1. Course Profiles

Course profiles of all the Engineering and Non-Engineering Courses as listed in the Scheme of Studies, are attached herewith.

NED University of Engineering and Technology

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Course Profile

COURSE CODE& TITLE ES-108: Ideology and Constitution of Pakistan	SEMESTER ☐ SPRING ■ FALL	CREDIT HOURS TH ☐ 3 ■ 2 ☐ 1 ☐ 0 PR ☐ 3 ☐ 2 ☐ 1 ■ 0
PREREQUISITE COURSE(S) N/A	DATE OF COURSE CONTENT APPROVAL 2025	APPLIED FROM BATCH **2025**

COURSE CONTENTS

Two-Nation Theory

Nation and Nationalism in British India. Inclusive nationalism, Exclusive nationalism, Freedom movement in British India, Two-Nation Theory.

Ideology: definition and its significance

Difference between Philosophy, Ideology, and Theory. Evolution of Islamic ideology in British India. Pakistan movement: role of ideology. Ideological factors that shaped the Constitution(s) of Pakistan (Objectives Resolution 1949).

Introduction to the Constitution of Pakistan

Definition and importance of a constitution. First Constituent Assembly of Pakistan. Main issues that delayed the Constitution-making in Pakistan. Dissolution of the Constituent Assembly. Second Constituent Assembly of Pakistan. Third Constituent Assembly of Pakistan.

Constitution and State Structure

Federal form of State. Parliamentary form of government. Structure of Government (executive, legislature, and judiciary). Distribution of powers between federal and provincial governments.

Fundamental Rights, Principles of Policy, and Responsibilities

Duty of the citizens of Pakistan (Article 5). Overview of fundamental rights to citizens of Pakistan guaranteed by the Constitution 1973 (Articles 8-28). Overview of Principles of Policy (Articles 29-40).

Constitutional Amendments

Procedures for amending the Constitution. Notable constitutional amendments and their implications: 8th, 13th, 17th, and 18th.

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	**Describe** the historical evolution of Islamic ideology in British India and critically evaluate its influence on the freedom movement and the basic principles of the Constitution of Pakistan	C-2	The Engineer and the world
2	**Discuss** the foundational concepts of the Constitution of Pakistan, including the structure of the state, system of governance, key institutions, fundamental rights, and civic responsibilities of citizens.	C-2	The Engineer and the world

REMARKS (if any):

Recommended by: _____ (Chairperson/Date)

Approved by: _____ (Dean/Date)

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Course Profile

COURSE CODE& TITLE ES-206: Islamic Studies	SEMESTER ☐ SPRING ■ FALL	CREDIT HOURS TH ☐ 3 ■ 2 ☐ 1 ☐ 0 PR ☐ 3 ☐ 2 ☐ 1 ■ 0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL** **15-05-2024**	**APPLIED FROM BATCH** **2024**

COURSE CONTENTS

Fundamentals of Islam: Tauheed, Arguments for the Oneness of God; **Al-Ambiya-22, Al-Baqarah-163-164,** Impact of Tauheed on human life, Place of Man in the Universe: **Al Israa/Bani Israil-70**; Purpose of creation: **Al zariyat-56,** Prophethood, Need for Prophet, Characteristics of Prophet, Finality of Prophethood: **Al-Imran-79, Al-Hashr-7, Al-Maidah-3,** and Faith in Hereafter (Aakhirat), Effects on worldly life: **Al-Hajj-5, Al-Baqarah-48, Hadith**

Ibadah: Concept of Ibadah, Major Ibadah, Salat, Zakat, Hajj and Jihad. **Al-Mu'minun-1-11, Al Anfaal- 60, & Two Ahadiths**

Basic Sources of Shariah: The Holy Quran, Its revelation and compilation, the authenticity of the Text, Hadith, Its need, Authenticity and Importance, Consensus (Ijmaa), Analogy (Qiyas)

Moral and Social Philosophy of Islam: The concept of Good and Evil; **A'l e Imran - 110, Al Nahl-125,** Akhlaq-e-Hasna with special reference to **Surah Al-Hujrat, verses 10, 11, 12, 13,** Professional Ethics (Kasb-e-Halal) **Al Taha-81, Al Baqar 188, one hadith.**

Seerat of the Holy Prophet(PBUH):

a) Moral and ethical teachings of the Holy Prophet (PBUH) with special reference to Hajjat-ul-Wida, (Fundamentals of Islam, Social aspects, Economics aspects, political aspects

b). Personal Characteristics: perseverance & trust in Allah, honesty & integrity, simplicity & humility, mercy & compassion, clemency & forgiveness, bravery & valor, generosity, patience.

c) Engagement and communication with collaborators and foes:

Cases Study from Seerah: Charter of Madina, Ghazwa e Khandaq, Treaty of Hudaibya , Ghazwa e Khayber, Najran's Delegation, Victory of Makkah.

d) Social values and rights, (peace & harmony, tolerance, solidarity, collaborations, inclusivity & cohesion)

Case Studies from Seerah: Al –Fudoul Confederacy, Placement of Black stone, charter of Medina, Treaty of Hudaibya)

leadership skills (Vision, communication, negotiation, conflict management, decision making, relationship building, Integrity, positivity, compassion, empathy, loyalty, accountability, confidence, delegation, empowerment, problem-solving, foresightedness, openness, gratitude and justice).

Teaching of Holy Quran: Translation and tafseer of **Surah-e- Fatiha**, and The Selected Section of Sura Al-Furqan verses (63-77), Surah-**e-Luqman** (verses (12-19)).

Nazraah and Tajveed of: Suratul Fatiha, Ayatal Kursi, and last 10 surahs of the Holy Quran. (Ghunnah, Qalqalah, Al-Madd, Noon Sakinah & Tanween Rules)

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COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	**Explain** the provided Quranic verses and Hadiths and their functional meaning and about the specified topics.	**C2**	**Ethics**
2	**Describe** the foundational principles of Sariah sources and the exemplary characteristics of Seerat –un-Nabi (SAW) in personal and professional life.	**C2**	**Ethics**

REMARKS (if any):

Recommended by: _____ (Chairperson/Date)

Approved by: _____ (Dean/Date)

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Course Profile

COURSE CODE & TITLE ES-209: Ethical Behaviour (for Non-Muslims)	**SEMESTER** ☐ SPRING ■ FALL	**CREDIT HOURS** TH ☐ 3 ■ 2 ☐ 1 ☐ 0 PR ☐ 3 ☐ 2 ☐ 1 ■ 0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL 2018**	**APPLIED FROM BATCH** 2021

COURSE CONTENTS

Nature, Scope and Methods of Ethics: Ethics and Religion, Ethical teachings of World Religions

Basic Moral Concepts: Right and Wrong, Good and Evil

Ethical Systems in Philosophy: Hedonism, Utilitarianism, Rationalism & Kant, Self-Realization Theories, Intuitionism

Islamic Moral Theory: Ethics of Qur'an and its Philosophical basis, Ethical precepts from Qur'an and Hadith and Promotion of Moral Values in Society.

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	**Explain** the ethical teachings of the world's major religions.	**C2**	**PLO 7: Ethics**
2	**Describe** the importance and implications of ethics on individuals and societies.	**C2**	**PLO 7: Ethics**

REMARKS (if any):

Recommended by: _____ (Chairperson/Date)

Approved by: _____ (Dean/Date)

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Course Profile

COURSE CODE& TITLE	SEMESTER	CREDIT HOURS
MT-116: Calculus and Analytical Geometry	☐ SPRING ■ FALL	TH ■ 3 ☐ 2 ☐ 1 ☐ 0 PR ☐ 3 ☐ 2 ☐ 1 ■ 0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL**	**APPLIED FROM BATCH** 2025

COURSE CONTENTS

Set and Functions:
Define rational, irrational and real numbers; rounding off a numerical value to specified value to specified number of decimal places or significant figures; solving quadratic, and rational inequalities in involving modulus with graphical representation; Definition of set, set operations, Venn diagrams, De Morgan's laws, Cartesian product, Relation, Function and their types (Absolute value, greatest integer and combining functions). Graph of some well-known functions. Limit of functions and continuous and discontinuous functions with graphical representation.

Differential Calculus:
Differentiation and Successive differentiation and its application: Leibnitz theorem. Taylor and Maclaurin theorems with remainders in Cauchy and Lagrange form, power series. Taylor and Maclaurin series, L' Hopitals rule, extreme values of a function of one variable using first and second derivative test, asymptotes of a function, curvature and radius of curvature of a curve, partial differentiation, extreme values of a function of two variables with and without constraints. Solution of non-linear equation, using Newton Raphson method.

Integral Calculus:
Indefinite integrals and their computational techniques, reduction formulae, definite integrals and their convergence. Beta and Gamma functions and their identities, applications of integration relevant to the field.

Sequence & Series:
Sequence, Infinite Series, Application of convergence tests such as comparison, Root, Ratio, Raabe's and Gauss tests on the behaviour of series.

Analytical Geometry:
Review of vectors, scalars and vector products, Three-dimensional coordinate system and equation of straight line and plane and sphere, curve tracing of a function of two and three variables, surface revolutions, coordinate transformation.

Complex Number:
Argand diagram, De Moivre formula, root of polynomial equations, curve and regions in the complex plane, standard functions and their inverses (exponential, circular and Hyperbolic functions).

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COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	**Solve** real and complex numbers problems	**C3**	**Problem Analysis**
2	**Apply** Analytical geometry, different and integral calculus to engineering problems.	**C3**	**Problem Analysis**
3	**Carry out** calculation to discuss the behavior of sequence and series.	**C3**	**Problem Analysis**

REMARKS (if any):

Recommended by: _____ (Chairperson/Date)

Approved by: _____ (Dean/Date)

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Course Profile

COURSE CODE& TITLE	SEMESTER	CREDIT HOURS
CH-110: Chemical Engineering Principles	☐ SPRING ■ FALL	TH ■ 3 ☐ 2 ☐ 1 ☐ 0 PR ☐ 3 ☐ 2 ■ 1 ☐ 0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL** 26-05-2025	**APPLIED FROM BATCH** 2025

COURSE CONTENTS

Pressure scales, Composition of mixtures. Units, dimensions and conversions, temperature. Principles of stoichiometric combination.

Nature of balances: concept of a balance. Input-output relationships. Steady state considerations. Black box approach. Sub-systems and interconnections.
Familiarization with flow sheets. Block diagrams and tables. Process flow diagrams, P&I diagram.

Balances for batch & continuous plant. Mass balances for multiple streams of plant, Balances for combustion processes.
Choice of basis/datum for balances Overall and component balances, limiting and excess reactants. Balances for systems with recycle, purge, and by-pass streams. Mass balances for reactive & nonreactive processes, Tie components.

Simultaneous mass and energy balances; Temperature and pressure sub-systems and interconnections. Case studies on balances for a selection of important industrial processes. Energy balances for combustion processes. Efficiency and conversion. Standard states; Temperature and pressure dependence; Heat Effects; Computer applications in stoichiometric calculations.

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	**Define** the basic terminologies used in chemical engineering.	C1	Engineering Knowledge
2	**Apply** the concepts of conservation of mass and energy to calculate the material and energy requirement of a process for reacting and non-reacting systems.	C3	Problem Analysis
3	**Demonstrate** problem-solving skills by providing a framework and approach for complex engineering calculations.	C3	Design/Development of Solutions
4	**Use** different software to solve the material and energy balance problem	C3	Tool Usage

REMARKS (if any):

Recommended by: _____ **Approved by:** _____

(Chairperson/Date) (Dean/Date)

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Course Profile

COURSE CODE& TITLE CY-110: Applied Chemistry For Engineers	**SEMESTER** ☐ SPRING ■ FALL	**CREDIT HOURS** TH ☐3 ■2 ☐1 ☐0 PR ☐3 ☐2 ■1 ☐0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL** 14-04-2017	**APPLIED FROM BATCH** 2021

COURSE CONTENTS

Electrochemistry:
Laws of Electrolysis, E.M.F. series, corrosion (Theories, inhibition & protection).

Water & Sewage:
Sources of water, impurities, hardness, water softening, purification of water for potable and industrial purposes, electro dialysis, introduction to environmental pollution, main sources and effects, Sewage treatment.

Fuels:
Types of fuels, classification of fossil fuels.

Metals & Alloys:
Properties and general composition of metals and alloys such as Iron, Copper, Aluminum, Chromium, Zinc used in engineering field.

Engineering Materials:
Inorganic engineering materials: Cement
Class Organic engineering materials: Polymers, Rubbers, Plastics and Paints, Semiconductors and Dielectric materials.

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COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	**Understand** the fundamental concepts of electrochemistry, water treatment, fuels, metals, and engineering materials for their application in engineering processes.	**C2**	**Engineering Knowledge**
2	**Solve** engineering problems related to corrosion, water treatment, and fuel selection using fundamental concepts of electrochemistry, water chemistry, and fuel types.	**C3**	**Problem Analysis**
3	**Operate** laboratory equipment under guidance to accurately measure physical and chemical parameters, following standard procedures	**P3**	**Tool Usage**

REMARKS (if any):

Recommended by: _____ **Approved by:** _____

(Chairperson/Date) (Dean/Date)

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Course Profile

COURSE CODE& TITLE	SEMESTER	CREDIT HOURS
PP-103: Workshop Practice	☐ SPRING ■ FALL	TH ☐ 3 ☐ 2 ☐ 1 ■ 0 PR ☐ 3 ☐ 2 ■ 1 ☐ 0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL** 31/07/2015	**APPLIED FROM BATCH** 2025

COURSE CONTENTS

Carpentry: Exercises in preparing simple joints; Bench-fitting practice; Exercise in marking and fitting: Use of measuring instruments. Metal Processing: Simple machine shop operation such as Drilling, Milling. Turning. Polymer Processing Techniques: Injection Moulding. Extrusion. Protrusion Techniques, Blow Moulding, and Vacuum Forming. Welding of Plastics: Ultrasonic, friction, vibrations, hot plate, hot gas and resistance and inductive implant.

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	**REPEAT** experiment individually or in a group using modern tools with complete data recording & analysis complying with standards/codes or lab procedures and safety.	**P3**	**PLO 5: Tool Usage**

REMARKS (if any):

Recommended by: _____ **Approved by:** _____

(Chairperson/Date) (Dean/Date)

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Course Profile

COURSE CODE& TITLE	SEMESTER	CREDIT HOURS
CY-100: Essentials of Chemistry (For computer science students)	☐ SPRING ■ FALL	TH ☐ 3 ☐ 2 ☐ 1 ■ 0 PR ☐ 3 ☐ 2 ☐ 1 ■ 0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL**	**APPLIED FROM BATCH** 2023

COURSE CONTENTS

Stoichiometry:
Significant figures, mole and Avogadro number, empirical and molecular formulas, stoichiometry yield (theoretical and practical)

Atomic Structure and Bonding:
Subatomic particles, Rutherford's and Bohr's atomic models, quantum numbers, electronic configuration, chemical bond, theories of covalent bond, shapes of molecules.

States of Matter:
Kinetic molecular theory, gas laws, liquid properties, types of solids, types of crystals

Acid, Base and Salt:
Theories of acids and bases, buffer solutions

Solutions and Colloids:
Properties and types of solutions, concentration units, colloids, and its classification

Electrical Conductance:
Redox reaction with balancing concept, electrode, electrode potential, and electrochemical series, corrosion

Organic Chemistry:
Organic compounds and their classification, homologous series, functional groups, nomenclature of organic Compounds.

Inorganic Chemistry:
Periodic classification of elements, periodic laws, group trends of various properties of s and p block elements, general characteristics of transition elements, IUPAC nomenclature of complexes.

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	**Describe** the classification, periodic behavior, and nomenclature of organic, inorganic, and coordination compounds.	C2	Engineering Knowledge
2	**Explain** concepts of general chemistry stoichiometry, atomic structure, bonding, states of matter, acid-base theories, solutions, redox reactions, and electrochemistry for theoretical and practical problems.	C2	Problem Analysis
3	**Operate** the equipment with guidance to measure physical and chemical parameters	P3	Engineering Knowledge

REMARKS (if any):

Recommended by: _____ **Approved by:** _____

(Chairperson/Date) (Dean/Date)

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Course Profile

COURSE CODE& TITLE	SEMESTER	CREDIT HOURS
MM-102: Introduction to Engineering Materials	■ SPRING ☐ FALL	TH ☐ 3 ■ 2 ☐ 1 ☐ 0 PR ☐ 3 ☐ 2 ☐ 1 ■ 0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL** 12-01-2017	**APPLIED FROM BATCH** 2016-17

COURSE CONTENTS

Introduction to engineering materials, their scope and role in industrial development, raw materials for engineering materials: their availability and demand, fundamentals of engineering materials: atomic bonding, crystal structures of metals, introduction to polymers, ceramic, composite and semiconductor materials. Processing, properties and applications of metallic, polymeric, ceramic, composite and semiconductor materials. An introduction to new breeds of engineering materials e.g., shape memory materials, smart materials, electrical, magnetic and optical materials. Materials of aerospace and transportation industries. Laboratory activities.

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	**Identify** basic properties based on knowledge of atomic composition and chemical bonding and structure of various materials	C1	Engineering Knowledge
2	**Solve** for atomic packing factor, unit cell and lattice parameter of different materials	C3	Problem Analysis
3	**Work** as an individual/team member to express the knowledge of engineering materials	A3	Individual and Collaborative Teamwork
4	**Explain** the procedure for evaluating different materials properties	C2	Engineering Knowledge

REMARKS (if any):

Recommended by: _____ **Approved by:** _____

(Chairperson/Date) (Dean/Date)

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Course Profile

COURSE CODE& TITLE	SEMESTER	CREDIT HOURS
ES-105: Pakistan Studies	■ SPRING ☐ FALL	TH ☐ 3 ■ 2☐ 1☐ 0 PR ☐ 3 ☐ 2☐ 1■ 0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL** 21-06-2023	**APPLIED FROM BATCH** 2024

COURSE CONTENTS

Historical and Ideological Perspective of Pakistan Movement

Two Nation Theory, Factors leading to the creation of Pakistan, Jinnah and demand for Pakistan.

Land of Pakistan

Geophysical conditions of Pakistan, Geopolitical and strategic importance of Pakistan, Natural resources of Pakistan: mineral, water and power resources.

Constitutional process

Early efforts to make a constitution (1947-1956), Salient features of the Constitution of 1956, 1962, Political and Constitutional crisis of 1971, Salient features of the Constitution of 1973, Constitutional amendments from 1973 to date.

Contemporary issues of Pakistan

A brief Survey of Pakistan's economy, The Current Economic Situation of Pakistan: Problems & Issues and future perspective, Social Issues: Pakistan's society and culture: broad features, Literacy and education in Pakistan: problems and issues, Scientific and technical development in Pakistan, Citizenship: national and international. Environmental Issues: Environmental pollution: causes, hazards and solutions, National policy, International treaties, conventions and protocols.

Pakistan's Foreign Policy

Pakistan's Foreign Policy from 1947 to present, Relations with immediate neighbors, Relations with major powers, Relations with the Muslim world.

Human Rights

Conceptual foundations, Western and Islamic perspective of Human Rights, Human Rights in the Constitution of 1973, Human rights issues in Pakistan.

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	**Explain** the historical and ideological foundations of the Pakistan Movement and assess its contemporary relevance in both regional and global contexts.	C2	The Engineer and the world
2	**Discuss** key issues related to Pakistan's natural resources, economy, governance, and climate change, and propose viable solutions to address these challenges	C2	PLO 6: The Engineer and the world

REMARKS (if any):

Recommended by: _____ (Chairperson/Date)

Approved by: _____ (Dean/Date)

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Course Profile

COURSE CODE& TITLE	SEMESTER	CREDIT HOURS
ES-127: Pakistan Studies (For Foreigners)	■ SPRING ☐ FALL	TH ☐ 3 ■ 2 ☐ 1 ☐ 0 PR ☐ 3 ☐ 2 ☐ 1 ■ 0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL** 21-06-2023	**APPLIED FROM BATCH** 2025

COURSE CONTENTS

Land of Pakistan:
Land & People-Strategic importance- Important beautiful sights, Natural resources.

A Brief Historical Background:
A brief Historical survey of Muslim community in the sub-continent, British rule & its impacts, Indian reaction, Two nation theory, Origin & development, Factors leading towards the demand of a separate Muslim state, Creation of Pakistan

Government & Politics in Pakistan:
Constitution of Pakistan, A brief outline, Governmental structure, Federal & Provincial, Local Government Institutions, Political History, A brief account.

Pakistan & the Muslim World:
Relations with the Muslim countries

Language and Culture:
Origins of Urdu Language, Influence of Arabic & Persian on Urdu Language & Literature, A short history of Urdu literature.

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	**Describe** the historical, ideological, socio-economic, and political aspects of Pakistan as a nation and state.	**C2**	**The Engineer and The World**
2	**Discuss** Pakistan's culture, issues, and challenges through appropriate actions and advocacy	**C2**	**The Engineer and The World**

REMARKS (if any):

Recommended by: _____ (Chairperson/Date)

Approved by: _____ (Dean/Date)

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Course Profile

COURSE CODE& TITLE PF-101: IT Fundamentals and Applications	SEMESTER ■ SPRING ☐ FALL	CREDIT HOURS TH ☐ 3 ■ 2 ☐ 1 ☐ 0 PR ☐ 3 ☐ 2 ☐ 1 ■ 0
PREREQUISITE COURSE(S)	**DATE OF COURSE CONTENT APPROVAL** 26-05-2025	**APPLIED FROM BATCH** 2025

COURSE CONTENTS

Fundamentals of IT: Introduction to Information and Communication Technologies (ICT), Components and scope of ICT, ICT productivity tools, Emerging technologies and future trends, Ethical Considerations in Use of ICT Platforms and Tools, Applications of ICT in education, healthcare and finance. Digital citizenship.

Data Representation and Number Systems: Binary, octal, decimal, hexadecimal systems, data representation: characters, numbers, multimedia.

Databases: Fundamentals of databases, organization and storage, introduction to Information Systems (IS) and Management Information Systems (MIS), real world IS and MIS applications.

Data Communication and Computer Networking: Network topologies, Types of networks

Programming Languages: Evolution and structures: syntax, semantics, special purpose vs. general-purpose languages, comparative study of data types, control structures and algorithms, basics of coding, practical problem solving.

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme Learning Outcome (PLO)
At the end of the course, the student will be able to:			
1	**Describe** fundamental concepts in information technology and data management	**C2**	**Engineering Knowledge**
2	**Apply** programming constructs to solve complex problems using a modern high-level language	**C3***	**Tool Usage**
3	**Practice** the application of ICT tools and computer programming in a laboratory environment	**C3+**	**Tool Usage**

REMARKS (if any):

* Also to be assessed in lab work through software rubric in addition to theory.

+ Only to be assessed in lab work through software rubric.

Recommended by: _____ (Chairperson/Date)

Approved by: _____ (Dean/Date)

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COURSE CODE& TITLE	SEMESTER	CREDIT HOURS
EA-128: Functional English	■ SPRING ☐ FALL	TH ■ 3 ☐ 2 ☐ 1 ☐ 0 PR ☐ 3 ☐ 2 ☐ 1 ■ 0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL** 14-04-2017	**APPLIED FROM BATCH** 2022

COURSE CONTENTS

Listening skills and subskills: Effective listening techniques: listening for gist, details, and specific information in a range of situations (AV lectures, interviews, documentaries etc.)

Speaking skills: Speaking with fluency and accuracy in a variety of situations including conversations, group discussion, academic and social interaction, public speaking, presentation skills, and interviews**;** Pronunciation improvement exercises (through websites, apps, and in class worksheets)

Reading and subskills: Reading strategies: Skimming, scanning, and detailed reading, identifying main ideas, supporting details, and inferences (multiple genres including newspapers, books, stories, documentaries etc). Reading Practice: Reading comprehension tasks. Reading output tasks (notes, summary, discussion, counter argument etc.)

Study skills: Effective note-taking strategies for lectures, meetings, and reading texts. Taking in varied forms paragraph, lists, infographics etc.) ; Interpreting instructions oral and written. Effective examination taking technique (comprehending instructions, planning, and writing answers ensuring relevance and precise

Writing skills: Writing process, Pre-writing strategies (Mind mapping, cubing, outlining, clustering etc.); Writing to describe, argue, compare and contrast, persuade through writing prompts; Writing academic and professional genres: emails, letters, short report, resume, cover letter, building profiles on various job portal; Writing accuracy: Identifying and overcoming grammatical problems.

Vocabulary and grammar development: Vocabulary Development strategies. Exposure and practice to develop every day and academic vocabulary and basic grammatical structures applied in the formal contexts.

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	**Employ** effective study skills and strategies for various academic functions.	C3	Communication
2	**Comprehend** explicit and implicit information through reading and listening strategies.	C2	Communication
3	**Produce** various spoken and written genres for different academic and professional settings.	C6	Lifelong Learning

REMARKS (if any):

Recommended by: _____ **Approved by:** _____

(Chairperson/Date) (Dean/Date)

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F/QSP 11/17/01

Course Profile

COURSE CODE& TITLE: PH-129: Applied Physics	SEMESTER ■ SPRING ☐ FALL	CREDIT HOURS TH ■ 3 ☐ 2 ☐ 1 ☐ 0 PR ☐ 3 ☐ 2 ☐ 1 ■ 0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL** 26-05-2025	**APPLIED FROM BATCH 2025**

COURSE CONTENTS

Vectors & Mechanics: Review of vectors, Newton Laws and their Applications, Frictional Forces and determination of Co-efficient of Friction, Work-Energy Theorem, applications of law of Conservation of Energy, Angular Momentum, Centre of Mass.

Waves and Oscillations: Simple Harmonic Oscillator, Damped Harmonic Oscillation, Forced Oscillation and Resonance, Types of Waves and Superposition Principle

Optics and Lasers: Huygens Principle, Two-slit interference, Single-Slit Diffraction, Types of Lasers, Applications of Laser.

Modern Physics: Planck's explanations of Black Body Radiation Photoelectric Effect, De-Broglie Hypothesis, Electron Microscope, Atomic structure, X-rays, Radioactive Decay and Radioactive Dating, Radiation Detection Instruments

Electrostatics and Magnetism: Electric field due to different Charge Distribution, Electrostatic Potential Applications of Gauss's Law, Lorentz Force Ampere's Law, Magnetism, Magnetization, Magnetic Materials.

Electrical Elements and Circuits: Review of electric current, voltage, power, and energy, Ohm's law, inductance, capacitance, Basic Electrical circuits, Electromechanical systems.

Semiconductor Physics and Electronics: Energy levels in a Semiconductor, Hole concept, P-N junction, Diodes, Transistors, Basic Electronic circuits (e.g. rectifier).

Thermodynamics: Review of Laws of Thermodynamics, conduction, convection, and radiation. Thermal conductivity, specific heat, and overall heat transfer coefficients. Heating, Ventilation and Air Conditioning (HVAC).

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	**Discuss** principle of physics; and explain the concept of classical and modern physics to solve related problems	C2	Engineering Knowledge
2	**Use** the concept of Classical Physics for engineering problems	C3	Problem Analysis
3	**Apply** the concept of Modern Physics to solve physical problems	C3	Problem Analysis

REMARKS (if any):

Recommended by: _____ (Chairperson/Date)

Approved by: _____ (Dean/Date)

NED University of Engineering and Technology

Department of Chemical Engineering

Program Bachelors of Engineering in Chemical

F/QSP 11/17/01

Course Profile

COURSE CODE& TITLE	SEMESTER	CREDIT HOURS
MT-221: Linear Algebra & Ordinary Differential Equations	☐ SPRING ■ FALL	TH ■3 ☐2 ☐1 ☐0 PR ☐3 ☐2 ☐1 ☐0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL**	**APPLIED FROM BATCH** 2025

COURSE CONTENT

Linear Algebra: Linearity and linear dependence of vectors, basis, dimension of a vector space, field matrix and type of matrices (singular, non- singular, symmetric, non- symmetric, upper, lower, diagonal), Rank of a matrix using row operations and special method, echelon and reduced echelon forms of a matrix, determination of consistency of a system of linear equation using rank, matrix of linear transformations, eigen value and eigen vectors of a matrix, Diagonalization. Applications of linear algebra in relevant engineering problems.

1st Order Differential Equations: Basic concept: Formation of differential equations and solution of differential equations by direct integration and by separating the variables: Homogeneous equations and equations reducible to homogeneous from; Linear differential equations of the order and equations reducible to the linear form; Bernoulli's equations and orthogonal trajectories: Application in relevant Engineering.

2nd and Higher Orders Equations: Special types of IInd order differential equations with constant coefficients and their solutions: The operator D; Inverse operator I/D; Solution of differential by operator D methods; Special cases, Cauchy's differential equations; Simultaneous differential equations; simple application of differential equations in relevant Engineering.

Partial Differential Equation: Basic concepts and formation of partial differential equations: Linear homogeneous partial differential equations and relations to ordinary differential equations: Solution of first order linear and special types of second and higher order differential equations; D' Alembert's solution of the wave equation and two-dimensional wave equations: Lagrange's solution; Various standard forms.

Fourier Series: Periodic functions and expansion of periodic functions in Fourier series and Fourier coefficients: Expansion of function with arbitrary periods. Odd and even functions and their Fourier series; Half range expansions of Fourier series.

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	**Describe** formation of differential equations and system of linear equations to explain physical situations	C2	Engineering Knowledge
2	**Apply** appropriate methods to solve differential equations and system of linear equations of relevant engineering problems.	C3	Problem Analysis

REMARKS (if any):

Recommended by: _____ (Chairperson/Date)

Approved by: _____ (Dean/Date)

NED University of Engineering and Technology

Department of Chemical Engineering

Program Bachelors of Engineering in Chemical

F/QSP 11/17/01

Course Profile

COURSE CODE& TITLE	SEMESTER	CREDIT HOURS
CH-109 Chemical Engineering Drawing	☐ SPRING ■ FALL	TH ☐ 3 ☐ 2 ☐ 1 ■ 0 PR ☐ 3 ☐ 2 ■ 1 ☐ 0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL** 26-05-2025	**APPLIED FROM BATCH** 2025

COURSE CONTENTS

Introduction to engineering drawing and graphics: Use of drawing instruments and equipment, Basic drafting techniques and standards, Geometrical curves including plane curves, cycloid, Hypocycloid, and involute.

Projection fundamentals include projection theory, Orthographic projections, projection of points and lines, Dimensionaling and tolerance, engineering geometry, Sectioning, orthographic reading and writing, engineering curves, surface development, fastening methods, and connectors.

Introduction to Chemical Engineering Drawings: Piping, equipment, Fundamentals of Process Flow Diagrams, Symbols for Process Equipment, Drawing Flow Diagrams for Simple Chemical Processes, Drawing PFD for Unit Operations. Introduction to computer-aided drawing software. Computer-aided drawing.

Introduction to P&IDs, Symbols for Piping, Valves, and Instruments, Creating Simple P&ID Diagrams for Chemical Processes, Designing P&ID for small-scale chemical processes. Equipment Layouts and Plant Design Basic Equipment Layout Principles, Placement of Equipment in Chemical Plants. Drawing layouts for reactors, distillation columns, and pumps.

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	**Use** drawing instruments and CAD tools to create detailed machines and process engineering drawings with minimal supervision.	**P3**	**Tool Usage**

REMARKS (if any):

Recommended by: _____ **Approved by:** _____

(Chairperson/Date) (Dean/Date)

NED University of Engineering and Technology

Department of Chemical Engineering

Program Bachelors of Engineering in Chemical

F/QSP 11/17/01

Course Profile

COURSE CODE& TITLE	**SEMESTER**	**CREDIT HOURS**
CH-107 Chemical Engineering Thermodynamics-I	☐ SPRING ■ FALL	TH ☐ 3 ■ 2 ☐ 1 ☐ 0 PR ☐ 3 ☐ 2 ■ 1 ☐ 0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL** 14-07-2017	**APPLIED FROM BATCH** 2021

COURSE CONTENTS

Introduction to Thermodynamics, application areas of thermodynamics, state and path functions, concept of equilibrium & types, laws of thermodynamics and processes. Specific heat and enthalpy calculations, energy balance to open and closed system and its applications. PVT relations of pure substances ideal and real gases, compressibility factor, law of corresponding states and eccentric factor, equations of state and its applications Introduction to entropy, isentropic process, entropy changes ideal gas, entropy balance to open and closed system and its applications, ideal work, lost work and its applications. Gas Power Cycles, Basic assumptions and analysis of gas power cycles, Carnot cycle, introduction to gas turbine, Rankine cycle, Brayton cycle.

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	**Explain** the basic terminologies, interactions and laws of thermodynamics	C2	Engineering Knowledge
2	**Apply** thermodynamics concepts and laws on devices and **Use** of gas equations for real systems	C3	Design/Development of Solutions
3	**Imitate** independently different thermodynamics related experiments	P3	Investigation

REMARKS (if any):

Recommended by: _____ **Approved by:** _____

(Chairperson/Date) (Dean/Date)

NED University of Engineering and Technology

Department of Chemical Engineering

Program Bachelors of Engineering in Chemical

F/QSP 11/17/01

Course Profile

COURSE CODE& TITLE	SEMESTER	CREDIT HOURS
CH-216: Physical & Analytical Chemistry	☐ SPRING ■ FALL	TH ☐ 3 ■ 2 ☐ 1 ☐ 0 PR ☐ 3 ☐ 2 ■ 1 ☐ 0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL** 26-05-2025	**APPLIED FROM BATCH** 2025

COURSE CONTENTS

Kinetic theory of gases, Dalton's law Henry's law, Raoult's law, Antoine equation, Relative volatility
Chemical Analysis and Data Handling: Sample purification, accuracy and precision, errors, calibration methods, standard deviation and tests of significance. Constructing and interpreting quality control plots. The use of computers in data handling.

Surface Phenomena: Adsorption, Catalysis, Enzyme catalysis. Electrochemistry. including fuel cells.
Colloidal chemistry, Reaction kinetics and equilibrium.

Electro-analytical Techniques: Theoretical principles, Electro-analytical techniques such as potentiometry, conductometry, polarography, pH meter and voltammetry.

Chromatographic methods: Principle, Gas, Liquid and supercritical fluid chromatographic techniques, instrumentation and industrial applications in chemical analysis.

Spectroscopy, Basics of spectroscopy UV and visible spectroscopy

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	**Explain** the fundamentals of physical and analytical chemistry	C2	Engineering Knowledge
2	**Demonstrate** understanding of instrumental techniques	C3	Problem Analysis
3	To be able to **Perform** a given experimental task and to derive valid conclusion	P3	Investigation

REMARKS (if any):

Recommended by: _____ **Approved by:** _____

(Chairperson/Date) (Dean/Date)

NED University of Engineering and Technology

Department of Chemical Engineering

Program Bachelors of Engineering in Chemical

F/QSP 11/17/01

Course Profile

COURSE CODE& TITLE	SEMESTER	CREDIT HOURS
EE-124: Basic Electricity and Electronics	☐ SPRING ■ FALL	TH ☐ 3 ■ 2 ☐ 1 ☐ 0 PR ☐ 3 ☐ 2 ■ 1 ☐ 0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL** 13/09/2021	**APPLIED FROM BATCH** 2025

COURSE CONTENTS

Fundamentals of Electric Circuits: Charge, Current, Voltage and Power, Voltage and Current Sources. Ohm's Law Voltage and Current Laws: Nodes, Paths, loops and Branches, Kirchhoffs Current law, Kirchhoffs Voltage Laws, the single loop.

Circuits: The single node-pair circuits, series and parallel connected. Independent sources, resistors in series and parallel, voltage and current division

Basic Nodal and Mesh Analysis: Multi-Nodal Analysis, the super node, Mesh Analysis, the super mesh

Circuit Analysis Techniques: Linearity and Superposition, Source Transformations. The venin and Norton Equivalent Circuits, Maximum Power Transfer, Delta-Wye Conversion

Capacitors and Inductors: Capacitors, Inductor, Inductance and Capacitance Combination

Basic RL and RC Circuits: The Source-Free RL Circuit, Properties of the Exponential Response, the Source-Free RC Circuits. The Unit-Steps Function and driven RL Circuits. Natural and forced response and driven RL Circuits. The RLC Circuit The Source-Free Parallel Circuit, the over damped parallel RLC Circuits, Critical Damping, the under damped Parallel RLC Circuit. The Source-Free Series RLC Circuit, the complete response of the RLC Circuit. The lossless LC Circuit

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	Have **understanding** of basic circuit analysis laws and **Apply** them to solve various circuits.	**C3**	**Engineering Knowledge**
2	**Use** various techniques to solve and analyze electrical circuits and problems effectively	**C4**	**Problem Analysis**
3	**Manipulate** various electrical circuits under guidance and are able to verify different network theorem	**P3**	**Investigation**

REMARKS (if any):

Recommended by: _____ **Approved by:** _____

(Chairperson/Date) (Dean/Date)

NED University of Engineering and Technology

Department of Chemical Engineering

Program Bachelors of Engineering in Chemical

F/QSP 11/17/01

Course Profile

COURSE CODE & TITLE CH-218: Chemical Process Industries	SEMESTER ☐ SPRING ■ FALL	CREDIT HOURS TH ■3 ☐2 ☐1 ☐0 PR ☐3 ☐2 ☐1 ■0
PREREQUISITE COURSE(S)	**DATE OF COURSE CONTENT APPROVAL** 26-05-2025	**APPLIED FROM BATCH** 2025

COURSE CONTENTS

Introduction to data analysis, investigation, design, and communication fundamentals in chemical engineering. Introduction to chemical products and process design. Needs analysis and problem identification. Literature search and brainstorming. Design requirements, constraints, and criteria. Process synthesis, block diagrams, process flow diagrams (PFD), and piping and instrumentation diagrams (P&ID).

Types of Chemical Industries; Acid Industries: Manufacture, history, properties and uses of acetic acid, formic acid, benzoic acid, phthalic acid, oxalic acid, sulphuric acid, nitric acid.

Sugar and Fermentation Industries: Introduction, culture development, inoculum preparation, nutrients for microorganisms, toxic effects on culture. Manufacture, properties, and uses of Industrial alcohol, absolute alcohol, butyl alcohol, glycerol, ethylene glycol, and propylene glycol.

Fertilizer Industry: Ammonia and Urea, Pulp and Paper Industry. Polymers and Petrochemical Industry. Cement Industry

Industrial sodium Compounds: The manufacture, properties, and uses of industrial sodium compounds like sodium thiosulfate, sodium bromide, sodium sulfate, and sodium sulfite, etc

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1.	**Recall** the processes involved in the manufacture of chemical products, including raw material pretreatment	**C1**	**Engineering Knowledge**
2.	**Use** industry-specific knowledge of chemicals to evaluate and propose sustainable process designs	**C3**	**The Engineer and the World**
3.	**Demonstrate** awareness of safety, health, and environmental impacts in the evaluation of industrial chemical processes, emphasizing responsible and ethical decision-making	**A3**	**Lifelong Learning**

REMARKS (if any):

Recommended by: _____ **Approved by:** _____

(Chairperson/Date) (Dean/Date)

NED University of Engineering and Technology

Department of Chemical Engineering

Program Bachelors of Engineering in Chemical

F/QSP 11/17/01

Course Profile

COURSE CODE& TITLE	SEMESTER	CREDIT HOURS
PF-206: Engineering Economics and Management (Social Science Electives)	☐ SPRING ■ FALL	TH ☐3 ■2 ☐1 ☐0 PR ☐3 ☐2 ☐1 ■0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL** 03/01/2024	**APPLIED FROM BATCH** 2025

COURSE CONTENTS

Introduction:

Basic Concepts and principles of Economics, Micro- and Macro-economic theory, the problem of scarcity. Basic concepts of Engineering Economy, Financial effectiveness and non-monetary factors.

Economic Environment:

Consumers and producer goods, Goods and services, Demand & Supply concept. Market Equilibrium, Elasticity of demand, Elasticity of Supply, Measures of Economics worth, Price, supply-demand-relationship, Revenue, Cost and profit function.

Elementary Financial Analysis:

Basic accounting equation. Development and interpretation of financial statements-Income Statement, Balance Sheet and Cash Flow, Working capital management, Financial Ratio Analysis.

Time Value of Money and Financial Returns:

Concepts of simple, compound and effective interest rates, Less often than compounding period and more once a year; Present Value, Future Value and Annuities concepts, Uniform gradient and geometric sequence of cash flow.

Depreciation and Taxes: Depreciation concept, Economic life, Methods of depreciation, Gain (loss) on the disposal of an asset, Depreciation as a tax shield.

Basic cost concepts and Break Even Analysis:

Types of costs and cost curves; Determination of Cost/Revenues. Numerical and graphical presentations. Practical applications, BEA as a management tools for achieving financial/operational efficiency.

Management:

Project Management; Integration of Organization Strategy with Projects, Defining the project, developing a network plan, managing risk, reducing project time, project selection and comparing alternatives techniques scheduling resources. Introduction to System, Application and Products (SAP) in Data processing.

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme Learning Outcome (PLO)
At the end of the course, the student will be able to:			
1	**Understand** the basic concepts of engineering economics and economic environment keeping in view the local and global markets	C2	The Engineer and the World
2	**Analyze** financial statements to improve the financial and operational efficiency of an organization by reducing the cost and increasing the profit	C4	Lifelong Learning
3	**Apply** project management principles to business and economic scenarios	C3	Project Management and Finance

REMARKS (if any):

Recommended by: _____
(Chairperson/Date)

Approved by: _____
(Dean/Date)

NED University of Engineering and Technology

Department of Chemical Engineering

Program Bachelors of Engineering in Chemical

F/QSP 11/17/01

Course Profile

COURSE CODE& TITLE	**SEMESTER**	**CREDIT HOURS**
MG-257 Organizational Behaviour (Social Science Electives)	☐ SPRING ■ FALL	TH ☐ 3 ■ 2 ☐ 1 ☐ 0 PR ☐ 3 ☐ 2 ☐ 1 ■ 0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL** 2023	**APPLIED FROM BATCH** 2025

COURSE CONTENTS

Introduction to Organizational Behavior; What Is Organizational Behavior?

The Individual; Diversity in Organizations, Attitudes and Job Satisfaction, Emotions and Moods, Personality and Values, Perception and Individual Decision Making, Motivation: From Concepts to Applications

The Group; Foundations of Group Behavior, Understanding Work Teams, Communication, Leadership, Power and Politics, Conflict and Negotiation, Foundations of Organization Structure

The Organization System; Organizational Culture, Human Resource Policies and Practices, Organizational Change and Stress Management

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	**Discuss** key organizational behavior concepts and its implications in engineering	**C2**	**Lifelong Learning**
2	**Apply** organizational behavior skills with reference to the engineering profession	**C3**	**The Engineer and the World**

REMARKS (if any):

Recommended by: _____ **Approved by:** _____

(Chairperson/Date) (Dean/Date)

NED University of Engineering and Technology

Department of Chemical Engineering

Program Bachelors of Engineering in Chemical

F/QSP 11/17/01

Course Profile

COURSE CODE& TITLE	SEMESTER	CREDIT HOURS
MG-228 Sociology & Development (Social Science Electives)	☐ SPRING ■ FALL	TH ☐ 3 ■ 2 ☐ 1 ☐ 0 PR ☐ 3 ☐ 2 ☐ 1 ■ 0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL** 2018	**APPLIED FROM BATCH** 2025

COURSE CONTENTS

Introduction to Sociology: Importance and scope, study of social life, exploring the global village, Sociology as a science, relationship with other social sciences, the sociological imagination, development of sociology, Society and community, Social interaction processes.

Social groups & Social Institutions: Definition, functions, and types of social groups, Structure and function of social institutions.

Culture and Related Concepts: Definition, Types and Elements of Culture, Role of Culture in Organization, Socialization and Personality.

Social Stratification: Factors of Social Stratification, Approach to study Social Stratification, Power, Prestige, and Authority, Social mobility, migration.

Social and cultural change: Definition and dynamics of social change, Impact of globalization on society and culture, Resistance to change.

Sociology of Development: Significant sociological questions, Measures of inequality and development, Modernization theory and explanation of underdevelopment, Education, Industrialization & development.

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	**Discuss** key concepts and theoretical perspectives of sociology	**C2**	**The Engineer and the World**
2	**Evaluate** contemporary social and developmental issues in pursuance of sustainable practices	**C4**	**Ethics**
3	**Express** ideas and plans for socioeconomic changes in society	**A3**	**Lifelong learning**

REMARKS (if any):

Recommended by: _____ **Approved by:** _____

(Chairperson/Date) (Dean/Date)

NED University of Engineering and Technology

Department of Chemical Engineering

Program Bachelors of Engineering in Chemical

F/QSP 11/17/01

Course Profile

COURSE CODE& TITLE CH-209: Fluid Mechanics-I	SEMESTER ■ SPRING ☐ FALL	CREDIT HOURS TH ☐ 3 ■ 2 ☐ 1 ☐ 0 PR ☐ 3 ☐ 2 ■ 1 ☐ 0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL**	**APPLIED FROM BATCH** 2025

COURSE CONTENTS

Introduction: Liquids and gases, properties of fluids, Force, mass and weight, Units and Conversions.

Fluid Statics: Basic equations, pressure forces on surfaces, Pressure vessels, piping, pressure measuring devices.

Bernoulli's equation and its applications; diffusers and sudden expansion: Torricelli's equation, cavitation and unsteady flows.

Fluid Friction: Reynolds Experiment; laminar and turbulent flows; Friction factor method, fitting loses, enlargements and contractions, friction in non-circular channels, economic pipe diameter, Concept of Boundary Layer and its importance in fluid mechanics, flow around submerged objects.

Momentum: Momentum balances; steady flow applications, nozzles and diffusers.

Dimensional Analysis:

Buckingham –Pi Theorem; Reynold's law of Similitude.

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	**Understand** the physical properties of fluid and mechanics of Laminar, Turbulent & Transition flows.	**C2**	**Engineering Knowledge**
2	**Apply** the laws of mass, energy & Linear momentum on steady state fluid flow problems in simple geometries	**C3**	**Problem Analysis**
3	**Demonstrate** fundamental concepts of fluid flow through laboratory experiments and carry out friction loss calculations on various fluid flow systems and pipe fittings.	**P3**	**Investigation**

REMARKS (if any):

Recommended by: _____ **Approved by:** _____

(Chairperson/Date) (Dean/Date)

NED University of Engineering and Technology

Department of Chemical Engineering

Program Bachelors of Engineering in Chemical

F/QSP 11/17/01

Course Profile

COURSE CODE& TITLE	SEMESTER	CREDIT HOURS
CH-220: Chemical Engineering Thermodynamics-II	■ SPRING ☐ FALL	TH ☐ 3 ■ 2 ☐ 1 ☐ 0 PR ☐ 3 ☐ 2 ☐ 1 ■ 0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL** 26-05-2025	**APPLIED FROM BATCH** 2025

COURSE CONTENTS

Mass, energy and entropy balance, laws of thermodynamics, thermodynamic cycles and equation of state,
General Vapour Liquid Equilibrium (VLE) behavior: Equilibrium criterion and Raoult's law. Bubble point, Dew point and Flash calculations.
Fundamental property equations: Partial derivatives, identities and Maxwell relations, residual properties, calculation of thermodynamic properties for pure substances.
Fugacity, chemical potential, activity coefficients, and the Gibbs-Duhem relation. Mixture properties: Partial molar quantities; Excess properties; mixing rules, thermodynamic properties calculations of mixtures.
Activity models: Introduction, calculations in Phase Equilibria: Liquid-Liquid, development of ternary diagrams, Liquid-Solid, thermodynamic Analysis of Chemical Processes.
Chemical reaction equilibrium: Equilibrium constants; single and multi-reaction equilibria, Dependence of equilibrium constant on T, P, and composition.
Introduction to Statistical Thermodynamics: Boltzman model, fermi-dirac model, Bose Einstein model, Maxwell Boltzman model

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	**Apply** Laws, phase equilibrium principles, and energy balance equations to perform various calculations.	C3	Problem Analysis
2	**Analyze** chemical reaction equilibrium and phase behavior in multi-component systems.	C4	Design/Development of Solutions

REMARKS (if any):

Recommended by: _____
(Chairperson/Date)

Approved by: _____
(Dean/Date)

NED University of Engineering and Technology

Department of Chemical Engineering

Program Bachelors of Engineering in Chemical

F/QSP 11/17/01

Course Profile

COURSE CODE& TITLE	SEMESTER	CREDIT HOURS
CH-219: Heat Transfer	■ SPRING ☐ FALL	TH ■ 3 ☐ 2 ☐ 1 ☐ 0 PR ☐ 3 ☐ 2 ■ 1 ☐ 0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL** 26-05-2025	**APPLIED FROM BATCH** 2025

COURSE CONTENTS

Fundamentals of Heat Transfer, Conduction, Fourier's law of heat conduction, steady-state one-dimensional heat conduction without and with heat generation, conduction in multi-layer geometries and its application in insulation, unsteady-state heat conduction, Introduction to heat conduction in two dimensions.

Convection: Concept of free and forced convection; concept of heat transfer coefficient and Newton's law of cooling; forced convection in laminar and turbulent flows in pipes and on flat plates; use of dimensional analysis in convection; concept of overall heat transfer coefficient, Convective heat transfer with and without phase change. Correlations for forced and natural convection. Concept of thermal boundary layer and its analogy with momentum boundary layer.

Radiation Heat Transfer: Laws of radiation, radiation surface behavior, concept of shape factors for black body and non-black body radiation.

Heat Transfer Equipment: Types and selection criteria; types of heat exchangers and design; heat transfer with phase change; boiling and condensation; the boiling curve; and evaporator selection.

Industrial applications categorization, selection criteria, and design of numerous heat transfer equipment: heat exchangers. International standards, e.g., TEMA, ASTM, and IPS standards.

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	**Explain** the modes of heat transfer and their governing mechanisms.	**C2**	**Engineering Knowledge**
2	**Describe** the mechanism of heat transfer in boiling and condensation and estimation of respective heat transfer coefficients	**C3**	**Problem Analysis**
3	**Apply** different methods/strategies to the design of heat transfer equipment	**C4**	**Design/ Development of Solutions**
4	**Imitate** experiments on heat transfer equipment and interpret experiment data.	**P3**	**Investigation**

REMARKS (if any):

Recommended by: _____ **Approved by:** _____

(Chairperson/Date) (Dean/Date)

NED University of Engineering and Technology

Department of Chemical Engineering

Program Bachelors of Engineering in Chemical

F/QSP 11/17/01

Course Profile

COURSE CODE& TITLE CH-221: Particulate Technology	SEMESTER ■ SPRING ☐ FALL	CREDIT HOURS TH ■ 3 ☐ 2 ☐ 1 ☐ 0 PR ☐ 3 ☐ 2 ■ 1 ☐ 0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL** 26-05-2025	**APPLIED FROM BATCH** 2025

COURSE CONTENTS

Particle and particulate systems (Sieve analysis, Particle size analysis); Processing (Granulation, Sedimentation); Powder, ultra-fine, and nanoparticles technology

Particle Formation and processing: granulation, Agglomeration, fluidization, and size reduction; description and energy calculations for coarse to ultrafine size reduction equipment.

Engineering the Properties of Particulate Systems: Colloids, Coal-Water Slurries, Slurry Rheology, Motion of particles in fluid: drag force on a spherical particle, motion of bubbles and drops, accelerated motion of particles in centrifugal field, sedimentation of fine particles and coarse particles.

Storage and Transport: Hopper Design, Conveyors and their types, Pneumatic Conveying, Standpipes, Slurry Flow, flow through porous media, the Carman-Kozney equation. Safety considerations in solid transport.

Separation: Filtration, Settling, Cyclones, Electrostatic precipitation.

Solid -Liquid mixing: Types of mixing and mixing mechanism. Equipment for solid-liquid mixing.

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	**Perform** elementary calculations for analyzing typical industrial processes involving particulate solids	C2	Engineering Knowledge
2	**Describe** common equipment involving paniculate solids	C3	Problem Analysis
3	**Evaluate** the energy efficiency and operational effectiveness of different particle size reduction equipment for coarse to ultrafine materials.	C4	Design / Development of Solution
4	To be able to **Perform** a given experimental task and to derive valid conclusion	P3	Investigation

REMARKS (if any):

Recommended by: _____ **Approved by:** _____

(Chairperson/Date) (Dean/Date)

NED University of Engineering and Technology

Department of Chemical Engineering

Program Bachelors of Engineering in Chemical

F/QSP 11/17/01

Course Profile

COURSE CODE& TITLE	SEMESTER	CREDIT HOURS
MT-224: Complex Variables & Fourier Series	■ SPRING ☐ FALL	TH ■ 3 ☐ 2 ☐ 1 ☐ 0 PR ☐ 3 ☐ 2 ☐ 1 ■ 0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL**	**APPLIED FROM BATCH** 2025

COURSE CONTENTS

Infinite Series: Application of convergence tests such as comparison, Root, Ratio, Raabe's and Gauss tests on the behavior of series.

Complex Variable: Limit, continuity, zeros, and poles of a complex function. Cauchy-Riemann equations, conformal transformation, contour integration.

Laplace Integral & Transformation: Definition, Laplace transforms of some elementary functions, first translation or shifting theorem, second translation or shifting theorem, change of scale property, Laplace transform of the nth order derivative, initial and final value theorem. Laplace transform of integrals, Laplace transform of functions t" F(t) and F(t)/t, Laplace transform of periodic functions, evaluation of integrals, definition of inverse Laplace transform and inverse transforms, convolution theorem, solutions of ordinary differential and partial differential equations using Laplace transform (I.V.P's & B.V.P's). Z and Inverse Z transformations, properties of Z-transformation and applications.

Fourier Series: Introduction to Fourier series. Euler Fourier formulae, even and odd functions, application of Fourier series. Fourier transform and fast Fourier transform and properties with applications.

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	**Apply** techniques of Laplace and Fourier series in relevant engineering problems.	C3	Engineering Knowledge
2	**Discuss** the Infinite series and complex integrals	C2	Problem Analysis

REMRKS (if any):

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Course Profile

COURSE CODE & TITLE PF-301: Professional Ethics	SEMESTER ■ SPRING ☐ FALL	CREDIT HOURS TH ☐ 3 ■ 2 ☐ 1 ☐ 0 PR ☐ 3 ☐ 2 ☐ 1 ■ 0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL** 26-05-2025	**APPLIED FROM BATCH** 2025

COURSE CONTENTS

Introduction to Ethics. Professional Ethics, Engineering Ethics, Business Ethics: Ethics and Professionalism. Need and Scope of Engineering and Professional Ethics, Development of Engineering Ethics, Major issues in Engineering & Professional Ethics. Ethical Dilemma. Resolving Ethical Dilemmas and Making Moral Choices, Techniques to resolve issues, Codes of Ethics, Codes of local and international professional bodies including PEC, Ethical Theories, Utilitarianism, Rights Ethics and Duty Ethics, Moral Theories: Virtue Ethics Self- Realization & Self Interest, Ethical Problem Solving Techniques: Line drawing, flow Charting, Conflict Problems, Professional Responsibilities, Risk and Safety as an Ethical Concern for Engineers, Workplace Responsibilities and Ethics: Teamwork. Confidentiality and Conflicts of Interest. Whistleblowing, Bribe and Gift, Risk and Cost-Benefit Analyses. Gender Discrimination and Sexual Harassment Environmental Ethics. Plagiarism. Hacking. Spamming. Academic and Research Integrity, Honesty: Truthfulness, Trustworthiness.

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	**Discuss** the contemporary frameworks of professional and engineering ethics in the light of ethical theories and dilemmas.	**C2**	**Engineer and the World**
2	**Apply** principles, theories, and codes of ethics in situations related to professional practice.	**C3**	**Ethics**
3	**Value** continuous professional development, ethical practices, and an aspirational mindset for personal and collective growth in engineering, fostering lifelong learning.	**A3**	**Lifelong Learning**

REMARKS (if any):

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NED University of Engineering and Technology

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Course Profile

COURSE CODE& TITLE	SEMESTER	CREDIT HOURS
PF-205: Community Service	■ SPRING ☐ FALL	TH ☐ 3 ■ 2 ☐ 1☐ 0 PR ☐ 3 ☐ 2 ☐ 1 ■ 0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL**	**APPLIED FROM BATCH:** 2025

COURSE CONTENTS

Orientation to Community Service: [Taught component]

Introduction to the concept and practice of community service. Need, objectives and benefits of community service. Foundational theories (educational, undergraduate curriculum, humanities, social science, corporate social responsibility etc.). Tools and skills needed in community service. Contextual examples in community service; case examples. Professional and ethical conduct during community service

Community Service Attachment

Completing 30-35 hours of formal assignment at an organization

Community Service Experience Documentation

Writing a report documenting the experience and submitting it on the prescribed format.

NOTE: Total contact hour for theory (thought component 8 + documentation activity 6) will be 14 hours.

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1.	**Express** an interest in contributing to the community and society individually and collectively through social projects.	A3	PLO 6: Engineer and the World
2.	**Volunteer** to help make a difference to a specific group, community, or organization.	A2	PLO 11: Lifelong Learning

REMARKS (if any):

Recommended by: _____ (Chairperson/Date)

Approved by: _____ (Dean/Date)

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Course Profile

COURSE CODE& TITLE CH-315: Fuel And Energy	SEMESTER ☐ SPRING ■ FALL	CREDIT HOURS TH ☐ 3 ■ 2 ☐ 1 ☐ 0 PR ☐ 3 ☐ 2 ■ 1 ☐ 0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL** 26-05-2025	**APPLIED FROM BATCH** 2025

COURSE CONTENTS

Introduction to fuels, overview of locally available fuels. Classification and storage of solids, liquids, and gaseous fuels

Characterization of fuel: Oil, coal, and gas, storage, handling, and preparation of fuels

Fuel selection: Criteria and characterization for selecting fuels for industrial Purposes. Fuel upgradation: Carbonization, liquefaction, and gasification of coal; synthetic fuels; petroleum refining, natural gas processing & syngas production, Fischer-Tropsch process, and clean coal technology.

Principles Of Combustion: Combustion Of solid, liquid and gaseous fuels, mechanism and kinetics of combustion. Combustion calculation

Combustion technologies: Oil & Gas Burners, Fluidized Bed Combustion Boilers. Furnaces and Waste Heat Recovery: Classification, general fuel economy measures in furnace, excess air, heat distribution temperature control draft control.

Overview of Energy Policies: Energy conversion: Energy conversion technologies in industrial energy systems: an overview of technologies and engineering thermodynamics for process utility boilers, steam turbine, gas turbine, combined heat and power (CHP).

Emissions control: Greenhouse gas emissions and its consequences, energy efficiency measures in industry, Optimization of industrial Energy systems, Reduction potential for greenhouse gas emissions in industry, Carbon capture and sequestering.

Alternative Resources of Energy: Introduction to ARE sources. Biomass Sources, Biomass conversion processes and technologies. Gasification and liquefaction. Kinetics of gasification. Solar energy, hydel power, wind and tidal energy, geothermal energy, Energy conservation, methodologies of selected systems,

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COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	**Discuss** the basic properties of the fuels, principles and the concepts of energy generation	C2	Engineering Knowledge
2	**Solve** problems in various combustors by analyzing different fuels and energy recovery systems, assessing their environmental impact, and proposing remedial actions.	C3	Problem Analysis
3	**Practice** the calculation of basic properties of the fuels	P3	Investigation

REMARKS (if any):

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Course Profile

COURSE CODE& TITLE	SEMESTER	CREDIT HOURS
CH-313: Fluid Mechanics-II	☐ SPRING ■ FALL	TH ☐ 3 ■ 2 ☐ 1 ☐ 0 PR ☐ 3 ☐ 2 ☐ 1 ■ 0
PREREQUISITE COURSE(S)	**DATE OF COURSE CONTENT APPROVAL**	**APPLIED FROM BATCH**
CH-209: Fluid Mechanics-I	26-05-2025	2025

COURSE CONTENTS

Centrifugal pump characteristics; NPSHI and its application in chemical engineering; concept of specific speed; similarity laws in centrifugal pumps; pumps in series and parallel; Positive displacement pumps, their classification, characteristics and selection; matching system characteristics with pump characteristics.
Flow through porous media: Fluidization and types of fluidized beds and their use in chemical engineering, Particle and Regime classification, minimum fluidization and particulate fluidization, entrainment and elutriation, concept of hydrodynamic characteristics of fluidized beds, bubbling fluidization, turbulent fluidization. slurry bed fluidization. Industrial application of fluidization.
Introduction to non -Newtonian fluids: Flow through packed beds, types of packing, hydrodynamics of packed column
Fluid Motion: Fluid Motion in the Presence of Solid Particles, Relative motion between a fluid and a single particle, Effect of presence of other particles and wall on the particle velocity Turbo-machinery and its classifications. Compressors, their classification, characteristics and selection. Turbines, their classification and selection. Compressible flow and its application in chemical engineering, concept of chocked flow.

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	**Explain** the principles and selection criteria of fluid handling equipment, including pumps, compressors, and turbines, for chemical engineering applications.	C2	Engineering Knowledge
2	**Apply** fluid mechanics concepts to evaluate the flow behavior of Newtonian and non-Newtonian fluids through porous media, fluidized beds, and packed columns.	C3	Problem Analysis
3	**Analyze** fluid motion, compressible flow, and fluid-solid interactions to solve engineering problems in fluid transportation and handling systems.	C4	Design/Development of Solutions

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Course Profile

COURSE CODE& TITLE	SEMESTER	CREDIT HOURS
CH-222: Programming and Data Sciences for Chemical Engineers	☐ SPRING ■ FALL	TH ☐ 3 ■ 2 ☐ 1 ☐ 0 PR ☐ 3 ☐ 2 ■ 1 ☐ 0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL** 26-05-2025	**APPLIED FROM BATCH** 2025

COURSE CONTENTS

Introduction to Big Data and Python Programming, Variables and Assignment Statements, Arithmetic operators, Function print and an intro to strings, getting input from the user, Flow charts, program structure, logic building, algorithms

Boolean operators and, or and not. The if statement and Comparison Operators, Algorithms, Pseudocode, Control Statements, If statement, If else. else statements

Sequence-Controlled Repetition, Sentinel-Controlled Repetition, Nested Control Statements, break and continue statements

Defining functions, functions with multiple parameters, Random Number generation, case study: A game if chance, python standard library, math module functions, Default parameters values, Keyword Arguments, scope rules, import: A deeper look, function Call stack, Case study: Processing sample dataset in python

Lists and Tuples: Lists, Tuples, Unpacking Sequences, Sequences Slicing, del statement, Passing lists to functions, Sorting lists, searching sequences, simulating stacks with lists, Two Dimensional lists

Creating a Dictionary, iterating through a dictionary, Basic Dictionary operations, Dictionary Methods keys and values Dictionary Comparisons, Comparing sets, Mathematical set operations. Mutable set operators and Methods, Set Comprehensions

Array oriented programming with NumPy: Creating arrays from existing data, array Attributes, Filling arrays with specific values, creating arrays from Ranges, List vs array performance, NumPy calculation Methods, Indexing and slicing, views, Reshaping and transposing

Manipulating Strings: Formatting strings, concatenating and repeating strings, stripping whitespace from strings, other string manipulation functions

Files and Exceptions: Files, Text file processing, updating text files, serialization with JASON, Focus on security, pickle serialization and deserialization, Handling expressions

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COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	**Understand** the fundamentals of computer hardware, software, and programming concepts, including basic Python programming syntax and flow control mechanisms.	**C2**	**Engineering Knowledge**
2	**Apply** Python programming techniques to solve problems using functions, sequences (lists, tuples), and manipulate data through control structures and algorithms.	**C3**	**Problem Analysis**
3	**Analyze** and manipulate data using advanced Python libraries (NumPy, dictionaries, and sets), with an understanding of string manipulation, file processing, and exception handling.	**C4**	**Tool Usage**

REMARKS (if any):

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Course Profile

COURSE CODE& TITLE	SEMESTER	CREDIT HOURS
CH-312: Mass Transfer	☐ SPRING ■ FALL	TH ■ 3 ☐ 2 ☐1☐ 0 PR ☐ 3☐ 2 ■1☐ 0
PREREQUISITE COURSE(S) NIL	**DATE OF COURSE CONTENT APPROVAL** 26-05-2025	**APPLIED FROM BATCH** 2025

COURSE CONTENTS

Introduction to mass transfer, processes and operation; Theory of mass transfer, concept of mass transfer coefficient, overall mass transfer coefficient, analogies between momentum and mass transfer coefficients; Diffusion in fluids molecular and eddy diffusion in a gas and liquid; Steady state diffusion under stagnant and laminar flow condition, diffusion measurement and calculations. ordinary diffusion in multicomponent gaseous mixtures, diffusion in solids, interface mass transfer; Classification of mass transfer operations; the choice of mass transfer methods; Principles and laws

Fick's law of diffusion; steady state diffusion in fluids at rest or in laminar motion: Concept of mass transfer coefficients, their calculation in laminar and turbulent flows; interphase mass transfer, equilibrium and diffusion across the interface and the concept of stages. Phase equilibrium in mass transfer.

Distillation: Introduction to distillation; Application and fundaments of distillation; Lewis-Sorel; McCabe - Thiele methods; Importance of the reflux ratio; calculation of minimum reflux ratio; number of plates at total reflux; underwood and Fenske methods; selection of economic reflux ratio; Effect of multiple feeds and side streams; Plate efficiency and Murphree's formula. Concept of a theoretical plate and HETP;

Concept of NTU and HTU; Method of transfer units and HTU. Enthalpy-concentration method. Multi-component distillation: degrees of freedom in separation specifications. Key components in multi-component mixtures and recovery fraction. Continuous flash distillation with heat balancing; Equilibrium and enthalpy expressions; numerical examples of multi-component separation problems; side streams and partial condensers; Column design: tray design; hydraulics and performance; Batch distillation: operation at constant product composition or constant reflux ratio. Calculation of column diameter and height; Heterogeneous azeotropes; Illustrative examples of azeotropic distillation. Reactive distillation.

Absorption: Extension of design techniques to absorption.

Adsorption: Introduction to Adsorption; The nature of adsorbents. Adsorption equilibria. Adsorption from liquids. structure of adsorbents, Adsorption equipment and regeneration of spent adsorbents.

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COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	**Explain/clarify** the concepts and reasons behind the mass transfer operations.	C2	Engineering Knowledge
2	**Develop/apply** different types of mathematical relations to solve the mass transfer problems.	C3	Problem Analysis
3	**Designing** of the mass transfer operations.	C5	Design/Development of Solutions
4	**Practice** mass transfer theory using experimental tools in Laboratory.	P3	Tool Usage

REMARKS (if any):

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Course Profile

COURSE CODE& TITLE MT-331: Probability & Statistics	SEMESTER ☐ SPRING ■ FALL	CREDIT HOURS TH ■3 ☐2 ☐1 ☐0 PR ☐3 ☐2 ☐1 ■0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL** 14-04-2017	**APPLIED FROM BATCH** 2019

COURSE CONTENTS

Statistics

Introduction, Types of data & variables, presentation to data, object, classifications, Tabulation, Frequency distribution, Graphical representation, Simple & Multiple Bar diagrams, Sartorial & Pie-Diagram, Histogram, Frequency Polygon, Frequency Curves & their types.

Measure of Central Tendency and Dispersion

Statistics Averages, Median Mode, Quartiles, Range, Moments, Skewness & Kurtosis, Quartile Deviation, Mean Deviation, Standard Deviation, Variance & its coefficient, Practical Significance in related problems.

Probability

Basic concepts, Permutation & Combination, Definitions of probability, Laws of probability, Conditional probability, Baye's rule. Related problems in practical significance.

Random Variables

Introduction, Discrete & Continuous random variables, Random Sequences and transformations, Probability distribution, Probability density function, Distribution function, Mathematical expectations, Moment Generating Function (M.G.F.), Markove random walks chain/Related problems.

Probability Distributions

Introduction, Discrete probability distributions, Binomial, Poisson, Hyper geometric & Negative binomial distributions. Continuous probability distribution, Uniform, Exponential & Normal distributions & their practical significance.

Sampling and Sampling Distributions

Introduction, Population, Parameter & Statistics, Objects of sampling, Sampling distribution of Mean, Standard errors, Sampling & Non-Sampling Errors, Random Sampling, Sampling with & without replacement, Sequential Sampling, Central limit theorem with practical significance in related problems.

Statistical Inference and Testing of Hypothesis

Introduction, Estimation, Types of Estimates, Confidence interval, Tests of Hypothesis, Chi-Square distribution/test, one tails & two tails tests. Application in related problems.

Curve Fitting

Introduction, fitting of a first and second degree curve, fitting of exponential and logarithmic curves related problems, Principle of least squares, Second order Statistics & Time series not in bit detail.

Simple Regression & Correlation

Introduction, Scatter diagrams, Correlation & its Coefficient, Regression lines, Rank Correlation & its Coefficient, Probable Error (P.E), Related problems.

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COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1.	**Discuss** the fundamental concepts in Probability and statistics	C2	Engineering Knowledge
2.	**Analyze** data to produce mathematical models in relevant engineering problems	C4	Problem Analysis

REMARKS (if any):

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(Chairperson/Date) (Dean/Date)

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Course Profile

COURSE CODE& TITLE	SEMESTER	CREDIT HOURS
EA-304: Business Communication and Ethics	☐ SPRING ■ FALL	TH ■ 3 ☐ 2 ☐ 1 ☐ 0 PR ☐ 3 ☐ 2 ☐ 1 ■ 0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL**	**APPLIED FROM BATCH** 2025

COURSE CONTENTS

Communication Skills (Oral): Definitions and Conditions, Modes:- verbal, non-verbal, vocal, non-vocal, sender, receiver, en-loding, decoding, noise, context, emotional maturity, relationships, etc. Language, perception. Non-verbal, body language, physical appearance, cultural differences etc. Personal and interpersonal skills/perceptions. Communication dilemmas and problems. Public Speaking – speaking situation, persuasion.

Part-II Written Communication: Formal / Business letters. Memos (brief revision). Notice and minutes of meetings. Contracts and agreements (basic theoretical knowledge and comprehension). Research / scientific reports. Tenders (basic theoretical knowledge and comprehension). Participating in seminars, interviews, writing and presenting conference papers, solving IELTS type papers. (Non-examination).

Part-III Engineering / Business Ethics: Course objective. Need for code of ethics. Type of ethics, involvement in daily life. Problems/conflicts/dilemmas in application. Review of Pakistan Engineering Council Code of Conduct.

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	**Applied** principles, theories and codes of ethics in situations related to professional practice	**C3**	**Ethics**
2	**Composed** effective business messages for various purposes and audiences	**C6**	**Communication**
3	**Demonstrate** effective oral communication and inter personal skills in simulated processual and business situations	**A3**	**Communication**

REMARKS (if any):

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Course Profile

COURSE CODE& TITLE	SEMESTER	CREDIT HOURS
CH-309: Chemical Reaction Engineering	■ SPRING ☐ FALL	TH ■ 3 ☐ 2 ☐ 1 ☐ 0 PR ☐ 3 ☐ 2 ■ 1 ☐ 0
PREREQUISITE COURSE(S) CH-110: Chemical Engineering Principles CH-220: Chemical Engineering Thermodynamics-II	**DATE OF COURSE CONTENT APPROVAL** 26-05-2025	**APPLIED FROM BATCH** 2025

COURSE CONTENTS

Kinetics of homogeneous reactions: Rate of reaction, variables affecting the rate of reaction, order of reaction, rate constant; searching for a mechanism of reaction, activation energy and temperature dependency, Interpretation of batch reactor data for single and multiple reactions. Integral method and differential method of analysis for constant volume and variable volume batch reactors, Search for a rate equation.

Design of homogeneous and heterogeneous reactors, Batch, Mixed flow, Plug flow reactors, Comparison of single reactor, multiple reactor systems in parallel/series. Temperature and pressure effects. Adiabatic and non-adiabatic operations.

Surface phenomenon and catalysis, Heterogeneous reaction systems, Rate equations for heterogeneous reactions, Fluid particle reactions, Determination of rate controlling steps, Catalysis desorption Isotherms, Kinetics of solid catalyzed reactions, Design of fluid solid catalytic reactors.

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	**Apply** principles of chemical reaction kinetics to develop and analyze reaction mechanism.	C3	Engineering Knowledge
2	**Demonstrate** relevant skills and techniques for processing and interpretation of reaction rate data.	C2	Problem Analysis
3	**Design** an appropriate reactor type and /or combination to achieve desired conversion	C5	Design/ Development of Solutions
4	**Investigate** reaction parameters by using laboratory tools.	P3	Investigation

REMARKS (if any):

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(Chairperson/Date) (Dean/Date)

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Course Profile

COURSE CODE& TITLE	SEMESTER	CREDIT HOURS
CH-316: Instrumentation and Process Control	■ SPRING ☐ FALL	TH ■ 3 ☐ 2 ☐ 1 ☐ 0 PR ☐ 3 ☐ 2 ■ 1 ☐ 0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL** 26-05-2025	**APPLIED FROM BATCH** 2025

COURSE CONTENTS

Principles, sensors, modifiers, recorders etc., calibration and error analysis, instrumentation for temperature, flow, level, weight, load, pressure, composition and pH measurement, transducers, advanced measurement devices employing piezoelectric current, ultrasonic, laser, microwave etc. final control elements.

Process modeling procedure and validation, response and linearization, Laplace transformation, step, impulse and frequency response, dead time and transfer functions, construction of block diagrams, dynamics of first and second order systems. Non-Linear processes.

Introduction to Process Control: Concept of feedback/feed forward and components of a typical control loop, structure and interpreting control diagrams, symbols and terminology, control objectives integration with safety, environment, production rate and quality.

Feedback control: Overall transfer function testability, controllers (P, PI, PID etc.) algorithm, final control elements, dynamic behavior of feedback-controlled processes, representation of control systems, multiple control loops, cascade, ratio, over-riding etc., introduction to stability of chemical processes, tuning methods, response, stability including Routh's criteria, Bode plots, Nyquist method, initial and final value theorem. Feed forward control: Introduction, modelling, algorithm, tuning, and performance.

Discretisation: Computer control. Introduction to distributed Control Systems, performance, applications and case studies, computer-aided design of control systems using programming, controller self-learning.

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	**Explain** the fundamental concepts, selection criteria and significance of instrumentation in process control	C3	Engineering Knowledge
2	**Access** the dynamic behavior, stability and frequency response for various controllers and process control system by developing transfer function.	C2	Problem Analysis
3	**Develop** and **apply** various control configurations to chemical process units.	C5	Design/ Development of Solutions
4	**Measure** the behavior different control variables under the influence of disturbance using hardware tools.	P3	Investigation

REMARKS (if any):

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COURSE CODE& TITLE	SEMESTER	CREDIT HOURS
CH-318: Integrated Management Systems	■ SPRING ☐ FALL	TH ■ 3 ☐ 2 ☐ 1 ☐ 0 PR ☐ 3 ☐ 2 ☐ 1 ■ 0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL** 26-05-2025	**APPLIED FROM BATCH** 2025

COURSE CONTENTS

Traditional Quality Control, Total Quality management, Deming's principles, Customer focus, Employee involvement, Continuous process improvement, PDCA cycle

Seven step process: Kaizen, Quality measurements, Quality costs, QFD, QMS-ISO9000 standards-requirements and documentation, Taguchi methods, quality loss function, Parameter design and Tolerance design concepts

Six sigma concepts: Define and measure phase, flow charting, basic tools, probability and hazard plotting, Six sigma measurements, basic control charts and process performance matrices, Measurement systems analysis.

Design of experiments: Basics, single factor, two factor experiments. ANOVA, Taguchi approach to design of experiments, orthogonal arrays, Signal to noise ratio, RSM-concepts and methods.

Analysis approach: Fundamental aspects of reliability, Reliability mathematics, Reliability testing and evaluation methods. FMEA, Failure data analysis

Total Productive Maintenance: Maintainability and Availability Concepts, Reliability management. Quality Certifications: ISO9001-2000, ISO14001, ISO22000/HACCP, HALAL Certification, ISO17025, ISO45001/OHSAS18001, SMETA (Sedex member ethical trade audit).

Concept, clauses and implementation in industries.

Overall Equipment Effectiveness (OEE): Concept, formulation, relation with productivity and efficiency and benefits. Cost of Poor Quality: Concept, calculation and usage in industry.

Root cause analysis (RCA): Concept, techniques to conduct RCA and usage in industry.

Corrective Action Preventive Action (CAPA): Concept, techniques of CAPA. Relation with RCA and its benefits. Good Manufacturing Practices (GMP), Good Laboratory Practices (GLP) and Good Warehouse Practices (GWP): Concept, techniques, implementation and benefits.

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COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	**Understand** the core principles of traditional quality control, Total Quality Management (TQM), Deming's principles, and continuous process improvement techniques such as the PDCA cycle.	C2	**Engineering Knowledge**
2	**Apply** Six Sigma methodology and design of experiments (DoE) tools, including basic control charts, ANOVA, and Taguchi methods, to improve process performance and reliability in industrial settings.	C3	**Problem Analysis**
3	**Perform** economics for enhancing the quality and equipment effectiveness using good manufacturing practices	C6	**Project Management and Finance**

REMARKS (if any):

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Course Profile

COURSE CODE& TITLE	SEMESTER	CREDIT HOURS
CH-314: Numerical Methods with Software Applications for Chemical Engineers	■ SPRING ☐ FALL	TH ☐ 3 ■ 2 ☐ 1 ☐ 0 PR ☐ 3 ☐ 2 ■ 1 ☐ 0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL** 26-05-2025	**APPLIED FROM BATCH** 2025

COURSE CONTENTS

Linear Algebra: Matrix and First-order Linear Systems. Eigen values and Eigen vectors. Finite difference and theory of interpolation; Iterative methods; Taylor, Newton Series etc. Approximation zeros (roots); numerical integration and differentiation. Iterative methods for solution of linear systems, design value problems, numerical solutions of ordinary differential equations.
Linear Algebra Application: Matrix calculations, solution of linear equations, Eigen value calculation. Numerical solution/calculation of integrals, derivatives and differential equations.
Transfer function manipulation and study of transient response of various first and second order systems, plotting Bode and Root Locus diagrams. Introduction to simulations using software tools..

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	**Understand** and **apply** linear algebra techniques, such as matrix operations, eigenvalue calculations, and numerical methods for solving first-order linear systems, to solve engineering problems.	C3	**Design/Development of solutions**
2	**Analyze** and **implement** iterative numerical methods, such as Newton's method and Taylor series, to approximate solutions to complex engineering problems like numerical integration, differentiation, and differential equations.	C4	**Problem Analysis**
3	**Use** software tools to simulate, analyze, and interpret the transient response of first- and second-order systems, and apply numerical methods for the solution of differential equations and plotting Bode/Root Locus diagrams.	C5	**Tool Usage**

REMARKS (if any):

Recommended by: _____ **Approved by:** _____

(Chairperson/Date) (Dean/Date)

NED University of Engineering and Technology

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Course Profile

COURSE CODE& TITLE	SEMESTER	CREDIT HOURS
CH-320: Environmental Engineering	■ SPRING ☐ FALL	TH ☐ 3 ■ 2 ☐ 1 ☐ 0 PR ☐ 3 ☐ 2 ■ 1 ☐ 0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL** 26-05-2025	**APPLIED FROM BATCH** 2025

COURSE CONTENTS

Introduction to Environment and ecology, pollution concept, types of pollution. Environmental national and international policy and standards

Environmental Monitoring (gas, liquid, solid): sampling and monitoring mechanism, design and types of samples, Pre sampling requirements/information, sampling and design purposes.

Pollution Control and Treatment Techniques: Air pollution control technologies, sub soil/ soil pollution control technologies, noise pollution control technologies, cleaner production and zero emissions, Biotechnology for environment, industrial pollution control; covering design, sizing and operation.

Climate change: Global warming and climate change, Different weathers, Earth's climate system, types and influencing factors, greenhouse effect, energy use and carbon emissions, Effect and importance of climate on environment, Impact of climate, impacts of climate changes on human life and environment, History and data analysis of climate changes, controls of climate changes, UNO action plan of climate changes.

Assessment Techniques: Principles and purposes of IEE and EIA and its significance for the society, Main stages in EIA process. Public consultation and participation in EIA process. EIA methods and techniques for impact prediction and evaluation. Environmental standards.

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1.	**Demonstrate** an understanding of environmental and ecological concepts, pollution types, monitoring mechanisms, control technologies, climate change impacts, and environmental policies at national and international levels.	**C2**	**Engineering Knowledge**
2.	**Integrate** environmental monitoring data, pollution control techniques, and climate change mitigation strategies to propose sustainable solutions aligned with IEE/EIA principles and societal needs.	**C5**	**Design/Development of Solutions**
3.	**Practice** Environmental Engineering theory using experimental tools in Laboratory.	**P3**	**Investigation**

REMARKS (if any):

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Course Profile

COURSE CODE& TITLE	SEMESTER	CREDIT HOURS
CH-421: Process Modeling, Simulation and Optimization	☐ SPRING ■ FALL	TH ■ 3 ☐ 2 ☐ 1 ☐ 0 PR ☐ 3 ☐ 2 ■ 1 ☐ 0
PREREQUISITE COURSE(S) None	**DATE OF COURSE CONTENT APPROVAL** 26-05-2025	**APPLIED FROM BATCH** 2025

COURSE CONTENTS

Chemical processes design basics, design principles, Hierarchy of process design, Process synthesis and design strategy Development of models: Mathematical models; conservation laws, steady state models; dynamic models, distributed and lumped models, Pinch design method, Heat and power integration

Optimization Models and their significance: Adaptive models, Empirical models based on non-linear regressive adaptive refinement of models, State variables models and matrix differential equations, and Quantitative models.

Optimization by Simulation tools: Analysis of systems behavior for process optimization, flexibility and safety. Stability and multiple states, and multi variable (constrained and unconstrained) functions; linear Optimization methods; Analytical/numerical techniques for single variable programming.

Overview of different simulation tools and their limitations, Basic equipment, Development of various industrial processes and their analysis, data entry and properties selection by using ASPEN HYSYS, Energy and economics evaluation.

Case studies: Reactor network design, Separation system selection and design, Design of heat exchanger networks Design and development of processes by using ASPEN HYSYS

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	**Understand** the fundamental concepts of process design, simulation and optimization.	**C2**	**Engineering Knowledge**
2	**Analyze** and optimize steady-state and dynamic mathematical models for chemical processes.	**C4**	**Problem Analysis**
3	**Evaluate** real-world problems through case studies by applying process modeling, simulation, and optimization techniques.	**C6**	**Design/ Development of Solutions**
4	Utilize Aspen HYSYS and other simulation tools to **design**, optimize, and analyze industrial processes.	**C5**	**Tool Usage**

REMARKS (if any):

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Course Profile

COURSE CODE& TITLE	SEMESTER	CREDIT HOURS
CH-422: Chemical Plant Design	☐ SPRING ■ FALL	TH ■ 3 ☐ 2 ☐ 1 ☐ 0 PR ☐ 3 ☐ 2 ☐ 1 ■ 0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL** 26-05-2025	**APPLIED FROM BATCH** 2025

COURSE CONTENTS

General design considerations. Design codes, standards & materials selection.

Economic Evaluation and Optimization: Basic Concepts of (Cost Indexing & Optimization, Optimization of Unconstrained Functions, Linear Programming Applications, Non-Linear Programming with Constraints.

Process Design: Process design and development, process flow sheeting, flow diagrams. PFD and PID, Equipment, and instrument symbols.

Process Design and Risk Assessment: Process Hazards Checklists and surveys, Safety Reviews, Common Mode Failures (Event Trees & Fault Trees), QRA And LOPA.

Applications: Stationary equipment like. Vessel design, Low, medium and high-pressure storage and transportation vessels; Cryogenic vessels. Design of mass transfer equipment: material transport; material handling,

Heat transfer equipment including furnaces and refrigeration units., heat Exchangers, Piping and pipeline design. rotating equipment including Pumps, Motors, compressors, turbines.

Design Ethics: Local and Global Impact Analysis

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	**Design** of different process equipment by **applying** core chemical engineering knowledge	C4	Design/ Development of Solution
2	**Evaluate** the economic feasibility and project management aspects of chemical plant designs	C6	Project Management and Finance
3	**Demonstrate** critical, creative and evidence-based thinking to comprehend innovative responses to future challenges in process industries	A3	Individual and Collaborative Team Work

REMARKS (if any):

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Course Profile

COURSE CODE& TITLE	SEMESTER	CREDIT HOURS
CH-420: Separation Processes	☐ SPRING ■ FALL	TH ■ 3 ☐ 2 ☐ 1 ☐ 0 PR ☐ 3 ☐ 2 ■ 1 ☐ 0
PREREQUISITE COURSE(S) CH-312: Mass Transfer	**DATE OF COURSE CONTENT APPROVAL** 26-05-2025	**APPLIED FROM BATCH** 2025

COURSE CONTENTS

Introduction to separation processes, Liquid-Liquid extraction, Extraction Processes, Equilibrium data, Calculation of the number of theoretical stages for various cases of countercurrent and co-current operations.

Humidification and Cooling Towers: Humidification terms, wet-bulb and adiabatic saturation temperature. Humidity data for the air-water system, temperature- humidity chart, enthalpy-humidity chart, determination of humidity, humidification and dehumidification. Basic principles, types, features and operation of various cooling towers. Cooling tower design; Alternative sinks for waste heat. Design of equipment based on worst case scenarios. Water and air-based systems. Environmental effects.

Drying: General principles, Rate of drying. Diffusion and Capillary theory of drying. Classification and selection of dryers (Tray, tunnel, rotary. drum, spray, pneumatic, fluidized beds, turbo-shelf, disc and centrifuge dryers), solvent drying, superheated steam drying, freeze drying, flash drying, partial-recycle dryers, the drying of gases.

Leaching: General principles. Factors influencing the rate of extraction. Mass transfer in leaching operations. Equipment for leaching, Calculation of the number of stages by graphical methods.

Crystallization: Growth and properties of crystals, saturation and nucleation. crystallization rate, impurities, effect of temperature on solubility.

Solubility and phase diagram. fractional crystallization, caking. crystallizers, principles of construction and operations.

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	**Explain** the fundamental principles of various separation processes.	C2	Engineering Knowledge
2	**Select** appropriate separation technique for the intended problem	C4	Problem Analysis
3	**Design** single and multistage separation systems for various separation processes.	C5	Design/ Development of Solution
4	**Practice** separation processes theory using experimental tools in laboratory	P3	Tool Usage

REMARKS (if any):

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Course Profile

COURSE CODE& TITLE	SEMESTER	CREDIT HOURS
CH-426 Nanotechnology Engineering (Depth Electives-I)	☐ SPRING ■ FALL	TH ☐ 3 ■ 2 ☐ 1 ☐ 0 PR ☐ 3 ☐ 2 ☐ 1 ■ 0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL** 26-05-2025	**APPLIED FROM BATCH** 2025

COURSE CONTENTS

Basics: Definition of nanomaterials and their importance
Nanomaterials and their importance, Role and Impacts: Effect of the nano-size on physico-chemical properties of nanomaterials and comparison with bulk/coarse-grained materials (electrical, magnetic and optical properties, surface and structural properties, chemical reactivity)
Preparation: Fabrication of nanomaterials (nanoparticles, thin films, complex nanostructures) with physical techniques (lithography, pulsed laser deposition, electron beam epitaxy, chemical vapour deposition)
Synthesis: Chemical synthesis (coprecipitation, sol-gel, thermal decomposition of organo- metallic compounds, hydrothermal, sonochemical and microwave synthesis) of nanomaterials (nanoparticles, thin films). Functionalization and coating of nanomaterials' surfaces.
Analysis: Characterization of nanomaterials (issues related to the nano size) Assembling: Assembly of nanoparticles (self-assembly, directed assembly) into complex structures (composites, films, bulk materials)
Application of nanomaterials and Nano safety: applications in different fields Nanotechnology in clean and renewable energies: nanotechnologies in solar cells and thin film photovoltaics, nanotechnologies in rechargeable batteries: Li-ion batteries, Li-Polymer batteries
Energetic materials, nanotechnologies in thermoelectricity, fuel cells and supercapacitors, nanotechnology in hydrogen production and storage, energy sustainability, green nanofabrication, safety, and economics. Growth and properties of crystals, saturation and nucleation. crystallization rate, impurities, effect of temperature on solubility.

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	develop a deep understanding of how the unique properties of nanomaterials differ from those of bulk materials and recognize their significance in various applications.	**C2**	**Engineering Knowledge**
2	Apply various fabrication and synthesis techniques to design and create nanomaterials, demonstrating practical problem-solving skills in nanotechnology engineering.	**C3**	**Problem Analysis**

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Course Profile

COURSE CODE& TITLE	**SEMESTER**	**CREDIT HOURS**
CH-427 Computational Fluid Dynamics (CFD) (Depth Electives-I)	☐ SPRING ■ FALL	TH ☐ 3 ■ 2 ☐ 1 ☐ 0 PR ☐ 3 ☐ 2 ☐ 1 ■ 0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL** 26-05-2025	**APPLIED FROM BATCH** 2025

COURSE CONTENTS

CFD and its significance, problem solving using CFD
Conservation laws of fluid motion and boundary conditions: Scope and limitations of experimental, analytical and numerical methods in transport processes. The Continuity Equation and governing equations for Momentum, Heat and Mass transport in a continuum; The General Transport Equation.
Turbulence and its modelling: Characteristics of simple turbulent flows, The effect of turbulent fluctuations on properties of the mean flow, Reynolds-averaged Navier-Stokes equations, Large eddy simulation, Direct numerical simulation,
The finite volume method for convection and diffusion problems: Finite volume method for one-, two- and three-dimensional steady state diffusion, The power-law scheme, TVD schemes, The hybrid differencing scheme
Discretization: basic concepts and methods, Discretized forms and solution methodologies for steady and unsteady-state one-dimensional heat conduction, Extension of discretization concepts to two- and three- dimensional domains, Modeling of Convection and Diffusion terms using various discretization schemes; Calculation of flow field using SIMPLE algorithm. Simulation of various one- and two-dimensional laminar flow situations covered during Transport Phenomena using a CFD software and comparison of results with analytical solutions.

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	Grasp the key principles underlying CFD, including fluid conservation laws, governing transport equations, and boundary conditions, and be able to explain the scope and limitations of various computational techniques in fluid flow analysis.	**C2**	**Engineering Knowledge**
2	Use the finite volume method to solve steady-state diffusion problems, discretize the governing equations for fluid flow, and apply CFD software tools to simulate laminar flow scenarios, comparing the results with analytical solutions.	**C3**	**Problem Analysis**

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Course Profile

COURSE CODE& TITLE	SEMESTER	CREDIT HOURS
CH-428 Machine Learning Technology (Depth Electives-I)	☐ SPRING ■ FALL	TH ☐ 3 ■ 2 ☐ 1 ☐ 0 PR ☐ 3 ☐ 2 ☐ 1 ■ 0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL** 26-05-2025	**APPLIED FROM BATCH** 2025

COURSE CONTENTS

Machine learning; concept learning: General-to-specific ordering of hypotheses, Version spaces Algorithm, Candidate elimination algorithm;
Supervised Learning: decision trees, Naïve Bayes, Artificial Neural Networks, Support Vector Machines, Overfitting, noisy data, and pruning, Measuring Classifier Accuracy; Linear and Logistic regression; Unsupervised Learning: Hierarchical Agglomerative Clustering. K-means partitional clustering; Self-Organizing Maps (SOM) k-Nearest-neighbor algorithm; Semi supervised learning with EM using labeled and unlabeled data;
Reinforcement Learning: Hidden Markov models, Monte Carlo some inference Exploration vs. Exploitation tradeoffs, Markov Decision Processes, Ensemble Learning using committees of multiple hypotheses, Bagging, and Boosting
Applications: The Computational Support of Scientific Discovery, Pre and Post Processing in Machine Learning and Data Mining, Machine Learning in User Modeling, Economics, Finance and Marketing, Medical Applications, Power Systems, Human Language Technology and Intelligent Information Systems

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	Understand various supervised and unsupervised machine learning algorithms, such as decision trees, Naïve Bayes, SVM, K-means, and hierarchical agglomerative clustering, for classification and clustering tasks.	**C2**	**Engineering Knowledge**
2	Apply and compare the performance of different machine learning models, addressing issues such as overfitting, noisy data, and the tradeoff between exploration and exploitation in reinforcement learning, and apply ensemble learning techniques.	**C3**	**Problem Analysis**

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Course Profile

COURSE CODE& TITLE	SEMESTER	CREDIT HOURS
CH-429 Petroleum Refinery Engineering (Depth Electives-I)	☐ SPRING ■ FALL	TH ☐ 3 ■ 2 ☐ 1 ☐ 0 PR ☐ 3 ☐ 2 ☐ 1 ■ 0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL** 26-05-2025	**APPLIED FROM BATCH** 2025

COURSE CONTENTS

Crude Petroleum Oil, Indigenous and World resources, Composition of Crude Oil, Physical Properties of Crude Oil, Origin of Hydrocarbons, Exploration Techniques, Resource Estimation, Oil Field Development, Well Logging, Oil Production Processes. Feed stock Properties and Processing: Petroleum Products and Test Methods, Crude Oil Analysis, Lubricating Oils and Grease, Characterization of feed stocks and product, Processing Operations in a Petroleum Refinery, Crude Oil Receiving, Crude processing, Desalting of Crude Oil, Distillation and Stripping, Atmospheric Distillation, Stabilization, Amine Absorption.

Design Approach: Material and Energy Balances, Measurement of Quantity of Crude Oil and Products, Overall Material Balance, Energy Balance in a Plant, in Heat Exchanger, in a Furnace and Distillation Column, Design calculations for Distillation and Stripping, Processes of Distillation and Stripping, Batch Distillation, Boiling Point and Equilibrium Diagrams, Reactor Calculations, Reactors in Refineries, Design Steps for Crude Pipes , Economic Pipe Diameter, Product Transfer Lines, Gas Transfer Lines, Pumps and Compressors problem

Modern Techniques: Modern petroleum processing, Refining operation, Atmospheric distillation, Vacuum distillation, Alkylation, Reforming Isomerization, Hydroprocessing, Visbreaking and Coking, Gas Processing and Polymerization, Refinery supporting processes, Solvent Extraction. Auxiliary Operation; Supporting processes of Refinery, Auxiliaries operation of refinery. Use of linear programming techniques to solve refinery blending and production problems. Plant management and economics

Environment and Safety: Waste in Refinery, Gas waste management, liquid waste management and solid waste management, Safety analysis of refinery, HAZAN analysis, DOW index, MOND index

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	Understand the fundamental properties of crude oil and its feedstocks and describe the basic refining processes used in petroleum refineries.	**C2**	**Engineering Knowledge**
2	Apply material and energy balance calculations to solve refinery process design problems, including distillation, stripping, and hydro processing.	**C3**	**Problem Analysis**

REMARKS (if any):

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(Chairperson/Date) (Dean/Date)

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Course Profile

COURSE CODE& TITLE	SEMESTER	CREDIT HOURS
CH-430 Gas Processing& Transmission (Depth Electives-I)	☐ SPRING ■ FALL	TH ☐ 3 ■ 2 ☐ 1 ☐ 0 PR ☐ 3 ☐ 2 ☐ 1 ■ 0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL** 26-05-2025	**APPLIED FROM BATCH** 2025

COURSE CONTENTS

Introduction to natural gas industry, gas production, testing of well fluid; Test separator, Multiphase flow meters, establishing GOR. Separation process: Gas-liquid separation design and configuration

Gas Sweetening Process: Chemical and Physical solvent processes. Membrane/molecular sieve processes, Cryogenic separation, solvent regeneration. Dehydration of Natural Gas, LPG recovery and condensate stabilization, LNG and CNG. Gas processing facilities, process flow schemes and product specifications.

Processing facilities: Gas processing facilities, process flow schemes and product specifications. Gas Emissions: Disposal of gas field emissions, effluent, produced water (EOR, Re-injection, flaring) Design, metallurgy and corrosion protection of gas pipelines and equipment. Sludge handling.

Gas compression and Equipment's: Gas compression; compressors types, selection between centrifugal and reciprocating compressor, design considerations. Energy conservation in gas processing facilities.

Pigging of gas lines· Flare System: Flare system design; PSVs, blow down, flare/vent stack sizing. Case Study Simulation of Sweetening Process.

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	Understand the fundamental processes involved in gas production, testing of well fluids, and gas processing facilities, including gas-liquid separation and gas sweetening.	**C2**	**Engineering Knowledge**
2	Apply problem-solving techniques to analyze and design gas processing systems, including gas sweetening, dehydration, and gas compression systems, considering factors such as process flow and product specifications.	**C3**	**Problem Analysis**

REMARKS (if any):

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Course Profile

COURSE CODE& TITLE	SEMESTER	CREDIT HOURS
PF-401: Entrepreneurship	☐ SPRING ■ FALL	TH ☐3 ■2 ☐1 ☐ 0 PR ☐3 ☐2 ☐1 ■ 0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL** 26-05-2025	**APPLIED FROM BATCH:** 2025

COURSE CONTENTS

Introduction to Entrepreneurship: Definition and concept of entrepreneurship; Why to become an entrepreneur? Entrepreneurial process; Role of entrepreneurship in economic development.

Entrepreneurial Skills: Characteristics and qualities of successful entrepreneurs (including stories of successes and failures); Areas of essential entrepreneurial skills and ability areas such as creative and critical thinking, innovation and risk taking.

Opportunity Recognition and Idea Generation: Opportunity identification, evaluation and exploitation; Idea generation techniques for entrepreneurial ventures.

Marketing and Sales: Target market identification and segmentation; Four P's of Marketing; Developing a marketing strategy; Branding.

Financial Literacy: Basic concepts of income, savings and investments; Basic concepts of assets, liabilities and equity; Basic concepts of revenue and expenses; Overview of cash-flows; Overview of banking products including Islamic modes of financing: Sources of funding for startups (angel financing, debt financing, equity financing etc.)

Team Building for Startups: Characteristics and features of effective teams; Team building and effective leadership for startups.

Regulatory Requirements to Establish Enterprises in Pakistan: Types of enterprises (e.g., sole proprietorship; partnership; private limited companies etc.); Intellectual property rights and protection; Regulatory requirements to register an enterprise in Pakistan, with special emphasis on export firms; Taxation and financial reporting obligation.

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1.	**Describe** the entrepreneurial process and its role in economic development, identifying opportunities in diverse economic contexts	**C2**	**Engineer and the World**
2.	Demonstrate **commitment** to identifying, evaluating, and exploiting entrepreneurship opportunities through brainstorming, group discussions and applying idea-generation techniques.	**A3**	**Communication**
3.	**Apply** creative and critical thinking to generate innovative ideas and continuously improve entrepreneurial ventures.	**C3**	**Lifelong Learning**

REMARKS (if any):

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Approved by: _____ (Dean/Date)

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Course Profile

COURSE CODE& TITLE	SEMESTER	CREDIT HOURS
CH-424: Chemical Process Safety & OSHA	■ SPRING ☐ FALL	TH ☐ 3 ■ 2 ☐ 1 ☐ 0 PR ☐ 3 ☐ 2 ☐ 1 ■ 0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL** 26-05-2025	**APPLIED FROM BATCH** 2025

COURSE CONTENTS

Accident and Loss Statistics, The Nature of the Accident Process, Inherent Safety, Seven Significant Disasters.
Toxicology: Toxicological studies, Dose versus response (models and curves), Threshold Limit Valus.
Fires, explosions & their preventions: The Fire Triangle, Flammability, Ignition Sources, Sprays and Mists, Explosions. Explosion Proof equipment and Instruments, Ventilation, Sprinkler system, Miscellaneous Concepts for preventing fires and explosions
Reliefs: Relief concepts, Location, types and characteristics. Relief systems, Spring-Operated and Disc relief, Venting, Relief for thermal Expansion of Process Fluids. Case Studies.
Legal framework and OHS Management System. Roles and responsibilities towards safety: Safety cultures in academic institutions.
Hazards and Risk Assessments, Material safety data sheets, Safety data sheets and the GHS (Globally Harmonized Systems).
Calculations on accident data: Total Incident Rate(TIR), Total Recordable Incident Rate (TRIR), Lost Time Incident Rate (LTIR). Risk Concept and Terminology, Risk assessment procedure, Risk Metrics, Risk Estimation and Acceptability Criteria, Principles of risk prevention, Selection and implementation of appropriate Risk controls, Hierarchy of controls.
Preparing for Emergency Response Procedures: Fire, Chemical Spill, First Aid, Safety Drills/Trainings: Firefighting, Evacuation in case of emergency:
Incident investigation, Importance of investigation, recording and reporting, Techniques of investigation, Monitoring, Review, Auditing, Health and safety

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	**Apply** the concepts of fire and explosion prevention to minimize risks in chemical processes**.**	C3	Problem Analysis
2	**Manage** changes by advancing health and safety principles within management systems, cultures, practices, and priorities	C4	Project Management and Finance
3	**Commit** to observe safe working practices in any workplace	A3	Individual and Collaborative Team Work

REMARKS (if any):

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Course Profile

COURSE CODE& TITLE	SEMESTER	CREDIT HOURS
CH-423: Chemical Process Utility & Maintenance Engineering	■ SPRING ☐ FALL	TH ☐ 3 ■ 2 ☐ 1 ☐ 0 PR ☐ 3 ☐ 2 ☐ 1 ■ 0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL** 26-05-2025	**APPLIED FROM BATCH** 2025

COURSE CONTENTS

Introduction to various process utilities, their roles and importance in process plant operations. Raw, potable, fire, process, cooling systems. Waste water systems, Water treatments

Types of boilers, their operation, thermic fluid heater, complete boiler house. Steam distribution and utilization, condensate recovery system, waste heat recovery.

Plant air, instrument air systems and breathing air. Air from blowers and compressor. Compressors, vacuum pumps, and ejectors

Vapor compression refrigeration, absorption refrigeration, multi stage refrigeration, cascade refrigeration, vacuum refrigeration. Refrigerants and their types

Fuel system: Natural gas system; Inert gas system: Nitrogen gas. Power distribution system.

Role of maintenance in plant operation· Types of maintenance: preventive, predictive, and corrective, break down and total productive maintenance. Individual versus group replacement; infernal versus Eternal maintenance.

Scheduling and maintenance planning. Management of maintenance, Hierarchy and training of maintenance workforce

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	**Analyze** workplace layouts to evaluate how ergonomic factors, utility systems, and environmental conditions affect safety, comfort, and project cost.	**C4**	**Project Management and Finance**
2	**Understand** the emerging challenges in utility system optimization, predictive maintenance, and reliability engineering in chemical plants.	**C2**	**Life-long Learning**
3.	**Express** a deep understanding of the role of maintenance in plant operation, showing a preference for preventive, predictive, and corrective maintenance methods to enhance plant efficiency	**A3**	**Communication**

REMARKS (if any):

Recommended by: _____ **Approved by:** _____

(Chairperson/Date) (Dean/Date)

NED University of Engineering and Technology

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Course Profile

COURSE CODE& TITLE	SEMESTER	CREDIT HOURS
CH-431: Biochemical Engineering (Depth Elective-II)	■ SPRING ☐ FALL	TH ☐ 3 ■ 2 ☐ 1 ☐ 0 PR ☐ 3 ☐ 2 ☐ 1 ■ 0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL** 26-05-2025	**APPLIED FROM BATCH** 2025

COURSE CONTENTS

Review of elementary aspects of microbiology, Biochemistry, molecular biology, and genetic engineering. Introduction of biological systems to produce commercial goods and services, e.g., foods, pharmaceuticals, chemicals, fuels, diagnostics, waste treatment, and biomaterials. Introduction to design of bioprocess systems, including biosafety and sustainability.· Development of reaction kinetics associated with biological systems. Quantification of metabolism. Development of material balances for key constituents in bioreactors operated in different modes, e.g., batch, fed-batch, continuous stirred-tank reactor (CSTR), perfusion, recycle. Introduction to mass and heat transfer considerations for bioreactors. Dynamic simulation of cultures defined by ordinary differential equations. Introduction of downstream processes associated with biological systems and recovery of biological products.

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	Critically **evaluate** and **design** biochemical processes for sustainable production of bio-based products, assessing their economic, environmental, and health impacts.	**C6**	**The Engineer and the World**
2	**Understand** the emerging global challenges in biotechnology.	**C2**	**Lifelong Learning**

REMARKS (if any):

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Course Profile

COURSE CODE& TITLE	SEMESTER	CREDIT HOURS
CH-432: Biofuels and Biorefineries (Depth Elective-II)	■ SPRING ☐ FALL	TH ☐ 3 ■ 2 ☐ 1 ☐ 0 PR ☐ 3 ☐ 2 ☐ 1 ■ 0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL** 26-05-2025	**APPLIED FROM BATCH** 2025

COURSE CONTENTS

Renewable biomass resources: Manufacture of biofuels and recovery of products· Biochemical Engineering and Bioprocess Management for Fuel Ethanol: Historical Development of Bioethanol as a Fuel, Fermenter Design and Novel Fermenter Technologies, Simultaneous Saccharification and Fermentation and Direct Microbial Conversion, The Economics of Bioethanol, Sustainable Development and Bioethanol Production Chemistry, Biochemistry, and Microbiology of Lignocellulosic Biomass: Structure and properties of lignocellulosic biomass, Cellulases: Biochemistry, Molecular Biology, and Biotechnology, Chemical compositions and reactions of lignocellulosic biomass, Pretreatment and processing of lignocellulosic biomass Biorefinery layout and process design: Systematic Screening of Multiple Processing Paths in Biorefineries: The ABC (Assessing Biomass to Chemicals) Project and Its Potential to Build Process Synthesis Capabilities Life cycle assessment of a biorefinery: Techno-economic Assessment and Risk Analysis of Biorefinery Processes, Optimal Synthesis of Sustainable Biorefineries

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	Critically **evaluate** and **design** biorefineries for sustainable production of biofuels, assessing their economic, environmental, and health impacts.	C6	The Engineer and the World
2	**Understand** the emerging global challenges in biofuel production.	C2	Lifelong Learning

REMARKS (if any):

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Course Profile

COURSE CODE& TITLE	SEMESTER	CREDIT HOURS
CH-433: Environment Impact Assessment (Depth Elective-II)	■ SPRING ☐ FALL	TH ☐ 3 ■ 2 ☐ 1 ☐ 0 PR ☐ 3 ☐ 2 ☐ 1 ■ 0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL** 26-05-2025	**APPLIED FROM BATCH** 2025

COURSE CONTENTS

Introduction: Introduction to environmental impact assessment, environment Background, Sustainable development, principles and procedures, origin and development· History of Environmental Impact Assessment: Definition of Environmental Impact Assessment, Benefits and Directive of Environmental Impact Assessment, Impact prediction methodologies and mitigation measures a. Air b. Surface and groundwater c. Biologic d. Noise e. Cultural and socio-economic, Participation, presentation and review The Environmental Impact Assessment Process: Types of Assessments 1) Environmental Assessments 2) Environmental Impact Statement, Basic Steps in the Process 1) Alternative 2) Screening 3) Scoping 4) Impact analysis 5) Mitigation 6) Follow-up 7) Public involvement Monitoring and Auditing: The importance of monitoring and auditing in the EIA process, Case study: Special topics a. Social Impact Assessment b. Strategic Environmental Appraisal

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	**Evaluate** the environmental and societal impacts of large-scale industrial and infrastructural projects using environmental impact assessment (EIA) methodologies	C6	The Engineer and the World
2	**Understand** the emerging global challenges in formulation of an EIA report, including ethical considerations, stakeholder engagement, and financial constraints.	C2	Lifelong Learning

REMARKS (if any):

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Course Profile

COURSE CODE& TITLE	**SEMESTER**	**CREDIT HOURS**
CH-434: Sustainability in Process & Energy Systems (Depth Elective-II)	■ SPRING ☐ FALL	TH ☐ 3 ■ 2 ☐ 1 ☐ 0 PR ☐ 3 ☐ 2 ☐ 1 ■ 0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL** 26-05-2025	**APPLIED FROM BATCH** 2025

COURSE CONTENTS

Fundamental Approach: Principles of Sustainable Systems LCA and role of technology: Technology Development and Lifecycle Assessment, Metrics for Technology Evaluation

Green Technology and applications: Green Chemistry and Materials, Materials preparation and characterization

Resource Management: Resource Management Technologies, Sustainable Water and Wastewater Systems, High - Performance Building Systems, Applied Renewable Energy Technologies, Energy Management and Power Systems, Sustainable Transportation Technologies, Behavioural Aspects and Feedback Systems

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	**Evaluate** the environmental and societal impacts of large-scale industrial and infrastructural projects using sustainability frameworks.	C6	The Engineer and the World
2	**Understand** emerging global challenges in sustainable development, including ethical considerations, stakeholder engagement, and financial constraints.	C2	Lifelong Learning

REMARKS (if any):

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Course Profile

COURSE CODE& TITLE	SEMESTER	CREDIT HOURS
CH-435: Nuclear Waste Assessment & Management (Depth Elective-II)	■ SPRING ☐ FALL	TH ☐ 3 ■ 2 ☐ 1 ☐ 0 PR ☐ 3 ☐ 2 ☐ 1 ■ 0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL** 26-05-2025	**APPLIED FROM BATCH** 2025

COURSE CONTENTS

Radiation characteristics and protection: Types of radiation, Interaction of radiation with matter, Modes of exposure, Effects of radiation, Dose- response characteristics, Radiological protection.

Decommissioning: Decommissioning of nuclear facilities, Decontamination Techniques, dismantling techniques, Decommissioning strategy, Decommissioning operations, nuclear decommissioning authority, Decommissioning of nuclear submarines, Regulatory aspects in decommissioning, Safety and financial aspects of decommissioning. Case histories

Radioactive waste classification and inventory: Radioactive substances and radioactive waste, Classification of radioactive waste, Partitioning and transmutation, Waste inventory, General principles of waste management Management, Treatment and Conditioning of radioactive waste: General principles of waste management, Regulatory issues of waste management, Operations Preceding Treatmentand Conditioning, Treatment of Waste, Conditioning of Waste, Characterization of Conditioned Waste, Spent fuel Management, high-level waste Management, Transuranic waste. Low-level waste, Mixed waste

Storage, transportation and Disposal of radioactive waste: Storage, Safety Aspects of Radioactive Material Transport, Transportation of radioactive materials, Waste packages, Transportation of waste, Disposal concepts & systems, Disposal management and practices, Performance assessment of disposal system, Disposal of Spent fuel & high-level waste.

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	**Evaluate** the environmental and societal impacts of nuclear waste and its management.	C6	The Engineer and the World
2	**Understand** emerging global challenges in nuclear waste management.	C2	Lifelong Learning

REMARKS (if any):

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Course Profile

COURSE CODE& TITLE	**SEMESTER**	**CREDIT HOURS**
CH-436: Computer-Aided Process Synthesis (Depth Elective-III)	■ SPRING ☐ FALL	TH ☐ 3 ■ 2 ☐ 1 ☐ 0 PR ☐ 3 ☐ 2 ☐ 1 ■ 0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL** 26-05-2025	**APPLIED FROM BATCH** 2025

COURSE CONTENTS

Significance of Process Analysis and Simulation in Chemical Engineering: Chemical Process Simulators, Applications of Process Simulation, Convergence Analysis, Sensitivity Analysis, Design Specifications

Preliminary Analysis and Evaluation of Processes: Overview of Flowsheet Synthesis, Mass, and Energy Balances, Equipment Sizing and Costing, Economic Evaluation, Design and Scheduling of Batch Processes. The design process: (a) Steps in product and process design, (b) Safety and environmental considerations, (c) Role of computers in process synthesis Heuristics for process creation and integration: Algorithmic approaches to process synthesis

Synthesis of separation trains for: (a) Ideal fluid mixtures, (b) non-ideal fluid mixtures, Gas mixtures, (d) Solid-fluid mixtures

Chemical Reactors: Reactor design and reactor network synthesis, Synthesis of reactor-separator-recycle networks

Heat Exchange Equipment and process Heat Integration: Thermal pinch analysis and heat exchanger network synthesis

Optimization Approaches to Process Synthesis and Design: Optimization Techniques for Reactor Network Synthesis, Structural Optimization of Process Flowsheets, Optimal Design and Scheduling for Multiproduct Batch Plants.

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	**Apply** process analysis, simulation techniques, and optimization methods to design and optimize chemical processes	C3	Engineering Knowledge
2	**Analyze** and assess the sustainability, economic feasibility, and environmental impact of synthesized process flowsheets, ensuring compliance with industrial best practices and regulatory frameworks.	C4	The Engineer and the World

REMARKS (if any):

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Approved by: _____ (Dean/Date)

NED University of Engineering and Technology

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Course Profile

COURSE CODE& TITLE	SEMESTER	CREDIT HOURS
CH-437: Polymer & Composites (Depth Elective-III)	■ SPRING ☐ FALL	TH ☐ 3 ■ 2 ☐ 1 ☐ 0 PR ☐ 3 ☐ 2 ☐ 1 ■ 0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL** 26-05-2025	**APPLIED FROM BATCH** 2025

COURSE CONTENTS

Introduction to polymer-composites: Basic about polymers, melts and screening, rubber formation, the elastomer matrix, polymers of larger connectivity, reinforcing fillers, Hydrodynamic reinforcement elastomers, Polymer-filler & Filler-filler interactions of Natural polymer blends and composites: Starch-Cellulose Blend, Starch-Sodium Caseinate Blend, Novel Plastics and Foams from Starch and Polyurethanes, Chitosan-Properties and Application, Blends and Composites.

Advances in Polymer Composites: Macro- and Micro composites, Classification of Composites, Polymer Matrix Composites, Factors Affecting Properties of PMCs, Fabrication of Composites, Applications Relations between material structures and properties for polymers and composites.: Mechanical and thermal properties of thermoplastics, thermosets and composites based on glass, carbon, and aramide fibres. Polymer types and application: Polymerization and kinetics, molecular weight, structure and morphology, crystallization regimes, glass transition and melting point, mechanical properties, processing, composite classification, applications, matrices and reinforcements.

Shock and Impact Response of Glass Fiber-Reinforced Polymer Composites: testing of composites, production of fibres, production of MMCs, CMCs, PMCs, effect of structure on physical and mechanical properties.

Carbon Fiber-Reinforced Polymer Composites: Production, properties and application of carbon-carbon composites, mechanics of composites, Characterization of Injection- Molded Parts with Carbon Black-Filled Polymers

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	**Apply** knowledge of polymer composites to design, analyze, and optimize materials with specific mechanical and thermal properties for industrial applications.	C3	Engineering Knowledge
2	**Assess** the environmental footprint, recyclability, and long-term sustainability of polymeric materials, considering economic viability and regulatory constraints.	C4	The Engineer and the World

REMARKS (if any):

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Course Profile

COURSE CODE& TITLE	SEMESTER	CREDIT HOURS
CH-438: Corrosion Engineering (Depth Elective-III)	■ SPRING ☐ FALL	TH ☐ 3 ■ 2 ☐ 1 ☐ 0 PR ☐ 3 ☐ 2 ☐ 1 ■ 0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL** 26-05-2025	**APPLIED FROM BATCH** 2025

COURSE CONTENTS

Corrosion engineering: Introduction to corrosion science and engineering, Significance of corrosion and purpose, forms of corrosion, causes of corrosion, corrosion rate determination, corrosion environments and damage, corrosion classification, roles of corrosion engineer, Electrochemical kinetics of Corrosion: Theory and thermodynamics of corrosion, Nernst equation, Pourbaix diagrams, emf and galvanic series. Faraday law and corrosion rate determination. Electrode kinetics, polarization, and types, Ohmic drop at electrolyte/metal interface, mixed potential theory, passivity. Galvanic and concentration cell corrosion: Fundamentals of galvanic series, determining rates of galvanic corrosion. Pitting and Crevice Corrosion: Mechanism of pitting and crevice corrosion evaluation and examination.
Atmospheric Corrosion: Atmospheric Corrosion of metals, corrosion products
Oxidation: Introduction, initial stages, mechanism and thermodynamics Corrosion failures: Corrosion testing: salt spray/fog test, electrochemical corrosion testing, corrosion data analysis, Tafel extrapolation.
Corrosion protection measures: cathodic/anodic protection, coatings, metallic coating, organic and in-organic coating and inhibitors, synergistic mixtures, design considerations, corrosion of ceramics and degradation of polymers.

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	**Apply** corrosion science principles to analyze corrosion rates, identify mechanisms, and evaluate protection measures for materials in various environments.	**C3**	**Engineering Knowledge**
2	**Assess** the environmental footprint, recyclability, and long-term sustainability of polymeric materials, considering economic viability and regulatory constraints.	**C4**	**The Engineer and the World**

REMARKS (if any):

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Course Profile

COURSE CODE& TITLE	**SEMESTER**	**CREDIT HOURS**
CH-439: Energy Auditing and Management (Depth Elective-III)	■ SPRING ☐ FALL	TH ☐ 3 ■ 2 ☐ 1 ☐ 0 PR ☐ 3 ☐ 2 ☐ 1 ■ 0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL** 26-05-2025	**APPLIED FROM BATCH** 2025

COURSE CONTENTS

Introduction: Energy Audit, Energy audit-necessity, Types of energy audit. Theoretical considerations of energy audits: Investigations on energy audits, comparison between financial audits and energy audits, quality aspects on energy audits Energy Management: Energy management (audit) approach- understanding energy costs, Bench marking, Energy performance, matching energy use to requirement Research on energy balances: Typification of energy balances, energy balance of an organization, multiple energy audits processing, universal data model for energy audits. Optimization: Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution Instruments: Energy audit technique and instruments

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	**Apply** energy auditing techniques to assess usage, optimize efficiencies, and manage resources using tools like energy balances, benchmarking, and fuel substitution.	C3	**Engineering Knowledge**
2	**Assess** the economic and sustainability impact of energy conservation strategies, integrating renewable energy solutions and regulatory compliance into decision-making.	C4	**The Engineer and the World**

REMARKS (if any):

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Course Profile

COURSE CODE& TITLE	SEMESTER	CREDIT HOURS
CH-440: Clean Coal Technology and Co-Generation (Depth Elective-III)	■ SPRING ☐ FALL	TH ☐ 3 ■ 2 ☐ 1 ☐ 0 PR ☐ 3 ☐ 2 ☐ 1 ■ 0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL** 26-05-2025	**APPLIED FROM BATCH** 2025

COURSE CONTENTS

Introduction of coal as fuel: Origin of Coal, Chemical and physical characteristics of coal, Coal analysis, types of coal, ranks of coal, grades of coal, classification systems

Review of boilers and steam cycles: (a) Principles of boiler operation, (b) Classification and specification, (c) Steam cycle, (d) Re-heater and re-heat cycle, (e) Combined cycle, (f)Heat recovery

Fuel and combustion calculations: (a) Characteristics of typical fuels, (b) Stoichiometric calculations, (c) Enthalpy calculation of air and combustion products, (d) Heat balance, (e)Generation of SOx and NOx Design of technologies for conversion of solid fuels

Pulverizing coal-fired technology: (a) Design of pulverized coal-fired furnace, (b) Pulverized coal burner, (c) Tangential firing, (d) Natural circulation design, (e) Forced and supercritical boilers

Atmospheric and pressurized fluidized-bed technology: (a) Features of fluidized-bed boilers, (b) Basics of fluidized beds, (c) Design of bubbling fluidized-bed boilers, (d) Design of circulating fluidized-bed boilers Integrated gasification combined cycle (IGCC) technology: (a) Potential and current status, (b) Design issues

Indirectly fired cycle: (a) Potential and current status, (b) Thermodynamic analysis

Emissions: (a) Emission of gaseous and solid pollutants, (b) Air pollution standards, (c) Emission control technologies ·Steam plant economics and tariff calculation

Revamping of old technologies with advanced technologies: (a) Revamping of existing boiler, (b) Co-firing of opportunity fuel with fossil fuel, (c) Waste to energy

Case studies: (a) Computer simulation of different cycle models, (b) Steam generator, (c) Detailed design of steam generating unit with examples, (d) Steam turbine

Effect of Coal usage on human health and environment: Coal mining, coal preparation, transportation, combustion by-products, emissions from coal combustion, NOx, Sox,particulate matter, greenhouse gases (CO2)

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	**Apply** clean coal technology and co-generation principles to design and optimize coal combustion systems, evaluating fuel characteristics, emissions, and economics for efficiency and sustainability	C3	Engineering Knowledge
2	**Assess** the economic viability, sustainability challenges, and environmental impact of clean coal and co-generation strategies.	C4	The Engineer and the World

REMARKS (if any):

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(Chairperson/Date) (Dean/Date)

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Course Profile

COURSE CODE& TITLE	SEMESTER	CREDIT HOURS
CH-415: Transport Phenomena	■ SPRING ☐ FALL	TH ■ 3 ☐ 2 ☐ 1 ☐ 0 PR ☐ 3 ☐ 2 ☐ 1 ■ 0
PREREQUISITE COURSE(S) CH-219 Heat Transfer CH-312 Mass Transfer	**DATE OF COURSE CONTENT APPROVAL**	**APPLIED FROM BATCH** 2025

COURSE CONTENTS

1. Transport processes fundamentals
Mechanisms of momentum, energy and mass transport, concept of continuum and fluid statics.

2. Momentum transport
Derivation of equations of continuity and motion (Navier-Stoke's equation), application in laminar and turbulent flow problems (Newtonian & non-Newtonian fluids), equation of change for isothermal systems.

3. Energy transport
Derivation of energy equation. application to heat transfer problems involving conduction, forced and free convection, application in laminar and turbulent flow problems, equation of change for non-isothermal systems and temperature distribution/profiles development, energy transport by radiation

4. Mass transport
Derivation of species conservation equations for binary and multi- component mixtures, application to mass transfer problems with and without chemical reaction, application in laminar and turbulent flow problems, development of concentration profiles.

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	**Explain/clarify** the transport mechanisms for momentum, heat and mass.	**C2**	**Engineering Knowledge**
2	**Analyze** the transport problems to investigate the mathematical relations of momentum, heat and mass.	**C4**	**Problem Analysis**
3	**Design** the transport mechanisms of various geometries and systems for momentum, heat and mass.	**C5**	**Design/Development of Solutions**

REMARKS (if any):

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Course Profile

COURSE CODE& TITLE	SEMESTER	CREDIT HOURS
CH-425: Project Management	■ SPRING ☐ FALL	TH ☐ 3 ■ 2 ☐ 1 ☐ 0 PR ☐ 3 ☐ 2 ☐ 1 ■ 0
PREREQUISITE COURSE(S) N/A	**DATE OF COURSE CONTENT APPROVAL** 26-05-2025	**APPLIED FROM BATCH** 2025

Contents

1. Project Management Concepts

History of Project Management, Introduction to Project Management, Project, Program & Portfolio Management, Project characteristics, Objectives & Requirements, Project phase stages, Project Life Cycle, project environment, Project Scope & Project Charter, Project Manager, Project Stakeholder Analysis

2. Project Proposal Development

Project Proposal, Characteristics of a good proposal, Types of Proposals, Request for Proposal, Request for Quotation, etc.). Proposal Templates etc.

3. Project Feasibility

A brief review of various aspects of Project Feasibility like Technical, Social, Managerial, Economic, Financial & Marketing, Administrative etc.

4. Project Selection Criteria Economic Analysis of Engineering Projects)

Using Break Even Analysis, Cost-benefit ratio, Internal Rate of Return, Net Present Value, etc.

5. Project Contract & Procurement Management

Engineering Contracts, Type of contracts, understanding of procurement Process & Cycle. SEPRA Rules

6. Project Planning and Scheduling

Project Planning (Resource & HR Planning), Work Breakdown Structure. Project Network & Scheduling, Manning Schedule and Activity Charts, (Critical Path Method (CPM)/Project Evaluation& Review Techniques.

7. Project Costing & Estimation

Const estimation in Projects Cost components in projects and methods for cost estimation in projects, cost control in Projects, Estimation of Outstanding Work. Earned Value Management. Schedule & C0st variance analysis.

8. Project HRM & Communication Management

Effective Organization and Communication for Successful Projects, Project Organizational Structures (Project Matrix and Project-Based Organizations), Project HR Plan Preparation, HR Need Assessment and HR Matrix, Building and Managing Effective Project Team, Selection & Control Mechanism of HRM in Projects, Effective Communication Plan,

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9. Project Risk Management

Definitions Project Risk. Project Risk Management Tools, Types of Project Risk, Project Risk Assessment, Risk Identification and Mitigation, Monitoring & Controlling Risk, Generic Risk Management Strategies & Technique.

10. Computer Application in Project Management

Basic/Elementary Introduction and hands-on basic exposure to the use of MS Project & Primavera P6 Software in Project Management

11. Project Quality Management

Defining Quality, Quality Assurance, and Quality Management. 7 Quality Improvement Tools as applied in Project Management, Project Quality Management Plan, Quality Management Processes, and Strategies.

12. Project Closure and Termination

Project Evaluation, defining project success, Project Completion Criteria, Project Audit, Project Termination and When to Close a project, the termination process, Project Close Up and Lesson Learnt, and Project Archive.

COURSE LEARNING OUTCOME AND ITS MAPPING WITH PROGRAMME LEARNING OUTCOME

Sr. No.	CLOs	Taxonomy level	Programme learning outcome (PLO)
At the end of the course, the student will be able to:			
1	**Develop** competencies in project costing, budgeting, and financial appraisal	C4	Project Management
2	**Demonstrate** effective individual and collaborative teamwork skills in project management, for successful project outcomes.	A3	Individual and Collaborative Teamwork

REMARKS (if any):

Recommended by: _____ (Chairperson/Date)

Approved by: _____ (Dean/Date)