, Impact, Role of Civil Engineer, Unit of measurement, Unit conversion (Length, Area, Volume).	04	10
2.	**INTRODUCTION TO CIVIL ENGINEERING MATERIALS:** List of materials, Details (types, properties, uses) of materials: Cement, Aggregate, Brick, Steel, Concrete, Stone, Soil, Mortar, Timber, Plastic, Epoxy, Flyash, Steel slag, Copper slag, Bitumen, Optical fiber, Pipe, Wire, Cable, Smart material, Basic hand fill tests.	08	12
3.	**BUILDING CONSTRUCTION:** Types of building, Components of building, Type of foundation and importance, Types of brick bonds, Principle of planning, Typical building layout, Symbols used in electrical layout, Symbols used for water supply, plumbing and sanitation. Nominal dimensions for door, window and furniture	10	20
4.	**INTRODUCTION TO TOWN PLANNING:** 5Principles of town planning, Necessity of town planning, Origin of town, Growth of town, Land use, Principles and objects of zoning, Advantages of zoning, Low cost housing, Prevention of slum, FSI.	04	10
5.	**INTRODUCTION TO SURVEYING AND LEVELLING:** Introduction: Fundamental principles, Classification. Linear measurement: Instruments used, Chaining on plane ground, Offset, Ranging. Angular measurement: Compass-Instrument used, Meridian, Bearing, Local attraction. Levelling: Instrument used, Terminology, Types of leveling, Methods of leveling. Modern tools: Introduction to theodolite, Total Station, GPS.	10	20
6.	**CONSTRUCTION EQUIPMENT:** Types of equipment- Functions, Uses. Hauling equipment-Truck,	04	10

	Dumper, Trailer. Hoisting equipment- Pulley, Crane, Jack, Winch, Sheave block, Fork truck. Pneumatic equipment-Compressor. Conveying equipment- package, screw, flight/scrap, bucket, belt conveyor. Drill, Tractor, Ripper, Rim pull, Dredger, Drag line, Power shovel, JCB, Hoe.		
7.	**RECENT TRENDS IN CIVIL ENGINEERING:** Mass Transportation, Rapid Transportation, Smart City, Sky scarper, Dams, Rain Water harvesting, Batch mix plant, Ready Mix Concrete plant, Green building, Earth quake resisting building.	05	10

List of Tutorial :

Sr. No	Name of Practical	Hours
1.	Unit conversation Exercise.	02
2.	Chart preparation of various materials.	02
3.	Different types of brick bonds.	04
4.	Layout of residential building.	02
5.	Introduction Linear and angular measurements	02
6.	Introduction to Theodolite	04
7.	Introduction to Dumpy level.	02
8.	Introduction to total station.	04
9.	Videosshowing working of construction Equipments.	04
10.	Presentation on various topics as in module 7 about recent trends.	04
	TOTAL	**30**

Text Book(s):

Title	Author/s	Publication
Elements of civil engineering	Anurag A. Kandya	Charotar Publication
Basic Civil Engineering	S. Ramamrutham	Dhanpatrai Publication

Reference Book(s):

Title	Author/s	Publication
Elements of civil engineering	Dr. R. K. Jain and Dr. P. P. Lodha	McGraw Hill Education
Basics of civil engineering	S.S. Bhavikatti	New age international Publishers

Web Material Links:

- http://nptel.ac.in/courses/105107122/
- http://nptel.ac.in/courses/105107157/
- http://nptel.ac.in/courses/105101087/
- http://nptel.ac.in/courses/105104100/

Course Evaluation:

Theory:

- Continuous evaluation consists of two tests each of 30 marks and 1 hour of duration and average of the same will be converted to 30 marks.
- Faculty evaluation consists of 10 marks as per the guidelines provided by the Course Coordinator.
- End Semester Examination consists of 60 marks.

Tutorial:

- Continuous Evaluation consists of performance of practical which should be evaluated out of 10 marks for each practical and average of the same will be converted to 40 marks.
- External viva consists of 60 marks.

Course Outcome(s):

After the completion of the course, the following course outcomes will be able to:

SECV1210	BASICS OF CIVIL ENGINEERING
CO 1	Explain the fundamental concepts of civil engineering, including its branches, scope, roles, and basic unit conversions.
CO 2	Identify and describe the properties, types, and applications of common civil engineering materials such as cement, concrete, steel, and aggregates.
CO 3	Illustrate and apply principles of building construction, including components, foundations, brick bonds, and building planning/layout.
CO 4	Demonstrate basic knowledge and applications of surveying and levelling techniques, including modern instruments like total station and GPS.
CO 5	Explain concepts of town planning, construction equipment, and recent trends in civil engineering such as smart cities, green buildings, and sustainable practices.

Mapping of CO with PO

SECV1210	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO 1	3	2	2	3	2	3		2		3	
CO 2	3	3	3		2		2	3	3		3
CO 3	3	2	2	2	3	3		2	2	1	
CO 4	3	3		3		2	3		2	3	
CO 5	3		3	2	2	1	2	3			

Mapping of CO with PSO

SECV1210	PSO1	PSO2	PSO3
CO 1	**3**	**3**	
CO 2	**2**	2	2
CO 3	3		2
CO 4		**2**	
CO 5	2	2	2

Level of Bloom's Revised Bloom's Taxonomy in Assessment

1: Remember	2: Understand	3: Apply
4: Analyze	5: Evaluate	6: Create

Module No	Content	RBT Level
1	Civil engineering: An overview	1, 2, 3
2	Introduction to civil engineering materials	1, 2
3	Building construction	1, 2
4	Introduction to surveying and levelling	1, 2
5	Introduction to town planning	1, 2, 3
6	Construction equipment	1, 2
7	Recent trends in civil engineering	1, 2,4

P P Savani University
School of Engineering
Department of Computer Engineering

Course Code: SECE1210
Course Name: Programming with C Essentials
Prerequisite Course(s): --

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
3	2	0	4	40	60	40	60	0	0	200

CE: Continuous Evaluation, ESE: End Semester Exam

Objective(s) of the Course:
To help learners to

- understand the basic components of a computer system.
- identify an appropriate approach to computational problems.
- develop logic building and problem-solving skills.

Course Content:

Module No.	Content	Hours	Weightage in %
1.	**Introduction to Computers Programming:** Introduction to programs, its significance, classification of programming language, Selection of a programming language, Flow Charts and Algorithms.	04	10
2.	**Introduction to Constants, Variables and Data Types:** Features of C Language, the Structure of C Program, Types of Errors, Debugging, Tracing the Execution of the Program, Watching Variables Values in Memory. Character Set, C Tokens, Keyword and Identifiers, Constants and Variables, Data Types - Declaration and Initialization, User Define Type Declarations - Typedef, Enum, Basic Input, and Output Operations, Symbolic Constants, Overflow and Underflow of Data.	07	15
3.	**Operators, Expressions, and Managing I/O Operations:** Introduction to Operators and its Types, Evaluation of Expressions, Precedence of Arithmetic Operators, Type Conversions in Expressions, Operator Precedence and Associatively. Introduction to Reading a Character, Writing a Character, Formatted Input and Output.	05	10
4.	**Conditional Statements:** Decision Making & Branching: Decision Making with If and If - else Statements, Nesting of If-else Statements, The Switch and go-to statements, Ternary (?:) Operator. Looping: The while Statement, The Break Statement & The Do. While loop, The FOR loop, Jump within loops - Programs.	06	15
5.	**Arrays:** Introduction, One-dimensional Arrays, Two-dimensional Arrays, Concept of Multidimensional Arrays.	06	15
6.	**Strings:** Declaring and Initializing String Variables, Arithmetic Operations on Characters, Putting Strings Together, Comparison of Two Strings, String Handling Functions.	05	12
7.	**User-Defined Functions:** Concepts of User-defined Functions, Prototypes, function Definition, Parameters, Parameter Passing, Calling a Function, Recursive Function.	06	13
8.	**Pointers:** Introduction to Pointers, Declaration and initialization of pointers, Pointer to	06	10

	pointer, pointer and array, pointer to array, array to pointer, function returning pointer.		
	TOTAL	**45**	**100**

List of Practical:

Sr. No.	Name of Practical	Hours
1.	Draw Flow Chart and write algorithm for at least five problems.	02
2.	Introduction to C programming environment, compiler, Linker, loader, and editor.	02
3.	Write programs to implement basic elements of C programming (different input functions, different output functions, different data types, and different operators)	04
4.	Write programs to implement control structures (if statement, if-else statement, nested if-else statement, switch statement, break statement, goto statement)	04
5.	Write programs to implement looping constructs (for loop, while loop, do-while and nested for loop)	04
6.	Write programs to implement arrays. (1-D array, and 2-D array)	04
7.	Write programs to implement strings. (input, output, different string inbuilt functions)	02
8.	Write programs to implement user-defined functions. (function with/without return type, function with/without argument, function and array)	04
9.	Write programs to implement recursive function.	02
10.	Write programs to implement pointers.	02
	TOTAL	30

Text Book(s):

Title	Author/s	Publication
Programming in ANSI C	E. Balagurusamy	Tata McGraw Hill
Introduction to Computer Science	ITL Education Solutions Limited	Pearson Education

Reference Book(s):

Title	Author(s)	Publication
Programming in C	Ashok Kamthane	Pearson
Let Us C	Yashavant P. Kanetkar	Tata McGraw Hill
Introduction to C Programming	ReemaThareja	Oxford Higher Education
Programming with C	Byron Gottfried	Tata McGraw Hill

Web Material Link(s):

- http://www.digimat.in/nptel/courses/video/106104128/L01.html
- https://www.youtube.com/watch?v=3QiItmIWmOM

Course Evaluation:

Theory:

- Continuous Evaluation consists of two tests, each of 30 marks and 1 hour of duration and average of the same will be converted to 30 marks.
- Faculty evaluation consists of 10 marks as per the guidelines provided by the Course Coordinator.
- End Semester Examination consists of 60 marks.

Practical:

- Continuous Evaluation consists of practical performance which should be evaluated out of 10 for each practical and average of the same will be converted to 20 marks.
- Internal viva consists of 20 marks.
- Practical performance/quiz/test consists of 30 marks during End Semester Exam.
- Viva-voce consists of 30 marks during End Semester Exam.

Course Outcome(s):

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

SECE1210	PROGRAMMING WITH C ESSENTIALS
CO 1	Observe and interpret the concepts for data representation, algorithms and coding methods in computer system.
CO 2	Immediately analyze the syntax and semantics of the "c" language and apply in program.
CO 3	Manage the less memory usage while developing the program.
CO 4	Classify the types of errors occur while running the program.
CO 5	Develop and utilize user-defined functions, arrays, strings and pointers in C for efficient data manipulation and code modularity.

Mapping of CO with PO

SECE1210	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	P010	PO11
CO 1	3	2	1							1	
CO 2	3	3	2	1	2					1	
CO 3	2	3	2	1	2		2				2
CO 4	2	3	1	2	1			2			
CO 5	3	3	3	2	3	2	2	2	1	1	2

Mapping of CO with PSO

SECE1210	PSO1	PSO2	PSO3
CO 1	3		3
CO 2	2	2	2
CO 3	1	2	
CO 4	2	1	
CO 5	2	2	

Level of Revised Bloom's Taxonomy in Assessment

1: Remember	2: Understand	3: Apply
4: Analyze	5: Evaluate	6: Create

Module No	Content	RBT Level
1.	Introduction to Computers Programming:	1,2
2.	Introduction to C, Constants, Variables and Data Types	1,2,3
3.	Operators, Expressions, and Managing I/O Operations	3,4
4.	Conditional Statements	2,3,4
5.	Arrays	2,3,5
6.	Strings	2,3
7.	User-Defined Functions	2,3,4,6
8.	Pointers	2,3,4,5

P P Savani University
School of Engineering

Department of Science and Humanities

Course Code: SEEC1210
Course Name: Basics of Electrical and Electronics
Prerequisite Course(s): --

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
03	02	00	04	40	60	40	60	00	00	200

CE: Continuous Evaluation, ESE: End Semester Exam

Objective(s) of the Course:
To help learners to
- Understand fundamental concepts of electrical related to Voltage, Current etc. and principles of circuit analysis.
- Explore electrical components, learn measurement and instrumentation along with elementary understanding of electronics.

Course Content:

Module No.	Content	Hours	Weightage in %
1	**Basic Introduction to Electricity and Magnetism** Concept of Charge, Coulomb's law, Electric Field, Intensity of electric field, Electric lines of force, Properties of electric lines of force, Electric flux, Flux density, Potential Difference and Current, Concept of Magnetic field, Coulomb's law of magnetic force, Magnetic Lines of Force, Magnetic flux.	11	24
2	**DC Circuits and Electromagnetism** Electrical circuit elements (R, L and C): Resistor, capacitor, Inductor, Voltage and Current sources, Ohm's law, effect of Temperature on resistance, temperature coefficient, Series and parallel combinations of Resistors and capacitors, Kirchoff's current and voltage laws, Thevenin and Norton Theorems. Ampere's law, Lenz and Faraday's laws for electromagnetic induction, Self inductance, Mutual inductance. Examples	12	26
3	**AC Circuits** Representation of sinusoidal waveforms, peak and RMS values, Phasor representation of AC quantities, real power, reactive power, apparent power, power factor, Three phase balanced circuits, voltage and current relations in star and delta connections, Power measurement in three phase circuits. Examples	11	25
4	**Electronics** Classification of Solids: Energy levels in solids, Semiconductors, Intrinsic and Extrinsic Semiconductor, N-type & P-type semiconductors, P-N junction diode, Characteristics of P-N junction diode, Types of Diodes: Photo diode, Light Emitting Diode, Solar cell, PIN diode, Varactor diode, Zener diode, Advantages of Semiconductor Devices.	11	25

List of Practical:

Sr. No.	Name of Practical	Hours
1.	To understand various electronic devices/components.	04
2.	To understand various tools (devices and equipments) used in electrical and electronic circuits for measurements.	04
3.	To study cathode ray oscilloscope and to understand how to take measurement, time period and frequency.	02
4.	To verify ohm's law using ammeter and voltmeter.	02
5.	To study the series and parallel connections of resistors.	04
6.	To study the series and parallel connections of capacitors.	04
7.	To verify Kirchoff's Current and Voltage Law.	02
8.	To study I-V characteristics of Light Emitting diode (LED).	02
9.	To study I-V characteristics of Zener diode.	02
10.	To understand Faraday's law of electromagnetic induction.	04
	Total	**30**

Text Book(s):

Title	Author/s	Publication
Basic electrical engineering	T.N. Nagsarkar and M.S. Sukhija	Oxford University Press, 3rd edition.
Basic electrical engineering	D.P. Kothari and I.J. Nagrath	Tata McGraw-Hill Education, 2010
Fundamentals of Electrical Engineering	L. S. Bobrow	Oxford University Press, 2011
Electronic Principles	Albert Malvino & David J. Bates	McGraw-Hill Education, 7th edition.
Electronic Devices and Circuits	David A. Bell	Oxford University Press, 5th edition

Web Material Link(s):

- https://archive.nptel.ac.in/courses/108/105/108105112/
- https://archive.nptel.ac.in/courses/108/101/108101091/

Course Evaluation:

Theory:

- Continuous Evaluation consists of two tests each of 30 marks and 1 hour of duration and average of the same will be converted to 30 marks.
- Faculty evaluation consists of 10 marks as per the guidelines provided by Course Coordinator.
- End Semester Examination will consist of 60 marks.

Practical:

- Continuous Evaluation consists of Performance and regular manual writing, checking of the practical throughout the semester consists 20 Marks.
- Internal viva or practical performance consist of 20 Marks.
- Practical performance/test of 30 marks during End Semester Exam.
- Viva/Oral performance of 30 marks during End Semester Exam.

Course Outcome(s):

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

SEEC1210	BASICS OF ELECTRICAL AND ELECTRONICS
CO 1	Apply fundamental electrical laws (Ohm's Law, KCL, KVL) to analyze basic electrical circuits with resistors, capacitors, inductors, and sources.

CO 2	Analyze and solve electrical circuits using network theorems such as Thevenin's, Norton's, Superposition, and apply node and mesh analysis techniques.
CO 3	Evaluate the performance of AC and DC circuits by analyzing power components, power factor, transient and steady-state behavior of RLC circuits.
CO 4	Explain the working principles and applications of semiconductor devices including PN junction diode, rectifiers, BJT, JFET, and MOSFET.
CO5	Design and analyze basic digital circuits using number systems, logic gates, Boolean algebra, combinational and sequential circuits.

Mapping of CO with PO

SEEC1210	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	P010	PO11
CO 1	3	2	1								
CO 2	3	3	2	1							
CO 3	3	2	1	1							
CO 4	2	1	1								
CO 5	3	2	3	1	1				1		

Mapping of CO with PSO

SEEC1210	PSO1	PSO2	PSO3
CO 1	3	3	3
CO 2	3	2	3
CO 3	3	1	3
CO 4	2	1	2
CO 5	3	2	3

Level of Bloom's Revised Bloom's Taxonomy in Assessment

1: Remember	2: Understand	3: Apply
4: Analyze	5: Evaluate	6: Create

Module No	**Content**	**RBT Level**
1	Basic Introduction to Electricity and Magnetism	1,2
2	DC Circuits and Electromagnetism	2,3,4,5
3	AC Circuits	2,3,4,5
4	Electronics	3,4,5

P P Savani University
School of Engineering

Department of Mechanical Engineering

Course Code: SEME1220
Course Name: Engineering Workshop
Prerequisite Course(s): --

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
-	02	-	02	-	-	100	-	-	-	100

CE: Continuous Evaluation, ESE: End Semester Exam

Objective(s) of the Course:
To help learners to

- learn about the safety measures required to be taken while using working in workshop.
- learn about how to select the appropriate tools required for specific operation.
- learn about different manufacturing technique for production out of the given raw material.
- understand applications of machine tools, hand tools, power tools and welding process.

List of Practical:

Sr. No	Name of Practical	Hours
1.	Introduction and Demonstration of Safety Norms. Different Measuring Instruments.	02
2.	To Perform a Job of Fitting Shop.	06
3.	To Perform a Job of Carpentry Shop.	06
4.	To Perform a Job of Sheet Metal Shop.	06
5.	To Perform a Job of Black Smithy Shop.	04
6.	Introduction and Demonstration of Grinding & Hacksaw Cutting Machine.	02
7.	Introduction and Demonstration of Plumbing Shop & Welding Process.	04
	TOTAL	**30**

Text Book(s):

Title	Author(s)	Publication
Elements of Workshop Technology Vol. I	Hajra Chaudhary S. K.	Media promoters & Publishers
Workshop Technology Vol. I and II	Raghuvanshi B.S.	Dhanpat Rai & Sons

Reference Book(s):

Title	Author(s)	Publication
Workshop Technology Vol. I	W.A.J. Chapman	Edward Donald Publication
Workshop Practices	H S Bawa	Tata McGraw-Hill
Basic Machine Shop Practice Vol. I, II	Tejwani V. K.	Tata McGraw-Hill

Web Material Link(s):

- http://nptel.ac.in/course.php

Course Evaluation:

Practical:

- Continuous Evaluation Consist of Performance of Practical which will be evaluated out of 10 for each practical and average of the same will be converted to 50 Marks.
- Internal Viva consists of 50 Marks.

Course Outcome(s):

After the completion of the course, the following course outcomes will be able to:

SEME1220	ENGINEERING WORKSHOP
CO 1	Understand the various measuring instruments.
CO 2	Understand the safety norms required in the workshop.
CO 3	Understand the application of various tools required for different operations.
CO 4	Remember the process of manufacture from a given raw material.
CO 5	Explain various manufacturing processes in machine shop.

Mapping of CO with PO

SEME1220	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO 1	2					2			2		1
CO 2						3		3	3		1
CO 3	2					2			1		1
CO 4	2								3		2
CO 5	2								3		2

Mapping of CO with PSO

SEME1220	PSO1	PSO2	PSO3
CO 1	2	3	2
CO 2			
CO 3	2	3	2
CO 4	3	3	3
CO 5	3	3	3

Level of Bloom's Revised Bloom's Taxonomy in Assessment

1: Remember	2: Understand	3: Apply
4: Analyze	5: Evaluate	6: Create

Practical No	Content	RBT Level
1	Introduction and Demonstration of Safety Norms. Different Measuring	1, 2, 4
2	Instruments.	1, 2, 3
3	To Perform a Job of Fitting Shop.	1, 2, 3
4	To Perform a Job of Carpentry Shop.	2, 3, 4
5	To Perform a Job of Sheet Metal Shop.	2, 3, 4
6	To Perform a Job of Black Smithy Shop.	2, 3, 4
7	Introduction and Demonstration of Grinding & Hacksaw Cutting Machine.	2, 3, 4

P P Savani University
School of Engineering
Department of Computer Engineering

Course Code: SECE1220
Course Name: Digital Proficiency
Prerequisite Course(s): --

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
3	0	0	3	40	60	0	0	0	0	100

CE: Continuous Evaluation, ESE: End Semester Exam

Objective(s) of the Course:
To help learners to

- provide foundational knowledge of digital tools and technologies.
- introduce the principles of digital communication, collaboration, and problem-solving.
- enhance awareness of emerging digital trends and their applications in engineering.

Course Content:

Module No.	Content	Hours	Weightage in %
1.	**Introduction to Digital Literacy** Overview of digital tools and their applications, Introduction to operating systems (Windows, Linux), Basics of file management and cloud storage solutions, Digital communication tools: Email, messaging platforms, and video conferencing tools (Zoom, Teams).	06	13
2.	**Office Productivity Tools** Word Processing: Document formatting, templates, and styles (MS Word/Google Docs). Presentation Tools: Slide design, animations (MS PowerPoint/Google Slides).	04	10
3.	**Data Handling and Analysis** Spreadsheets: Data entry, formulas, charts, pivot tables (MS Excel/Google Sheets). Introduction to data visualization tools (e.g., Tableau, Power BI, Google Data Studio). Applications of data analysis in engineering contexts. AI features in Excel and Google Sheets for predictive analysis.	07	15
4.	**Computational Problem-Solving** Introduction to algorithms and flowcharts. Solving simple engineering problems through programming. Applications of computational techniques in various engineering domains.	06	12
5.	**Cybersecurity and Ethical Practices** Understanding cybersecurity principles, Awareness of phishing, malware, and secure passwords, Digital footprints and privacy concerns, Ethical use of technology and copyright considerations.	05	12
6.	**Introduction to AI Tools and Applications** Overview of AI, Machine Learning, and their applications in engineering. Practical use of AI tools: ChatGPT for content creation and brainstorming, Canva for design and visual communication, GitHub Copilot for coding assistance. Ethical considerations in AI usage.	07	15
7.	**Emerging Technologies and Industry Trends** Overview of Industry 4.0 concepts: IoT, AI, Robotics, and Blockchain. Applications of emerging technologies in various engineering domains. Case studies: Smart cities, sustainable manufacturing, and automation. Preparing for	07	15

	future technological trends and job roles.		
8.	**Capstone Project and Case Study** Group project: Solve a practical engineering problem using digital tools. Case study presentations on the application of digital and AI tools in real-world scenarios.	03	08
	TOTAL	45	100

Text Book(s):

Title	Author/s	Publication
Digital Literacy for Dummies	Faithe Wempen	Wiley
Literacy in a Digital World: The Evolution and Development of Literacy Proficiency	Lorraine Dagostino, Jennifer Bauer, Michael Deasy, Ed.D., Kathleen Ryan	Rowman & Littlefield

Reference Book(s):

Title	Author(s)	Publication
Computer Fundamentals	P.K. Sinha and Priti Sinha	BPB Publications- 6th Edition
Microsoft Office 365: In Practice	Randy Nordell and Annette Easton	McGraw Hill Education- Latest Edition
Ethics for the Information Age	Michael J. Quinn	Pearson Education- 8th Edition
Industry 4.0: Managing the Digital Transformation	Alp Ustundag and Emre Cevikcan	Springer

Web Material Link(s):

- https://learn.microsoft.com/en-us/training/browse/
- https://www.ibm.com/think/topics/cybersecurity
- https://www.youtube.com/playlist?list=PLlKpQrBME6xLGL3Ty_1Wbd3nTZ_q_OKFQ

Course Evaluation:

Theory:

- Continuous Evaluation consists of two tests, each of 30 marks and 1 hour of duration and average of the same will be converted to 30 marks.
- Faculty evaluation consists of 10 marks as per the guidelines provided by the Course Coordinator.
- End Semester Examination consists of 60 marks.

Course Outcome(s):

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

SECE1220	Digital Proficiency
CO 1	Demonstrate proficiency in using digital tools, operating systems, and cloud platforms for effective communication and collaboration.
CO 2	Create, edit, and manage professional documents, presentations, and spreadsheets using modern office productivity software.
CO 3	Analyze and visualize data using advanced spreadsheet features and data visualization tools to solve engineering problems.
CO 4	Identify cybersecurity risks, implement ethical practices, and safeguard digital assets in professional environments.
CO 5	Apply AI tools and understand emerging technologies like IoT and blockchain to address real-world engineering challenges.

Mapping of CO with PO

SECE1220	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P010	PO11
CO 1	3	3		1	3			2	3		1
CO 2	3	2			3				3		1

CO 3	3	2	1	3	3						1
CO 4	3	2			3		3				1
CO 5	3	3	1		3						1

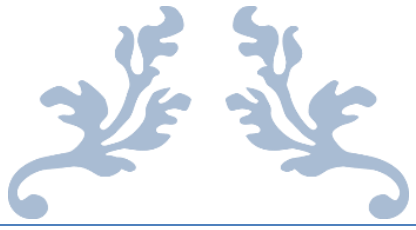
Mapping of CO with PSO

SECE1220	PSO1	PSO2	PSO3
CO 1	3	3	1
CO 2	2	2	3
CO 3	3	2	1
CO 4			3
CO 5	3	2	3

Level of Revised Bloom's Taxonomy in Assessment

1: Remember	2: Understand	3: Apply
4: Analyze	5: Evaluate	6: Create

Module No	**Content**	**RBT Level**
1.	Introduction to Digital Literacy	1,2,3
2.	Office Productivity Tools	2,3,4
3.	Data Handling and Analysis	2,3,4,5
4.	Computational Problem-Solving	2,3
5.	Cybersecurity and Ethical Practices	1,2,3
6.	Introduction to AI Tools and Applications	1,2,3,5
7.	Emerging Technologies and Industry Trends	3,4,5
8.	Capstone Project and Case Study	2,3,5,6



SECOND YEAR B.TECH

P P SAVANI UNIVERSITY

SCHOOL OF ENGINEERING

TEACHING & EXAMINATION SCHEME FOR SECOND YEAR B.TECH. PROGRAMME AY: 2025-26

Sem	Course Code	Course Title	OfferedBy	Teaching Scheme					Examination Scheme						
				Contact Hours				Credit	Theory		Practical		Tutorial		Total
				Theory	Practical	Tutorial	Total		CE	ESE	CE	ESE	CE	ESE	
3	SESH2110	Differential Methods & Complex Variable	SH	3	0	1	4	4	40	60	0	0	100	0	200
	SECH2290	Chemical Process Calculations	CH	2	0	2	4	4	40	60	0	0	40	60	200
	SECH2300	Mechanical Operations	CH	2	2	0	4	3	40	60	40	60	0	0	200
	SECH2310	Fluid Flow Operations	CH	2	2	0	4	3	40	60	40	60	0	0	200
	SECH2320	Materials Science and Technology	CH	2	0	0	2	2	40	60	0	0	0	0	100
	CFLS2140	Upper Intermediate Communicative English	CFLS	2	0	0	2	2	100	0	0	0	0	0	100
	CLSC2020	IPDC-I	CLSC	2	0	0	2	2	100	0	0	0	0	0	100
						Total	**22**	**20**							**1100**
4	SESH2120	Numerical Methods & Statistics	SH	3	0	2	5	5	40	60	0	0	100	0	200
	SECH2330	Heat Transfer Operations	CH	2	2	0	4	3	40	60	40	60	0	0	200
	SECH2340	General Chemical Technology	CH	2	2	0	4	3	40	60	40	60	0	0	200
	SECH2350	Chemical Engineering Thermodynamics-I	CH	2	0	2	4	4	40	60	0	0	40	60	200
	SECH2360	Mass Transfer Operations-I	CH	3	2	0	5	4	40	60	40	60	0	0	200
	CLSC2030	IPDC-II	CLSC	2	0	0	2	2	100	0	0	0	0	0	100
						Total	**24**	**21**							**1100**

P P Savani University
School of Engineering

Department of Science & Humanities

Course Code: SESH2110
Course Name: Differential Methods & Complex Variable
Prerequisite Course(s): SESH1110- Calculus

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
03	-	01	04	40	60	-	-	100	-	200

CE: Continuous Evaluation, ESE: End Semester Exam

Objective(s) of the Course:

To help learner to

- learn orientation of calculus and its applications in solving engineering problems including differential equations.
- learn introduction of Partial Differential Equations with methods of its solutions.
- learn applications of Laplace Transforms for solving ODEs.
- learn introduction of Periodic functions and Fourier series with their applications for solving ODEs.
- Represent complex numbers algebraically and geometrically.

Course Content:

Module No.	Content	Hours	Weightage in %
1.	Ordinary Differential Equation First order ODEs, Formation of differential equations, Exact, linear and Bernoulli's equations, Ordinary differential equations of higher orders, Homogeneous Linear ODEs of Higher Order, Homogeneous Linear ODEswith Constant Coefficients, Euler–Cauchy Equations Differential Operators Nonhomogeneous ODEs, Variation of Parameters.	10	20
2.	Partial Differential Equation Formation of First and Second order equations, Solution of First order Linear and Non-liner equations, Higher order equations with constant coefficients, Complementary function, Particular Integrals, Initial and boundary conditions, Modeling and solution of the Heat, Wave and Laplace equations.	08	17
3.	Laplace Transform Laplace Transform, Linearity, First Shifting Theorem, Existence Theorem, Transforms of Derivatives and Integrals, Unit Step Function, Second Shifting Theorem, Laplace Transformation of Periodic function, Inverse Laplace transform, Convolution, Systems of ODEs	07	13
Module No.	Content	Hours	Weightage in %
4.	Fourier Series Fourier Series of $2n$ periodic functions, Euler Formula, Arbitrary Period,Even and Odd function, Half-Range Expansions.	07	14
5.	Complex Variables Complex Variable – Differentiation, Complex number, polar form ofcomplex number, Cauchy-Riemann equations, analytic functions, harmonic functions, Mobius transformations and their properties.	08	21

6.	Complex Variable – Integration Representation by Fourier Integral, Cauchy's integral theorem and formula, Taylor and Laurent series.	05	15
	TOTAL	**45**	**100**

List of Tutorials:

Sr. No.	Name of Tutorial	Hours
1.	Ordinary Differential Equation-1	2
2.	Ordinary Differential Equation-2	2
3.	Ordinary Differential Equation-3	2
4.	Partial Differential Equation-1	2
5.	Partial Differential Equation-2	2
6.	Laplace Transform-1	1
7.	Laplace Transform-2	1
8.	Fourier Series-1	1
9.	Fourier Series-2	1
10.	Complex Variables -1	1
	TOTAL	**15**

Text Book(s):

Title	Author/s	Publication
Advanced Engineering Mathematics	Erwin Kreyszig	Wiley India Pvt. Ltd.
Complex Variables and Applications,	J. W. Brown and R. V. Churchill	McGraw Hill.

Reference Book(s):

Title	Author/s	Publication
Higher Engineering Mathematics	B. S. Grewal	Khanna Publishers
A first course in complex analysis with applications	Dennis G. Zill, Patrick D. Shanahan	Jones and Bartlett Publishers Inc.
Differential Equations for Dummies	Steven Holzner	Wiley India Pvt. Ltd.
Higher Engineering Mathematics	H.K. Dass, Er. Rajnish Verma	S. Chand & Company Pvt. Ltd.

Web Material Link(s):

- http://nptel.ac.in/courses/111105035/
- http://nptel.ac.in/courses/111106100/
- http://nptel.ac.in/courses/111105093/
- http://nptel.ac.in/courses/111108081/
- http://nptel.ac.in/courses/111/103/111103070/

Course Evaluation:

Theory:

- Continuous Evaluation consists of two tests each of 30 marks and 1 Hour of duration, which will be converted to 30 marks.
- Faculty evaluation consists of 10 marks as per the guidelines provided by the course coordinator.
- End Semester Examination consists of 60 marks.

Tutorial:

- Continuous Evaluation consists of performance of tutorial which will be evaluated out of 10 marks for each tutorial and average of the same will be converted to 30 marks.
- MCQ based examination consists of 10 marks.
- Internal Viva consists of 10 marks.

Course Outcome(s):

After completion of the course, the student will be able to

SESH2110	DIFFERENTIAL METHODS & COMPLEX VARIABLE
CO1	Describe 1st and 2nd order odes and pde's.
CO2	Classify differential equations and evaluate linear and nonlinear partial differentialequations.
CO3	Apply Laplace transform as a tool which are used to evaluate differential equation.
CO4	Examine the various tests of power series and Fourier series for learning engineering.
CO5	Demonstrate understanding of the basic concepts underlying complex analysis to evaluatedefinite integrals and infinite series.

Mapping of CO with PO

SESH2110	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	2	1	1	1								1
CO 2	1	1	1									1
CO 3	2	1	1	1								1
CO 4	2	1	1									1
CO 5	2	2	1	1								1

Mapping of CO with PSO

SECV2110	PSO1	PSO2	PSO3
CO 1	2	1	
CO 2	1	1	
CO 3	1	1	
CO 4	2		
CO 5	2	1	

Level of Bloom's Revised Bloom's Taxonomy in Assessment

1: Remember	2: Understand	3: Apply
4: Analyze	5: Evaluate	6: Create

Module No	Content	RBT Level
1	Ordinary Differential Equation	1, 2, 3, 5
2	Partial Differential Equation	1, 2, 4, 5
3	Laplace Transform	1, 2, 4, 5
4	Fourier Series	1, 2, 3, 5
5	Complex Variables	1, 2, 3, 4, 5
6	Complex Integration	1, 2, 3, 4, 5

P P Savani University
School of Engineering

Department of Chemical Engineering

Course Code: SECH2290
Course Name: Chemical Process Calculations
Prerequisite Course(s): --

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
02	--	02	04	40	60	--	--	40	60	200

CE: Continuous Evaluation, ESE: End Semester Exam

Objective(s) of the Course:
To help learner to

- know the conventions and the methods of chemical process.
- develop the basic acumen for the Chemical Engineering and its calculations.
- know how to carry out various process calculations.
- improve their analytical skills for various chemical processes.
- improve their technical ability in the form of numerical analysis of chemical problems.

Course Content:

Module No.	Content	Hours	Weightage in %
1.	**Introduction:** Chemical Engineering and Chemical Industry, Steady state andunsteady state processes, Unit Operations, Unit Processes and Process Flow Diagrams.	04	10
2.	**Graphics and Basics of Chemical Processes:** Graphical methods of curve fittings, Method of least squares, Solution of cubic equations by trial and error method, Conversion ofunits, Dimensional analysis, Properties of gas, liquid and solid, Equations of state.	05	10
3.	**Basic Calculations:** State properties: Molecular weight, Compositions, Density, Vapor pressure etc for gas, liquid and solid systems, Thermal properties: Heat capacity, Sensible heat, Latent heat, Heat of reaction, Heat of solution, Enthalpy calculations etc. for gas, liquid and solid systems,Techniques of problem Solution: Analytical, Graphical and Numerical, Gas laws and phase equilibria, Humidity, Saturation and Crystallization.	05	20
4.	**Material Balances:** Materials balance: Concepts of limiting and excess reactants, Batch,Stage-wise, Continuous and recycle operations, Material balance of	05	20

	systems involving mixing, extraction, distillation, crystallization, chemical reaction and recycle processes, Material balance equations based on conservation principle, Material balances for non-reactive processes (Unit Operations), Material balances for reactive processes.		
5.	**Vapour pressure:** Vapour pressure plots, Vapour pressure of immiscible liquids and vapour pressure of solutions; Humidity and saturation humidity chart, Super saturation, Distribution of a solute between immiscible and partially miscible liquids, Solubility of gases.	04	15
6.	**Thermo physics and Energy Balances:** Energy balances for closed and open systems based on energy conservation principle, Energy balances for non-reactive processes (Unit Operations), Energy balances for reactive processes, Coupled material and energy balances for single unit process, Heats of formation, combustion, reaction, solution, dilution, Effect of temperature on heat of reaction, Energy balance of systems withoutand with chemical reactions, Heat capacity calculations, Enthalpy changes of reactions, dissolution and laws of thermochemistry, Effect of pressure and temperature on heat of reactions.	07	25
	TOTAL	**30**	**100**

List of Tutorials:

Sr No	Name of Tutorials	Hours
1.	Tutorial – 1 – basics to Unit operations and Unit Conversion	02
2.	Tutorial – 2- Method of least squares	02
3.	Tutorial – 3- Dimensional analysis	02
4.	Tutorial – 4- Material Balances	02
5.	Tutorial – 5- Material Balances	02
6.	Tutorial – 6- Material Balances	02
7.	Tutorial – 7- Material Balances	02
8.	Tutorial – 8 - Material balances for non-reactive processes	02
9.	Tutorial – 9- Material balances for non-reactive processes	02
10.	Tutorial – 10 - Material balances for non-reactive processes	02
11.	Tutorial – 11 - Unsteady state material and energy balances	02
12.	Tutorial – 12 - Unsteady state material and energy balances	02
	TOTAL	**30**

Text Book(s):

Title	Author/s	Publication
Stoichiometry	Bhatt, B.I. and Vora, S.M.	Tata McGraw-Hill Publishing Co., New Delhi.
ChemicalProcess Principles Part-I	Hougen, O.A., Watson. K.M. and Ragatz, R.A.	John Wiley & Sons, (CBS Publishers & Distributor, New Delhi).

Reference Book(s):

Title	Author/s	Publication
Basic Principles and Calculation in Chemical Engineering	Himmelblau, D.M.	Prentice Hall, Inc.

Introduction to Chemical Engineering	S K Ghoshal, S K Sanyal and S Dutta	Tata McGraw-Hill Publishing Co. Ltd., New Delhi.
Conservation of Mass and Energy	Whitwell J.C. &Jone R.K.	McGraw-Hill, Singapore, 1973

Web Material Link(s):

- http://nptel.ac.in/courses/103103039/23

Course Evaluation:

Theory:

- Continuous Evaluation consists of two tests each of 30 marks and 1 Hour of duration, which will be converted to 30 marks.
- Faculty evaluation consists of 10 marks as per the guidelines provided by the course coordinator.
- End Semester Examination consists of 60 marks.

Tutorial:

- Continuous Evaluation consists of performance of tutorial which should be evaluated out of 10 Marks for each tutorial and average of the same will be converted to 30 marks.
- Numerical Test consists of 10 marks.
- Internal Viva consists of 10 marks.

Course Outcome(s):

After completion of the course, the student will be able to

SECH2290	**CHEMICAL PROCESS CALCULATIONS**
CO 1	Apply the concept of dimension and unit conversion to check dimensional consistency of balanced equations and understand the specific terms used in process calculation.
CO 2	Compute material balance problems on distillation, absorption, etc without chemical reactions.
CO 3	Compute material balance problems on batch and continuous process with chemical reactions.
CO 4	Solve energy balance problems on heat exchanger, evaporator, etc of various unit processes.
CO 5	Solve problems related to ideal and real gas and liquid solutions.

Mapping of CO with PO

SECH2290	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	2	1										1
CO 2		1			1				1	1		1
CO 3				1					1	1		1
CO 4			1		1					1		1
CO 5	2	1		1	1					1		1

Mapping of CO with PSO

SECH2290	PSO1	PSO2	PSO3
CO 1		1	
CO 2	1	1	
CO 3		1	
CO 4	1	1	
CO 5	1	1	

Level of Bloom's Revised Bloom's Taxonomy in Assessment

1: Remember	2: Understand	3: Apply
4: Analyze	5: Evaluate	6: Create

Module No	Content	RBT Level
1	Introduction	1,2,5
2	Graphics and Basics of Chemical Processes	1,2,3,4,5
3	Basic Calculations	3,4,5
4	Material Balances	3,4,5
5	Vapour pressure	1,2,3,4,5
6	Thermo physics and Energy Balances	3,4,5

P P Savani University

School of Engineering

Department of Chemical Engineering

Course Code: SECH2300

Course Name: Mechanical Operations

Prerequisite Course(s): --

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
02	02	--	03	40	60	40	60	--	--	200

CE: Continuous Evaluation, ESE: End Semester Exam

Objective(s) of the Course:

To help learner to

- understand many basic principles of Chemical Engineering operations such as Size Reduction, Filtration, Sedimentation, Mixing and Agitation etc. and their mathematical co-relation.
- understand basic principles of particle preparation and their characterization.
- study various methods for storage of solids and conveyors available for their transportation.
- understand the performance of different equipment for separation of solids and size reduction

Course Content:

Module No.	Content	Hours	Weightage in %
1.	**Properties of particulate solid** Introduction to particle technology, Characterization of solid particles, particle size measurement techniques, Mixed particles,specific surface of mixture, Particle population.	04	15
2.	**Size reduction and enlargement** Types of equipment and their studies, Principles of comminution, Laws of crushing and grinding, Closed and open circuit grinding, power requirements, Energy and power required for comminution,Industrial processes for particle size enlargement, size enlargement equipment comminution, Broad classification, Primary breaking operations, Intermediate crushing by crushers, cone, roll and impact crushers, Ball and fumbling mills—fine grinding, Determination of power consumption.	08	20
3.	**Properties of masses of solids** Storage of solids: Angle of repose, bulk storage, storage in bins andsilos.	04	10
4.	**Conveying of solids** Codes for characterization of solids, screw conveyers, belt conveyers, bucket elevators, pneumatic conveying of solids, Design of conveyor belts, Mechanical and pneumatic conveying equipment and power consumption.	04	15

5.	**Screening - equipment and efficiency** Screen analysis, Method of reporting screen analysis, Capacity and effectiveness of screens, Screen analysis, sizing curves, industrial sizing, screening revolving and vibrating screens, Screen efficiency and capacity, Classification: Laws, wet and dry methods, Types of classifiers—stationary, mechanical, centrifugal and hydraulic.	05	20
6.	**Filtration** Flow through porous media, Theories of filtration - Principles of filtration, constant rate and constant pressure filtration, Optimum cycle, compressible cakes and filter aids, constant pressure, constantrate filtration, compressible and incompressible cakes, cake resistance, filter media resistance, filter media, filter aids, filtration equipment (batch, continuous), selection criteria, washing of filter cakes, filtration by continuous vacuum and pressure filters.	05	20
	TOTAL	**30**	**100**

List of Practical:

Sr No	Name of Practical	Hours
1.	Determination of particle size by sieve analysis.	02
2.	Determination of the optimum speed and critical speed of a ball mill.	02
3.	Measurement of different bulk properties of powder samples.	02
4.	To study powder compaction behaviour using different powder compaction	02
5.	Study of particle size reduction by Roll crusher and Jaw crusher	04
6.	Characterization of powder flow ability by Angle of Repose.	04
7.	Obtaining the collection efficiency of cyclone	02
8.	Obtaining settling rates of slurry as function of solid concentration	02
9.	Power consumption in Agitated vessels	02
10.	Study of froth flotation process	02
11.	Study of Plate and Frame filter place	04
12.	Study of Centrifugation process	02
	TOTAL	**30**

Text Book(s):

Title	Author/s	Publication
Unit Operations of Chemical Engineering	W L McCabe and J C Smith	McGraw-Hill International
Principles of Mineral Dressing	A M Gaudin	Tata McGraw-Hill Publishing Co. Ltd., New Delhi
Elements of Ore Dressing	A F Taggart	John Wiley and Sons, New York

Reference Book(s):

Title	Author/s	Publication
Chemical Engineering Vol.- II, 6th Ed.	J.M. Coulson & J.F. Richardson	Elsevier, 2003 or Pergamon Press
Unit Operations	G.G. Brown Ed.	John Wiley & Sons, 1950
Transport Processes and Separation Process Principles' 4th Ed,	C.G. Geankopolis	Prentice Hall India, 2003

Web Material Link(s):
http://nptel.ac.in/syllabus/103107091

Course Evaluation:
Theory:

- Continuous Evaluation consists of two tests each of 30 marks and 1 Hour of duration, which will be converted to 30 marks.
- Faculty evaluation consists of 10 marks as per the guidelines provided by the course coordinator.
- End Semester Examination consists of 60 marks.

Practical:

- Continuous Evaluation consists of performance of Practical which will be evaluated out of 10 marksfor each practical and average of the same will be converted to 10 marks.
- Internal Viva consists of 10 marks.
- Practical performance/quiz/drawing/test of 15 marks during End Semester Exam.
- Viva/Oral presentation of various topics consists of 15 marks during End Semester Exam.

Course Outcome(s):

After completion of the course, the student will be able to

SECH2300	**MECHANICAL OPERATIONS**
CO 1	Apply and distinguish fluid particle systems and equipment.
CO 2	Select suitable size reduction equipment for solid solid separation method and conveying system.
CO 3	Describe and analyze agitation and mixing and their equipment.
CO 4	Classify solid liquid gas separation equipment. liquid gas separation equipment.

Mapping of CO with PO

SECH2300	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	2	2	2	2	1		1			1	1	
CO 2	3	2	2	2	1		1			1	1	
CO 3	2	2	2	2	1		1			1	1	
CO 4	2	2	2	2	1		1			1	1	

Mapping of CO with PSO

SECH2300	PSO1	PSO2	PSO3
CO 1	2	2	
CO 2	2	2	
CO 3	2	2	
CO 4	2	2	

Level of Bloom's Revised Bloom's Taxonomy in Assessment

1: Remember	2: Understand	3: Apply
4: Analyze	5: Evaluate	6: Create

Module No	Content	RBT Level
1	Solid Properties	1
2	Size Reduction	1,2,3,4
3	Particulate properties	1,2,4
4	Conveying of Solids	1,3,4
5	Screening	2,4,5
6	Filtration	2,4,5

P P Savani University
School of Engineering

Department of Chemical Engineering

Course Code: SECH2310
Course Name: Fluid Flow Operations
Prerequisite Course(s): --

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
02	02	--	03	40	60	40	60	--	--	200

CE: Continuous Evaluation, ESE: End Semester Exam

Objective(s) of the Course:
To help learner to

- get the introductory idea and explanation of basic fundamentals of Fluid Flow Operations which isused in the applications of chemical engineering, Porous media movement, Aerodynamics, hydraulics, Marine Engineering, Gas dynamics etc.
- learn Fluid Properties.
- understand the importance of flow measurement and its applications in Industries and to obtain theloss of flow in a flow system.

Course Content:

Module No.	Content	Hours	Weightage in %
1.	**Properties of fluids and concept of pressure** Definitions of Unit operations, Basic concepts of fluids and its application, Properties of fluids (Density, Viscosity, Surface Tension, Compressibility, Capillary, Vapour Pressure, Bulk Modulus, Cavitation, Classification of Fluids), Unit Conversion, Dimensional analysis.	05	15
2.	**Fluid statics & its application** Nature of fluids: Incompressible and compressible fluids, Pressure concepts, Force and Pressure, Pascal's law of Pressure at a point, Pressure measurement by Manometers – U tube, Inclined U tube and Differential, Centre of Pressure, Hydrostatic equilibrium in gravitational and centrifugal field, Hydrostatic forces on surface – Vertical, Horizontal and Inclined, Forces on curved Surfaces, Buoyancy and Buoyant Force, Centre of Buoyancy and Meta Centre.	05	20
3.	**Boundary layers & its applications** Concept of Boundary Layer, Boundary layer Thickness, Momentum Thickness, Displacement Thickness, Drag and Lift, Separation ofBoundary layer, Streamlined and Bluffed Bodies.	05	15
4.	**Momentum Balance and their Applications** Kinematics of fluid flow, Types of flow, Steady and Unsteady Flow, Potential flow, One – two and three Dimensional Flow, Uniform andNon Uniform Flow, Rotational and Irrotational Flow, Stream Lines and Stream Function, Velocity Potential Function, Relation betweenstream and velocity potential function, Flow nets, Continuity Equation for 2D and 3D flow in Cartesian co-ordinates system.	05	10

5.	**Basic fluid equations &fluid dynamics** Stream line and stream tubes, Average velocity, Mass velocity, Momentum balance, Bernoulli's equation without friction & its applications, Correction of Bernoulli's equation for fluid friction, Pump work in Bernoulli's equation. Newton's law of motion, Euler's Equation and its applications, Momentum Equation, Pitot Tube, Determination of volumetric flow with pitot tube, Principle of Venturimeter, Pipe Orifice and Rotameter.	05	20
6.	**Flow of incompressible fluids through ducts and its applications in conduits and thin layers** Flow of incompressible fluids in pipes, Friction factor, Laminar flow of Newtonian and non-Newtonian fluids, Turbulent flow in pipes and closed channels, Effect of roughness, Friction factor chart, Dragreduction in turbulent flow Friction factor in flow through channels of noncircular cross section, Friction from changes in velocity or direction, Effect of fittings and valves, Major and Minor Losses in Pipes, Hydraulic Gradient line and Total energy line, Equivalent Pipes.	05	20
	TOTAL	**30**	**100**

List of Practical:

Sr No	Name of Practical	Hours
1.	Determine metacentric height of floating body.	02
2.	Measurement of pressure using different types of manometers.	04
3.	Determine Co-efficient of Discharge by venturimeter, Orificemeter and Rotameter.	04
4.	Verification of Bernoulli's apparatus.	02
5.	Measurement of velocity of flow using Pitot tube.	02
6.	Measurement of Friction factor for Different pipes & annulus.	02
7.	Measurement of viscosity using Redwood Viscometer.	02
8.	Determine discharge through triangular/trapezoidal / rectangular notch.	02
9.	Determine different flow patterns by Reynolds's apparatus.	02
10.	Measurement of lift and drag of aerofoil.	02
11.	Measurement of static pressure distribution around aerofoil using wind tunnel.	02
12.	Experiment on viscosity by stoke's law	02
13.	Experiments on characteristics of centrifugal pumps	02
	TOTAL	**30**

Text Book(s):

Title	Author/s	Publication
Textbook of Fluid Mechanics and Hydraulic Machines	R. K. Bansal	Laxmi Publications
Introduction to Fluid Mechanics and Fluid Machines	S.K. Som& G Biswas.	Tata McGraw Hill Publication
Unit Operations of Chemical Engineering	McCabe W.L., Smith J.C., Harriott P.	McGraw Hill

Reference Book(s):

Title	Author/s	Publication
Fluid Mechanics	Frank M. White	Tata McGraw Hill Publication
Fluid Mechanics	R.K. Rajput	Schand Publication
Fluid Mechanics for Chemical Engineers	De Nevers N	McGraw-Hill

Web Material Link(s):

- http://nptel.ac.in/courses/112105171/1

Course Evaluation:

Theory:

- Continuous Evaluation consists of two tests each of 30 marks and 1 Hour of duration, which will be converted to 30 marks.
- Faculty evaluation consists of 10 marks as per the guidelines provided by the course coordinator.
- End Semester Examination consists of 60 marks.

Practical's:

- Continuous Evaluation consists of performance of Practical which should be evaluated out of 10 marks for each practical and average of the same will be converted to 10 marks.
- Internal Viva consists of 10 marks.
- Practical performance/quiz/drawing/test of 15 marks during End Semester Exam.
- Viva/Oral presentation of various topics consists of 15 marks during End Semester Exam.

Course Outcome(s):

After the completion of the course, the student will able to

SECH2310	FLUID FLOW OPERATIONS
CO 1	Describe fundamentals of fluids and its types.
CO 2	Analyze various flow problems and flow characteristics for various flow conditions.
CO 3	Demonstrate working of different flowmeters.
CO 4	Analyze major and minor frictional losses in different pipes fittings.
CO 5	Describe and observe different pumps and their performance.

Mapping of CO with PO

SECH2310	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	1	1	1							2		1
CO 2	2	1	1									
CO 3	1	1	1									
CO 4	1	1										
CO 5		1		1								

Mapping of CO with PSO

SECH2310	PSO1	PSO2	PSO3
CO 1	1		
CO 2	1	1	1
CO 3	2	1	
CO 4		3	
CO 5		1	1

Level of Bloom's Revised Bloom's Taxonomy in Assessment

1: Remember	2: Understand	3: Apply
4: Analyze	5: Evaluate	6: Create

Module No	Content	RBT Level
1	Basic Concept and Fluid statics & its application	1,2
2	Boundary layers & its applications	2,4
3	Kinematics of fluid flow	2,3,4
4	Basic fluid equations & fluid dynamics	1,2
5	Flow of compressible fluids and its applications	1,2,4,5
6	Flow of Fluids through Solids	2,3,4

P P Savani University
School of Engineering

Department of Chemical Engineering

Course Code: SECH2320
Course Name: Materials Science and Technology
Prerequisite Course(s): --

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
02	--	--	02	40	60	--	--	--	--	100

CE: Continuous Evaluation, ESE: End Semester Exam

Objective(s) of the Course:
To help learner to

- identify the different chemicals and related materials and their properties.
- understand the microstructures, crystallography, defects, and phase diagrams of different materials.
- help the students to understand the process involved in chemical and mechanical testing of materials under certain conditions.
- make them aware about the advancements in the area of materials used in chemical and allied industries.

Course Content:

Module No.	Content	Hours	Weightage in %
1.	**Introduction to Engineering Materials** Classification of engineering materials, Engineering requirements from materials, Basics of crystals and their correlated properties, Factors that govern material selection for engineering applications, Micro and macro examination.	05	15
2.	**Structure and Imperfections in Crystals** Introduction, Unit cells and their lattice structure, coordination number, crystal structure of metals, Atomic packing factor, Crystallographic planes and directions, Polymorphism and Allotropy, Diffusion in solids, Imperfection in crystals and their types.	05	10
3.	**Properties of Materials** Mechanical, Electrical and magnetic properties of materials,Selection of material like SS, Ti/Zr alloy and design for corrosion control, Factors determining the choice of materials of construction in chemical industries.	05	10
4.	**Ferrous metals and its Alloys** Iron and their alloys - Aluminium, copper, Zinc, lead, Nickel andtheir alloys with reference to the application in chemical	05	15

	industries. Phase Diagrams and Phase Transformation, TTT and CCT Diagrams. Iron-Iron Carbide and Iron-carbon diagrams, Overview of different types of irons - Wrought iron Pig iron, Cast iron, White Cast Iron, Grey Cast Iron, Malleable Cast Iron and their properties and characteristics, deformation of metals, Types of steel like Chromium, Manganese, Molybdenum and Manganese steels.		
5.	**Metals: their behaviours and properties** Solidification of metals and an alloy, Nucleation and Growth, Solidification defects, Effects of Structure on Mechanical Properties, Methods to control the grain structure resulting from solidification, Cooling curve of pure metal and alloy, Deformation in polycrystalline materials, Mechanical testing of materials (destructive & non-destructive) testing methods.	05	25
6.	**Heat Treatment and Surface hardening processes** Annealing and its types, Normalizing, Aus-tempering, Martempering Quenching and Temper heat treatment,Hardenability, Applications of above processes for the industrial practices, Flame and induction hardening,Carburizing, Nitriding and Carbonitriding, Applications of above processes for the industrial practices.	05	25
	TOTAL	**30**	**100**

Text Book(s):

Title	Author/s	Publication
Materials Science and Metallurgy	O. P. Khanna	Dhanpatrai Publication
Chemical Engineering Materials	Rumford F.	Constable and Company Limited, 2nd Edition, 1987
Membrane Separation Processes	Kaushik Nath	PHI Pvt. Ltd., 2008
Principles of Colloid and Surface Chemistry, 3rd Edn.	Hiemenz, P. C., and R. Rajgopalan	Marcel Dekker, NY, 1997.
Nano chemistry A chemical approach to nanomaterials	Ozin G. A, Andre C. Arsenault	Royal society of chemistry, UK,2005.

Reference Book(s):

Title	Author/s	Publication
Callister's Material Science and Engineering	R. Balasubramanian	Wiley India
Chemical Engineering Materials	Chaudhry H.	Indian Book Distributing Company, 2nd Edition, Delhi, 1982

Web Material Link(s):

- http://nptel.ac.in/downloads/113106032/

Course Evaluation:

Theory:

- Continuous Evaluation consists of two tests each of 30 marks and 1 Hour of duration, which will be converted to 30 marks.
- Faculty evaluation consists of 10 marks as per the guidelines provided by the course coordinator.
- End Semester Examination consists of 60 marks.

Course Outcome(s):

After the completion of the course, the student will able to

SECH2320	Materials Science and Technology
CO 1	Enable understanding of crystal structure of various materials.
CO 2	Analyze microstructures, crystallography and defects of different chemical engineering materials and metals
CO 3	Classify the metallurgy of ferrous and nonferrous metals and alloys.
CO 4	Define the basics of polymers and composite material.

Mapping of CO with PO

SECH2320	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	1			3			3			1		
CO 2	1			1			3			3		
CO 3	1			2						3		
CO 4	1			1								

Mapping of CO with PSO

SECH2320	PSO1	PSO2	PSO3
CO 1	3	3	2
CO 2	3	3	3
CO 3			
CO 4			

Level of Bloom's Revised Bloom's Taxonomy in Assessment

1: Remember	2: Understand	3: Apply
4: Analyze	5: Evaluate	6: Create

Module No	Content	RBT Level
1	Introduction to Engineering Materials	1,2
2	Structure and Imperfections in Crystals	2,3
3	Properties of Materials	4
4	Ferrous metals and its Alloys	2,3,4
5	Metals: their behaviours and properties	2,3,4
6	Heat Treatment and Surface hardening processes	2,5

P P Savani University
School of Engineering
Department of Science & Humanities

Course Code: SESH2120
Course Name: Numerical Method & Statistics
Prerequisite Course(s): SESH2110- Differential Methods and Complex Variable

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
03	-	02	05	40	60	-	-	100	00	200

CE: Continuous Evaluation, ESE: End Semester Exam

Objective(s) of the Course:
To help learner to

- provide the knowledge of numerical analysis & statistical methods to the students.
- mentally prepare the students to identify and formulate the engineering problem and obtain their solution.
- inculcate the analytical skill of the students to apply the Numerical & Statistical techniques to the problems of respective field.

Course Content:

Module No.	Content	Hours	Weightage in %
1.	**Approximations and Errors:** Errors and Their computations, General error formula. **Solution of Algebraic and Transcendental Equations:** Bracketing Methods (Bisection, Secant, Method of False Position), Convergence of Iterative Methods, Newton-Raphson Method, Newton-Raphson Method	7	17
2.	**Numerical Solutions of Linear Equations** Gauss-Seidel Method Iteration Method, Jacobi's Method, Gauss-SeidelMethod, Eigen Value Problem.	6	13
3.	**Numerical Differentiation and Integration** Finite Differences: Forward, Backward and Divided Differences Table,Newton's Forward, Backward and Divided Differences Interpolation Formula, Interpolation Polynomials, Lagrange Interpolation Formula Interpolation, Numerical Integration, Trapezoidal Rule, Simpson's 1/3-rule, Simpson's 3/8-rule.	10	20
4.	**Numerical Methods for ODEs**: Taylor's Series and Euler's Method, Modifications and Improvements in Euler's Method, Runge-Kutta 2nd Order & 4th Order Methods, Milne's Predictor-Corrector Methods, Boundary Value Problems.	7	16
5.	**Basics of Statistics** Elements, Variables, Observations, Quantitative and Qualitative data, Cross-sectional and Time series data, Frequency distribution, Dot plot, Histogram, Cumulative distribution, Measure of location, Mean, Median, Mode, Percentile, Quartile, Measure of variability, Range, Interquartile Range, Variance, Standard Deviation, Coefficient of Variation, Regression line and regression coefficient.	7	16

6.	**Probability Distribution** Introduction, Conditional probability, Independent events, independent experiments, Bayes' theorem, Probability distribution, Binomial distribution, Poisson distribution, Normal distribution.	8	18
	TOTAL	**30**	**100**

List of Tutorials:

Sr. No.	Name of Tutorial	Hours
1.	Approximations and Errors	2
2.	Solution of Algebraic and Transcendental Equations	4
3.	Numerical Solutions of Linear Equations	2
4.	Numerical Differentiation and Integration-1	2
5.	Numerical Differentiation and Integration-2	2
6.	Ordinary Differential Equations-1	2
7.	Ordinary Differential Equations-2	4
8.	Basics of Statistics-1	4
9.	Basics of Statistics-2	2
10.	Probability-1	4
11.	Probability-2	2
	TOTAL	**30**

Text Book(s):

Title	Author/s	Publication
Advanced Engineering Mathematics	Erwin Kreyszig	Wiley India Pvt. Ltd. New Delhi.
Probability and Statistics for Engineers	Richard A. Johnson Irwin Miller, John Freund	Pearson India Education Services Pvt. Ltd., Noida.

Reference Book(s):

Title	Author/s	Publication
Numerical Methods in Engineering & Science	B. S. Grewal	Khanna Publishers, New Delhi
Advanced Engineering Mathematics	R. K. Jain, S. R. K. Iyengar	Narosa Publishing House, New Delhi.
Introductory Methods of Numerical Analysis.	S. S. Sastry	PHI Learning Pvt. Ltd., New Delhi.
Statistics for Business and Economics	David R. Anderson, Dennis J. Sweeney,	Cengage Learning
	Thomas A.Williams	

Web Material Link(s):

- http://nptel.ac.in/courses/111106094/
- http://nptel.ac.in/courses/111105035/
- http://nptel.ac.in/courses/111101003/
- http://nptel.ac.in/courses/111105090/
- http://nptel.ac.in/courses/111107105/
- http://nptel.ac.in/courses/110107114

Course Evaluation:

Theory:

- Continuous Evaluation consists of two tests each of 30 marks and 1 Hour of duration, which will be converted to 30 marks.
- Faculty evaluation consists of 10 marks as per the guidelines provided by the course coordinator.
- End Semester Examination consists of 60 marks.

Tutorial:

- Continuous Evaluation consists of performance of tutorial which will be evaluated out of 10 marks for each tutorial and average of the same will be converted to 30 marks.
- MCQ based examination consists of 10 marks.
- Internal Viva consists of 10 marks.

Course Outcome(s):

After completion of the course, the student will be able to

SESH2120	NUMERICAL METHODS & STATISTICS
CO 1	Derive numerical solution of linear and nonlinear system of equation.
CO 2	Acquire knowledge of finite differences, interpolation, numerical differentiation andnumerical integration.
CO 3	Compare variety of numerical methods for solving ordinary differential Equation.
CO 4	Construct different statistical methods to collect, compare, interpret & evaluate data.
CO 5	Apply probability in decision making, artificial intelligence, machine learning etc.

Mapping of CO with PO

SESH2120	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	1	1	1								1
CO 2	2	1	1	2								1
CO 3	2	2	1	1								1
CO 4	2	1	1	1								1
CO 5												

Mapping of CO with PSO

SESH2120	PSO1	PSO2	PSO3
CO 1		2	
CO 2		2	
CO 3		2	
CO 4		2	
CO 5			

Level of Bloom's Revised Bloom's Taxonomy in Assessment

1: Remember	2: Understand	3: Apply
4: Analyze	5: Evaluate	6: Create

Module No	Content	RBT Level
1	Solution of Algebraic and Transcendental Equations	1, 2, 3, 4, 6
2	Numerical Solutions of Linear Equations	1, 2, 3, 5
3	Numerical Differentiation and Integration	1, 2, 3, 5
4	Numerical Methods for ODEs	1, 2, 3, 5, 6
5	Basics of Statistics	1, 2, 3, 4, 5
6	Probability Distribution	1, 2, 3, 4, 5

P P Savani University
School of Engineering

Department of Chemical Engineering

Course Code: SECH2330
Course Name: Heat Transfer Operations
Prerequisite Course(s): -

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
02	02	--	04	40	60	40	60	--	--	200

CE: Continuous Evaluation, ESE: End Semester Exam

Objective(s) of the Course:
To help learners to

- understand the basic concepts of conduction, convection and radiation heat transfer.
- understand how to formulate and be able to solve one- and two-dimensional conduction heat transfer problems.
- apply empirical correlations for both forced and free convection to determine values for the convection heat transfer coefficient.
- understand the basic concepts of radiation heat transfer to include both black body radiation and gray body radiation and evaluate radiation view factors using tables and the view factor relationships.

Course Content:

Module No.	Content	Hours	Weightage in %
1.	**Introduction** Modes of heat transfer - Conduction, Convection and Radiation,Material Properties of Importance in Heat Transfer – Thermal conductivity & Specific Heat Capacity.	03	05
2.	**Conduction: One Dimensional** Steady State Conduction through Constant Area, Thermal ContactResistance, Steady State Heat Conduction through a Variable Area – Cylinder & Sphere, Heat Conduction in Bodies with Heat Sources.	04	10
3.	**Convective Heat Transfer: One Dimensional** Principle of Heat Flow in Fluids and Concept of Heat Transfer Coefficient, Individual and Overall Heat Transfer Coefficient, Heat Transfer between Fluids Separated by a Flat Solid Wall & Separatedby a Cylindrical Wall, Enhanced Heat Transfer: Concept of Fins - Analytical Solution of Different Cases and Fin Efficiency, Thermal Insulation. Principle of Convection, Forced Convection Mechanism: Flow overa Flat Horizontal Plate**,** Flow through a Pipe or Tube – Turbulent, flow, Laminar flow, Flow through a Non-Circular duct, Flow over a Flat Plate, Flow over Cylinders and Spheres (Flow across a Cylinder,Flow across a Sphere, Flow across a Bank of tubes)**,** Momentum andHeat Transfer Analogies - Reynolds Analogy, The Chilton-Colburn Analogy, The Prandtl Analogy, The Van Karman Analogy.	06	25

4.	**Heat Transfer in Boiling and Condensation** Heat Transfer during Boiling, Boiling of Saturated Liquid - Nucleation Boiling, Maximum Heat Flux, Film Boiling, Heat Transfer during Condensation, Film Condensation, Condensation for Horizontal Tube - Condensation Outside Horizontal Tube or Bank of tube, Single Horizontal Tube, Vertical Tube of N Horizontal Tubes, Condensation inside a Horizontal Tube, Condensation for Packed and Fluidized bed.	05	15
5.	**Radiation Heat Transfer** Basic Definition Pertaining to Radiation - Emissive Power, Radiosity, Irradiation, Absoptivity, Reflectivity, and Transmissivity,Blackbody Radiation - Planck's law, Wien's law, The Stefan- Boltzmann law for Blackbody, Special Characteristic of Blackbody Radiation, Kirchhoff's law, Grey Body, Radiative Heat Exchanger between Surfaces - View Factor, Relation between View Factors, Heat Exchange between Non Blackbodies, Radiation Shield, Electrical Network for Radiation through Absorbing and Transmitting medium, Radiation Combined with Conduction and Convection.	06	15
6.	**Heat Exchangers** Elements of Shell and Tube Heat Exchanger, Thermal Design of HeatExchangers - Overall Heat Transfer Coefficient, Fouling Factor or Dirt Factor, Temperature Profiles in Heat Exchangers, LMTD Correction Factor, Individual Heat Transfer Coefficient, Pressure Drop in the Heat Exchanger, Correlation for Tube Side Pressure drop, Correlation for Shell Side Pressure Drop, Heat Transfer Effectiveness and Number of Transfer Units, Calculation and Designing of the Double-Pipe Heat Exchanger and Shell and Tube Heat Exchanger. Solution Properties – Concentration, Foaming, Degradation due to High Temperature, Scaling, Equipment Material – Evaporator, Natural Circulation Evaporator, Forced Circulation Evaporator, Falling Film Evaporator, Performance of Steam Heated Tubular Evaporators - Capacity and Economy - Single and Multiple Effect Evaporators, Boiling Point Elevation, Temperature Profile in an Evaporators, Method of Feeding: Multiple Effect Evaporators, Enthalpy Balance - Single Effect Evaporator, Effect of Heat of Dilution.	06	30
	TOTAL	**30**	**100**

List of Practical:

Sr. No	Name of Practical	Hours
1.	To determine Heat Transfer through Composite Wall at different temperature.	02
2.	Determination of Thermal Conductivity of Insulating Powder (Asbestos Powder).	02
3.	To find out Heat transfer in Double Pipe Heat Exchanger in Laminar Flow and Turbulent Flow.	04
4.	Calculation of Heat transfer Coefficient by Natural and Forced Convection	04
5.	Heat Transfer Calculation in Plate Heat Exchanger	04
6.	Shell and Tube Heat Exchanger	02
7.	Heat Transfer by Radiation: Stefan-Boltzmann Law	02
8.	Heat Transfer in Agitated Vessel	02
9.	Heat Transfer in Drop and Film wise Condensation Apparatus	04
10.	Pin-Fin Apparatus	04
	TOTAL	**30**

Text Book(s):

Title	Author/s	Publication
Heat Transfer	Holman J. P	Mc Graw-Hill
Heat Transfer: Principles and Applications	Dutta B. K	PHI
Process Heat Transfer	Kern D. Q	Tata Mc Graw-Hill Edition

Reference Book(s):

Title	Author/s	Publication
Unit Operations of Chemical Engineering	W. L., Smith, J. C., and Harriott	McGraw-Hill
Chemical Engineering - Vol. I.	Coulson, J.M., Richardson, J.F.	Pergamon and ECBS, 1970
Heat Transfer	Chapman, A.J.	Maxwell Macmillan International Edition, 1984

Web Material Link(s):

- https://nptel.ac.in/courses/103103032/

Course Evaluation:

Theory:

- Continuous Evaluation consists of two tests each of 30 marks and 1 Hour of duration, which will be converted to 30 marks.
- Faculty evaluation consists of 10 marks as per the guidelines provided by the course coordinator.
- End Semester Examination consists of 60 marks.

Practical:

- Continuous Evaluation consists of performance of Practical which will be evaluated out of 10 marksfor each practical and average of the same will be converted to 10 marks.
- Internal Viva consists of 10 mark.
- Practical performance/quiz/drawing/test of 15 marks during End Semester Exam.
- Viva/Oral presentation consists of 15 marks during End Semester Exam.

Course Outcome(s)

After the completion of the course, the student will able to

SECH2330	HEAT TRANSFER OPERATION
CO 1	Describe and classify different heat transfer process and its mode.
CO 2	Able to solve conduction, convection and radiation problems.
CO 3	Describe industrial applications and regimes involved in boiling and condensation.
CO 4	Predict extend of heat flow by radiation through grey, white and real surfaces.
CO 5	Categorize different types of evaporators with performance evaluation and to analyze material and energy balance for single and multi-effect systems.

Mapping of CO with PO

SECH2330	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	2	2	1						2	2		2
CO 2	3	2	3						2	2		3
CO 3	2	2	1						2	3		2
CO 4	2	2	1						2	2		3
CO 5	2	2	1						2	3		3

Mapping of CO with PSO

SECH2330	PSO1	PSO2	PSO3
CO 1	3	3	
CO 2	2	2	3
CO 3	2	1	1
CO 4	3		1
CO 5	3	2	3

Level of Bloom's Revised Bloom's Taxonomy in Assessment

1: Remember	2: Understand	3: Apply
4: Analyze	5: Evaluate	6: Create

Module No	Content	RBT Level
1	Introduction	1,2
2	Conduction: One Dimensional	2,3
3	Convective Heat Transfer: One Dimensional	1,3,5
4	Heat Transfer in Boiling and Condensation	2,3,5
5	Radiation Heat Transfer	1,3
6	Heat Exchangers	1,3,5

P P Savani University

School of Engineering

Department of Chemical Engineering

Course Code: SECH2340
Course Name: General Chemical Technology
Prerequisite Course(s): --

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
02	02	--	03	40	60	40	60	--	--	200

CE: Continuous Evaluation, ESE: End Semester Exam

Objective(s) of the Course:

To help learners to

- understand various chemical allied industries and their operations.
- know the wide field of chemical engineering in various sectors.
- get basic knowledge of industries like chlor-alkali, petrochemicals, pesticides, cement etc.

Course Content:

Module No.	Content	Hours	Weightage in %
1.	**Fuel and Energy** Classification of Fuel, Various Types of Coal, Coal as Chemical FeedStock, Coal Carbonization and Coke Oven Plant, Gasifiers, Gasification of Coal, Petro coke And Biomass. Origin, Occurrence and Characteristics of Crude Oil, Crude Oil Distillation and Secondary Processing, Manufacturing Processes of Formaldehyde, Acetaldehyde, Acetic acid, Acetic Anhydride, Maleic Anhydride, Nitrobenzene, Ethylene Oxide, Ethylene Glycol.	05	20
2.	**Chlor-Alkali Industry** Production of Common Salt, Caustic Soda, Chlorine, HydrochloricAcid and Soda Ash.	05	15
3.	**Pulp and Paper Industries** Raw Materials, Pulping Processes, Stock Preparation and PaperMaking, Chemical Recovery from Black Liquor.	05	15
4.	**Pesticides Industries** Processes for Manufacturing of Insecticides, Fungicides andHerbicides.	05	15
5.	**Polymer and Synthetic Fibre Industries** Introduction to Polymerization, Commodity Polymers, Rayon,Polyester, Polyamide, Acrylic Fibre and Nylons.	05	15
6.	**Cement & Glass Manufacturing Industries** Lime Stone Beneficiation and Manufacturing of Cement, Types ofCement, Manufacturing of Glass, Types of Glass.	05	20
	TOTAL	**30**	**100**

List of Practical:

Sr. No	Name of Practical	Hours
1.	To check the hardness of given water sample.	02
2.	To determine the loss on igniting the cement sample.	01
3.	To determine the total silica in the given sample.	02
4.	To determine the amount of potassium in the given sample of fertilizer.	04
5.	To determine the total insoluble residue in the cement sample.	04
6.	To determine % available chlorine in bleaching powder.	04
7.	To determine the amount of calcium in the given sample of fertilizer Volumetrically	04
8.	Determine the acid value of the given sample of oil.	04
9.	Preparation of detergent.	01
10.	Preparation of Boric acid by acidified solution of Borax ($Na_2B_4O_7$).	02
11.	Preparation of $CaCl_2$ from HCl and lime ($CaCO_3$).	02
	TOTAL	**30**

Text Book(s):

Title	Author/s	Publication
Dryden's Outlines of Chemical Technology - 3rd Edition	Gopala Rao. M. and Marshall Sittig	East-West Press, New Delhi, 2008
Shreve's Chemical Process Industries	George. T Austin	McGraw-Hill International Editions, Singapore, 1984

Reference Book(s):

Title	Author/s	Publication
Chemical vol. I, II, III, & IV	Chemical Engineering Education Development Centre	IIT Madras, 1975-78.
Introduction to Chemical Equipment Design: Mechanical Aspects	Bhattacharyya, B C.	CBS Publisher, 2012

Web Material Link(s):

- https://nptel.ac.in/courses/103103027/

Course Evaluation:

Theory:

- Continuous Evaluation consists of two tests each of 30 marks and 1 Hour of duration, which will be converted to 30 marks.
- Faculty evaluation consists of 10 marks as per the guidelines provided by the course coordinator.
- End Semester Examination consists of 60 marks.

Practical:

- Continuous Evaluation consists of performance of Practical which will be evaluated out of 10 marksfor each practical and average of the same will be converted to 10 marks.
- Internal Viva consists of 10 marks.
- Practical performance/quiz/drawing/test of 15 marks during End Semester Exam.
- Viva/Oral presentation consists of 15 marks during End Semester Exam

Course Outcome(s):

After the completion of the course, the student will able to

SECH2260	General Chemical Technology
CO 1	Recall fundamental principles of chemical engineering involved in process technology, including material balances, energy balances, and unit operations.

CO 2	Demonstrate comprehension of the interplay between different unit operations inchemical processes, and analyze how changes in operating conditions impact process performance and product quality.
CO 3	Apply theoretical knowledge to solve practical problems encountered in chemical process industries, such as optimizing reactor design, troubleshooting equipment failures, and ensuring compliance with safety regulations.
CO 4	Analyze complex chemical processes by breaking them down into component unitoperations, evaluating the efficiency of each step, and identifying potential areas for improvement or optimization.
CO 5	Critically assess the sustainability and environmental impact of chemical processes, considering factors such as energy consumption, waste generation, and raw material utilization, and propose strategies for minimizing adverse effects while maximizing efficiency and profitability.

Mapping of CO with PO

SECH2260	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	2	1	2	1					2	2		3
CO 2	2	2	2	3					2	3		2
CO 3	2	1	3	2					3	2		1
CO 4	3	3	3	1					3	3		2
CO 5	2	3	3	3					3	3		3

Mapping of CO with PSO

SECH2260	PSO1	PSO2	PSO3
CO 1	2	1	2
CO 2	3	3	3
CO 3	3	1	2
CO 4	2	2	1
CO 5	3	2	3

Level of Bloom's Revised Bloom's Taxonomy in Assessment

1: Remember	2: Understand	3: Apply
4: Analyze	5: Evaluate	6: Create

Module No	Content	RBT Level
1	Fuel and Energy	1,2
2	Chlor-Alkali Industry	1,2,5,6
3	Pulp and Paper Industries	1,2,5,6
4	Pesticides Industries	1,2,5,6
5	Polymer and Synthetic Fibre Industries	1,2,6
6	Cement & Glass Manufacturing Industries	1,2,5,6

P P Savani University
School of Engineering

Department of Chemical Engineering

Course Code: SECH2350
Course Name: Chemical Engineering Thermodynamics-I
Prerequisite Course(s): --

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
02	--	02	04	40	60	--	--	40	60	200

CE: Continuous Evaluation, ESE: End Semester Exam

Objective(s) of the Course:
To help the learners to

- understand and appreciate thermodynamics as applied to various Chemical Engineering Processes.
- avail practical experience on the principles, viz., thermodynamic laws, Solution thermodynamics,Phase equilibrium and reaction equilibrium.

Course Content:

Module No.	Content	Hours	Weightage in %
1.	**Introduction to the laws of Thermodynamics:** Concept of Equilibrium, Entropy & Gibbs Free Energy, Laws of Thermodynamics (Open and Closed Systems) and Equations ofChange (dU, dH, dA, dG).	04	10
2.	**Properties of pure fluids:** PVT behavior including EOS for mixtures; Fugacity estimation/ calculations based on PVT behavior, Heat effects accompanying chemical Reactions. Phase equilibrium criteria and VLE calculations for different pressure ranges including flash calculations.	03	15
3.	**Estimation of VLE data:** Fugacity, Fugacity Coefficient, Activity, Activity Coefficient, Activity coefficient calculation from experimental VLE data and data reduction, applications of Gibbs-Duhem relation for calculations of and consistency check for VLE data.	05	10
4.	**Phase Diagrams in Thermodynamics:** Phase diagrams for miscible, partially miscible and immiscible liquidmixtures, introduction to LLE and VLE calculations.	03	15
5.	**Thermodynamic Properties of Solutions:** Introduction to fugacity and activity, Activity Coefficients-Partial	09	30
	molar properties- miscible system, immiscible system, Chemical potential as a partial molar property-Lewis randall rule-Roults and Henry's law-Gibbs Duhem Equation Mathematical relation among thermodynamic functions, Maxwell's relations, Interrelation between H, S, U, G, C_p, C_v, properties of single- and two-phase system.Types of thermodynamic diagrams. Partially immiscible system, testing of vapor-liquid equilibrium data, Van Laar equation. Margules equation, Redlich-Kister equation, P-X-Y, T-X-Y, & X-Y Diagram, vapor-liquid equilibrium of ideal and non-ideal solution		

6.	**Refrigeration and liquefaction:** Carnot refrigerator, Vapour compression cycle, Absorption refrigeration, Choice of refrigerant, Heat pump, Liquefactionprocesses.	06	20
	TOTAL	**30**	**100**

List of Tutorials:

Sr No	Name of Tutorials	Hours
1.	Tutorial – 1 (Entropy & Gibbs Free Energy) Calculation	02
2.	Tutorial – 2 (Fugacity estimation) Calculation	04
3.	Tutorial – 3 (Phase equilibrium criteria) Calculation	04
4.	Tutorial – 4 (Fugacity Coefficient) Calculation	04
5.	Tutorial – 5 (Activity Coefficient) Calculation	02
6.	Tutorial – 6 (Henry's law-Gibbs Duhem Equation) Calculation	02
7.	Tutorial – 7 (Maxwell's relations) Calculation	04
8.	Tutorial – 8 (Carnot refrigerator) Calculation	04
9.	Tutorial – 9 (Vapour compression cycle) Calculation	02
10.	Tutorial – 10 (Absorption refrigeration) Calculation	02
	TOTAL	**30**

Text Book(s):

Title	Author/s	Publication
Introduction to Engineering Thermodynamics	J.M. Smith, Hendrick Van Ness, Michael M. Abbott,	McGraw Hill, New York, 2005.
Chemical Engineering Thermodynamics	S. Sundaram	Ahuja Publishers, New Delhi, 2001
A Textbook of Chemical Engineering Thermodynamics	K.V. Narayanan	PHI Learning, 2004

Reference Book(s):

Title	Author/s	Publication
Chemical Engineering Thermodynamics	B.F. Dodge	McGraw Hill, New York, 1971.
Chemical Engineering Thermodynamics	Y.V.C. Rao	Universities Press (1997)
Chemical Process Thermodynamics 3rd Ed,	B.G. Kyle	Prentice Hall India, 1994

Web Material Links:

- http://nptel.ac.in/courses/103106070/

Course Evaluation:

Theory:

- Continuous Evaluation consists of two tests each of 30 marks and 1 Hour of duration, which will be converted to 30 marks.
- Faculty evaluation consists of 10 marks as per the guidelines provided by the course coordinator.
- End Semester Examination consists of 60 marks.

Tutorial:

- Continuous Evaluation consists of performance of Tutorial which should be evaluated out of 10 marks for each Tutorial and average of the same will be converted to 10 marks.
- Internal Viva consists of 10 marks.
- Practical performance/quiz/drawing/test of 15 marks during End Semester Exam.
- Viva/Oral presentation of various topics consists of 15 marks during End Semester Exam.

Course Outcome(s):

After the completion of the course, the student will able to

SECH2350	**CHEMICAL ENGINEERING THERMODYNAMICS-I**
CO 1	Relate the terminology associated with engineering thermodynamics.
CO 2	Evaluate changes in different thermodynamic properties for pure fluids using eos.
CO 3	Correlate experimental vle data of pure component and ideal mixtures with suitable equations.
CO 4	Calculate feasibility of reaction, heat of reaction, extent of reaction & equilibrium composition.
CO 5	Construct to devise a technically feasible refrigerator for wide applications.

Mapping of CO with PO

SECH2350	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	2	1				2					1	
CO 2	2					2						
CO 3	2	1				2					2	
CO 4	3	1				2					2	
CO 5	2	1				2						

Mapping of CO with PSO

SECH2350	PSO1	PSO2	PSO3
CO 1			
CO 2		1	
CO 3		2	
CO 4		2	
CO 5		1	

Level of Bloom's Revised Bloom's Taxonomy in Assessment

1: Remember	2: Understand	3: Apply
4: Analyze	5: Evaluate	6: Create

Module No	**Content**	**RBT Level**
1	Introduction to the laws of Thermodynamics	1,2
2	Properties of pure fluids	2,3
3	Estimation of VLE data	3,4,5
4	Phase Diagrams in Thermodynamics	4
5	Thermodynamic Properties of Solutions	4,5,6
6	Refrigeration and liquefaction	5,6

P P Savani University
School of Engineering

Department of Chemical Engineering

Course Code: SECH2360
Course Name: Mass Transfer Operations - I
Prerequisite Course(s): --

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
03	02	--	04	40	60	40	60	--	--	200

CE: Continuous Evaluation, ESE: End Semester Exam

Objective(s) of the Course:
To help the learners to

- learn the concept of diffusion in gas, liquid & solid.
- understand the basics of inter-phase mass transfer.
- learn application of gas-liquid operation and simultaneous heat and mass transfer operations.

Course Content:

Module No.	Content	Hours	Weightage in %
1.	**Introduction** Introduction to Mass Transfer Operation, Classification of masstransfer	02	05
2.	**Diffusion** Introduction**,** Molecular diffusion, Flux, Models of diffusion, Fick's law, Molecular and eddy diffusion, Molecular diffusion in gases, Steady state molecular diffusion in a binary mixture through constant area - fluids at rest and laminar condition and for gases, A diffusing in non-diffusing B, equimolar counter current diffusion forgases.	08	15
3.	**Mass Transfer Coefficients and Analogy Equations** Introduction, Types of mass transfer coefficients, Dimensionlessgroups in mass transfer, Analogy between momentum, heat and mass transfer, Mass transfer coefficients for simple geometrical shapes.	06	15
4.	**Interphase Mass Transfer** Introduction, Theories of interphase mass transfer – two film,penetration, surface renewal and boundary layer theory.	04	10
5.	**Humidification and dehumidification** Introduction, Terminologies used, Adiabatic saturationtemperature, Wet-bulb temperature, Operation involving gas-liquid contact, Water cooling, Adiabatic Humidification – Cooling, Cooling range and approach, Nonadiabatic operations – evaporative cooling, Equipment for air-water contact, some accessories and operational features of cooling tower.	08	15

6.	**Drying** Introduction, Drying Equilibria, Some important terminologies, Mechanism and Theory of drying, Drying rate curve- Constant Rate period, Cross circulation, falling rate and through circulation, Continuous drying, Rate of batch drying – Cross circulation and through circulation, Rate of continuous drying, Batch driers – directand indirect driers, Continuous driers – direct and indirect driers, selection of driers.	07	15
7.	**Crystallization** Introduction, Solid Liquid equilibria, Solubility data,Supersaturation, Material and energy balance, Crystallization process, Method of nucleation, Crystal growth, Mier's supersaturation theory, Fractional crystallization, crystallization and precipitation, Caking of crystals , Crystallization equipment, Working principle of crystallizers like agitated batch, Swenson- walker, Circulating liquor and magma, Melt crystallization – Suspension based and progressive freezing, Purification, Reactive crystallization.	07	15
8.	**Distillation: Special Operations** Distillation in a packed column, Azeotropic, extractive, molecular and multicomponent distillation, Reactive distillation.	03	10
	TOTAL	**45**	**100**

List of Practical:

Sr No	Name of Practical	Hours
1.	Solid In Air Diffusion (Vaporization Of Naphthalene Balls)	02
2.	To determine the rate of drying for rotary dryer for different air flow rates & different air inlet temperatures.	04
3.	Mass Transfer With/Without Chemical Reaction (Solid-Liquid System – Dissolution Of Benzoic Acid In Aqueous NaOH Solution)	04
4.	To calculate the mass transfer coefficient in the Humidification and Dehumidification column.	04
5.	To perform Spray Drying.	02
6.	Vapour In Air Diffusion - To determine the diffusion coefficient of an organic vapor (i.e. CCl4) in air.	02
7.	To study mass transfer operation in water cooling tower for different flow & thermos dynamic conditions.	04
8.	Liquid – Liquid Diffusion - To study the effect of temperature on the diffusion coefficient.	04
9.	Natural Draft Tray Dryer - To perform drying test on solids & heat and mass transfer analysis of a drying process.	02
10.	To study Swenson Walker crystallizer.	02
	TOTAL	**30**

Text Book(s):

Title	Author/s	Publication
Mass Transfer – Principles and Operations	A.P. Sinha and Parameshwar De	PHI Learning Private Limited, New delhi
Mass Transfer concepts	K Ashokan	Universities Press
Unit Operations of Chemical Engineering	W L McCabe and J C Smith.	McGraw-Hill International

Reference Book(s):

Title	Author/s	Publication
Chemical Engineering Vol.- II, 6th Ed.	J.M. Coulson & J.F. Richardson	Elsevier, 2003 or Pergamon Press.
Unit Operations	G.G. Brown Ed.	John Wiley & Sons, 1950
Transport Processes and Separation Process Principles' 4th Ed	C.G. Geankopolis	Prentice Hall India, 2003.

Web Material Link(s):

- https://nptel.ac.in/courses/103103035/

Course Evaluation:

Theory:

- Continuous Evaluation consists of two tests each of 30 marks and 1 Hour of duration, which will be converted to 30 marks.
- Faculty evaluation consists of 10 marks as per the guidelines provided by the course coordinator.
- End Semester Examination consists of 60 marks.

Practical/Tutorial:

- Continuous Evaluation consists of performance of Practical which will be evaluated out of 10 marksfor each practical and average of the same will be converted to 10 marks.
- Internal Viva consists of 10 marks.
- Practical performance/quiz/drawing/test of 15 marks during End Semester Exam.
- Viva/Oral presentation consists of 15 marks during End Semester Exam.

Course Outcome(s):

After the completion of the course, the student will able to

SECH2360	MASS TRANSFER OPERATIONS - I
CO 1	Identify and demonstrate different mass transfer mechanism such diffusion.
CO 2	Explain and describe different mass transfer theories and analogies.
CO 3	Classify industrial dryers & crytallizers.
CO 4	Apply the knowledge of humidification & dehumidification to solve industrial problem in drying & crystalliation.

Mapping of CO with PO

SECH2360	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	3	1	1								1
CO 2	3	2	1									1
CO 3	3	2	1	1								
CO 4	3	2	1									1

Mapping of CO with PSO

SECH2360	PSO1	PSO2	PSO3
CO 1	1		
CO 2	1	1	
CO 3	1	2	
CO 4	1		

Level of Bloom's Revised Bloom's Taxonomy in Assessment

1: Remember	2: Understand	3: Apply
4: Analyze	5: Evaluate	6: Create

Module No	Content	RBT Level
1	Introduction	2,3
2	Diffusion	1,2
3	Mass Transfer Coefficients and Analogy Equations	2,3,4
4	Interphase Mass Transfer	4,5
5	Humidification and dehumidification	4,5
6	Drying	2,3,4
7	Crystallization	2,3,4
8	Distillation: Special Operations	2,4,5

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