



# SANKAR POLYTECHNIC COLLEGE

A Government Aided, Autonomous Institution, Approved by AICTE & Affiliated to DoTE  
SANKAR NAGAR – 627 357



## DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Course Outcomes, CO-PO-PSO Matrices and its Justification for N-Scheme Courses

### Course Details

Year & Sem:	I & I
Course Code:	N101
Course Title:	Communication English I

### Course Outcome:

CO	After completing the course, the students will be able to,
CN101.1	Apply grammar skills effectively in functional situations
CN101.2	Apply relevant knowledge to speak English fluently
CN101.3	Practice accurate way of written communication (letters, emails, and resume)
CN101.4	Interpret the concept critical thinking skills
CN101.5	Apply relevant ideas in language learning process

### CO-PO, PSO Matrices:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CN101.1	3	2	1	1	2	1	3	1	1
CN101.2	2	2	2	1	3	2	3	2	2
CN101.3	2	2	3	1	2	3	3	1	2
CN101.4	1	3	2	1	3	2	3	2	1
CN101.5	2	2	2	1	2	1	3	2	2
C101	2	2.2	2	1	2.4	1.8	3	1.6	1.6

### Justification for CO-PO-PSO Mapping

#### CN101.1 – Apply grammar skills effectively in functional situations

- PO1 (3): Strong grammar foundations enhance comprehension and communication in technical writing and documentation.
- PO2 (2): Grammar supports clear problem analysis documentation.

- PO3 (1): Minor role in design but aids in expressing design objectives.
- PO4 (1): Limited relevance in testing but supports reporting.
- PO5 (2): Clear communication is critical for ethical and sustainable practices.
- PO6 (1): Helps in team communication.
- PO7 (3): Grammar mastery supports continual self-learning and knowledge sharing.
- PSO1 (1), PSO2 (1): Basic support to technical documentation in electrical contexts.

### **CN101.2 – Apply relevant knowledge to speak English fluently**

- PO1 (2): Communication skills support understanding of fundamental concepts.
- PO2 (2): Facilitates effective problem articulation.
- PO3 (2): Aids in explaining and documenting designs.
- PO4 (1): Useful in communicating test results.
- PO5 (3): Crucial in discussing societal and ethical engineering practices.
- PO6 (2): Supports project communication.
- PO7 (3): Language fluency is vital for ongoing learning and professional development.
- PSO1 (2), PSO2 (2): Enables effective technical discussions and instructions.

### **CN101.3 – Practice accurate way of written communication (letters, emails, and resume)**

- PO1 (2): Supports writing technical documents.
- PO2 (2): Helps in expressing analytical results.
- PO3 (3): Essential for documentation during design and development.
- PO4 (1): Assists in drafting test reports.
- PO5 (2): Aids in communicating ethical and environmental responsibilities.
- PO6 (3): Crucial for project documentation and reporting.
- PO7 (3): Enhances the ability to present continual learning evidence.
- PSO1 (1), PSO2 (2): Supports formal communication of technical and maintenance tasks.

### **CN101.4 – Interpret the concept critical thinking skills**

- PO1 (1): Basic analytical skills support comprehension.

- PO2 (3): Core to analysing and solving problems logically.
- PO3 (2): Supports problem-solving during design processes.
- PO4 (1): Helps interpret test data.
- PO5 (3): Essential for evaluating ethical and environmental implications.
- PO6 (2): Aids in logical team decision-making.
- PO7 (3): Enhances reflection and adaptation during lifelong learning.
- PSO1 (2), PSO2 (1): Improves diagnostic thinking in electrical domains.

### **CN101.5 – Apply relevant ideas in language learning process**

- PO1 (2): Supports understanding of technical language and concepts.
- PO2 (2): Aids in analytical expression.
- PO3 (2): Helps in writing clear solution-oriented reports.
- PO4 (1): Limited relevance.
- PO5 (2): Communication aids dissemination of sustainable ideas.
- PO6 (1): Helps in group communication.
- PO7 (3): Strongly supports ongoing language and professional development.
- PSO1 (2), PSO2 (2): Language strategies enhance professional interaction and compliance.

<b>Year &amp; Sem:</b>	I & I
<b>Course Code:</b>	N102
<b>Course Title:</b>	Engineering Mathematics I

### Course Outcome:

CO	After completing the course, the students will be able to,
<b>CN102.1</b>	solve the simple problems in matrices, complex numbers
<b>CN102.2</b>	solve the expansions of $\sin(A\pm B)$ , $\cos(A\pm B)$ and $\tan(A\pm B)$ and demoivre's theorem problems
<b>CN102.3</b>	Solve problems involving limits and differentiation
<b>CN102.4</b>	Calculate partial differentiation & integration.
<b>CN102.5</b>	Calculate scalar product & vector product of vectors.

### CO-PO, PSO Matrices:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CN102.1	3	2	1	1	1	1	2	2	1
CN102.2	3	2	1	1	1	1	2	2	1
CN102.3	3	3	2	2	1	1	2	2	1
CN102.4	3	3	2	2	1	1	2	2	1
CN102.5	2	2	2	2	2	2	2	3	2
<b>C102</b>	<b>2.8</b>	<b>2.4</b>	<b>2</b>	<b>1.6</b>	<b>1.2</b>	<b>1.2</b>	<b>2</b>	<b>2.2</b>	<b>1.2</b>

### Justification for CO-PO-PSO Mapping

#### ◇ CN102.1: Solve the simple problems in matrices, complex numbers

- PO1 (3): Strong use of basic mathematics concepts like matrices and complex numbers.
- PO2 (2): Involves identifying and analysing structured numerical problems.
- PO3 (1): Limited design application; more theoretical.
- PO4 (1): Some application in solving and verifying results.
- PO5 (1): Slight relevance in societal or environmental context.
- PO6 (1): Helps in collaborative academic problem solving.

- PO7 (2): Builds foundational skills for life-long mathematical learning.
- PSO1 (2): Foundation for electrical problem-solving tools involving complex numbers.
- PSO2 (1): Indirect support for test and maintenance understanding.

**CN102.2: Solve the expansions of  $\sin(A\pm B)$ ,  $\cos(A\pm B)$  and  $\tan(A\pm B)$  and demoivre's theorem problems**

- PO1 (3): Requires understanding and applying core mathematics concepts.
- PO2 (2): Involves analysing trigonometric expressions.
- PO3 (1): Limited to analytical application; minimal system design.
- PO4 (1): Might be used in verifying through computation.
- PO5 (1): No direct application to sustainability.
- PO6 (1): Useful in academic team tasks.
- PO7 (2): Promotes deeper analytical learning.
- PSO1 (2): Supports electrical problem-solving where phasor analysis is involved.
- PSO2 (1): Basic level support in equipment calculation.

◇ **CN102.3: Solve problems involving limits and differentiation**

- PO1 (3): Core mathematical technique needed in engineering analysis.
- PO2 (3): Highly relevant in analyzing changing quantities.
- PO3 (2): Useful in modeling and supporting simple design-based decisions.
- PO4 (2): Important for evaluating technical data.
- PO5 (1): Limited application.
- PO6 (1): Skills applicable in collaborative tasks.
- PO7 (2): Encourages continual learning in calculus.
- PSO1 (2): Helps in understanding systems with rate of change (e.g., current, voltage).
- PSO2 (1): Foundation for control system behavior analysis.
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◇ **CN102.4: Calculate partial differentiation & integration**

- PO1 (3): Applies advanced math concepts crucial for engineering.
- PO2 (3): Requires analysis of multivariable functions.
- PO3 (2): Important in modeling and simulation support.
- PO4 (2): Directly applicable in tool-based problem-solving.
- PO5 (1): Indirect role in societal applications.
- PO6 (1): Collaboration in computation-focused tasks.
- PO7 (2): Builds further capacity for academic and professional learning.
- PSO1 (2): Useful in field analysis and electromagnetic systems.
- PSO2 (1): Supports learning in equipment behaviour.

◇ **CN102.5: Calculate scalar product & vector product of vectors.**

- PO1 (2): Relates to vector analysis fundamental in physics and engineering.
- PO2 (2): Involves analytical skills.
- PO3 (2): Applicable in physical system designs like force, motion, etc.
- PO4 (2): Required in simulations and testing environments.
- PO5 (2): Relevant for mechanical systems and energy modelling.
- PO6 (2): Applies to group-based simulations or lab work.
- PO7 (2): Important in continued technical education.
- PSO1 (3): Crucial in electrical engineering (e.g., torque in motors).
- PSO2 (2): Strong application in testing and measurement scenarios.

<b>Year &amp; Sem:</b>	I & I
<b>Course Code:</b>	N103
<b>Course Title:</b>	Engineering Physics I

### Course Outcome:

CO	After completing the course, the students will be able to,
C103.1	Explain the concept of SI units and dimensional formulae
C103.2	Explain the surface tension of liquids and viscosity of fluids.
C103.3	Explain the concept of projectile motion, circular motion and its application.
C103.4	Explain the propagation of sound and acoustics of building
C103.5	Explain the importance of hysteresis of magnetic materials and its uses.

### CO-PO, PSO Matrices:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
C103.1	3	2	1	1	1	1	2	1	1
C103.2	3	3	2	2	2	1	2	2	2
C103.3	3	3	2	2	2	1	2	2	2
C103.4	2	2	2	2	3	1	2	1	2
C103.5	2	2	2	2	3	1	2	2	2
<b>C103</b>	<b>2.6</b>	<b>2.4</b>	<b>1.8</b>	<b>1.8</b>	<b>2.2</b>	<b>1</b>	<b>2</b>	<b>1.6</b>	<b>1.8</b>

### Justifications for CO-PO-PSO Mapping

#### C103.1: Explain the concept of SI units and dimensional formulae

- PO1 (3): Strong use of basic math and science knowledge.
- PO2 (2): Involves identifying relationships between physical quantities.
- PO3 (1): Basic foundational knowledge only; no design involved.
- PO4 (1): Slightly relevant in applying formulas during testing.
- PO5 (1): Minor relevance through standard scientific norms.
- PO6 (1): Limited application in communication or project management.
- PO7 (2): Promotes understanding needed for continuous learning.

- PSO1 (1), PSO2 (1): Basic foundational impact on electrical concepts.

### **C103.2: Explain the surface tension of liquids and viscosity of fluids**

- PO1 (3): Applies physics to fluid behaviour.
- PO2 (3): Requires analysis of fluid-related problems.
- PO3 (2): Concepts aid in system design like lubrication.
- PO4 (2): Involves measurement of viscosity, etc.
- PO5 (2): Relevance in environmental fluid applications.
- PO6 (1): Basic awareness; minimal management role.
- PO7 (2): Encourages updating knowledge in materials science.
- PSO1 (2): Applies to hydraulic and thermal systems.
- PSO2 (2): Practical testing and maintenance relevance.

### **C103.3: Explain the concept of projectile motion, circular motion, and their applications**

- PO1 (3): Fundamental physics concept.
- PO2 (3): Requires mathematical modelling of motion.
- PO3 (2): Understanding motion helps in design of rotating systems.
- PO4 (2): Measurable in labs using motion analysis tools.
- PO5 (2): Related to safe design (centrifugal systems, etc.).
- PO6 (1): Minor connection.
- PO7 (2): Encourages updates in motion-related tech.
- PSO1 (2): Applies in rotating machine design.
- PSO2 (2): Essential in maintenance of motion systems.

### **C103.4: Explain the propagation of sound and acoustics of buildings**

- PO1 (2): Involves physics concepts.
- PO2 (2): Analysing sound paths, reflection, absorption.
- PO3 (2): Applies to design of auditoriums, machinery enclosures.
- PO4 (2): Standard acoustic tests apply.

- PO5 (3): High relevance for sustainable, noise-free design.
- PO6 (1): Low direct link.
- PO7 (2): Life-long learning in acoustics for energy-efficient building design.
- PSO1 (1): Limited direct use.
- PSO2 (2): Soundproofing in electrical installations.

**C103.5: Explain the importance of hysteresis in magnetic materials and its uses**

- PO1 (2): Physics-based understanding.
- PO2 (2): Analyse hysteresis loops and implications.
- PO3 (2): Impacts design of transformers, motors.
- PO4 (2): Standard testing like B-H curve measurement.
- PO5 (3): Strong link with energy loss, efficiency, sustainability.
- PO6 (1): Minor link to management.
- PO7 (2): Magnetic materials evolve; encourages ongoing learning.
- PSO1 (2): Core to transformer and motor performance.
- PSO2 (2): Key in maintenance/testing of magnetic devices.

<b>Year &amp; Sem:</b>	I & I
<b>Course Code:</b>	N104
<b>Course Title:</b>	Engineering Chemistry I

**Course Outcome:**

<b>CO</b>	<b>After completing the course, the students will be able to,</b>
C104.1	Explain the concept of atomic structures, chemical bonding, Acids, bases and solution
C104.2	Explain about the Surface chemistry, colloidal particles, catalyst and solid state
C104.3	Explain the concept of analysis, treatment and conservation of water
C104.4	Explain the details of electrochemistry, energy sources and nano technology
C104.5	Explain the methods of corrosion prevention

**CO-PO, PSO Matrices:**

<b>CO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PSO1</b>	<b>PSO2</b>
C104.1	3	2	1	1	1	1	2	2	1
C104.2	3	2	1	2	2	1	2	2	1
C104.3	2	2	2	2	3	2	3	2	2
C104.4	3	3	2	3	2	2	2	3	2
C104.5	2	2	2	1	3	2	3	2	3
<b>C104</b>	<b>2.6</b>	<b>2.2</b>	<b>1.6</b>	<b>1.8</b>	<b>2.2</b>	<b>1.6</b>	<b>2.4</b>	<b>2.2</b>	<b>1.8</b>

**Justification for CO-PO-PSO Mapping**

**C104.1: Explain the concepts of atomic structure, chemical bonding, acids, bases, and solutions.**

- PO1 (3): Strong foundational knowledge in basic chemistry contributes to understanding engineering science.
- PO2 (2): Moderate analysis of atomic and molecular behaviour in various engineering contexts.
- PO3 (1): Slight relevance in designing processes based on material chemistry.
- PO7 (2): Awareness of evolving chemical principles helps in lifelong learning.

#### **C104.2: Explain about the Surface chemistry, colloidal particles, catalyst and solid state**

- PO1 (3): Essential chemistry concepts for understanding materials and processes.
- PO2 (2): Required to analyze interactions and stability of colloids and catalysts.
- PO3 (2): Can assist in designing experiments or materials with required properties.
- PO7 (1): Encourages further exploration of advanced topics like nanocatalysis.

#### **C104.3: Explain the concept of analysis, treatment and conservation of water**

- PO1 (2): Applies scientific knowledge to water chemistry.
- PO2 (2): Identifies and analyses water impurities and treatment methods.
- PO3 (1): Supports design of basic water treatment methods.
- PO4 (2): Involves standard tests and measurements for water quality.
- PO5 (3): Strong relevance in environmental and sustainable engineering practices.
- PO7 (2): Promotes continued awareness about water conservation technologies.
- PSO2 (2): Supports sustainability and safety in industrial water usage.

#### **C104.4: Explain the details of electrochemistry, energy sources and nano technology**

- PO1 (3): Core scientific principles behind batteries, fuel cells, and nanotech.
- PO2 (2): Analytical skills applied in energy and nano applications.
- PO3 (2): Supports developing or improving electrochemical systems.
- PO4 (3): Testing of energy devices and nano-materials requires modern tools.
- PO5 (2): Energy conservation and nanotech play a role in sustainability.
- PO7 (3): Rapid advancements in energy/nano fields drive lifelong learning.
- PSO1 (3): Strong relevance to electrical energy and device applications.
- PSO2 (2): Applies to testing and sustainable use of modern technologies.

#### **C104.5: Explain the methods of corrosion prevention**

- PO1 (2): Applies knowledge of corrosion chemistry in electrical engineering.
- PO3 (1): Supports the design of systems with corrosion-resistant components.
- PO5 (3): Corrosion control is essential for safety, sustainability, and environmental protection.
- PO7 (3): Encourages learning about new corrosion prevention techniques.
- PSO1 (2): Relates to maintaining electrical machines and systems.

- PSO2 (3): Strong relevance in maintenance and safety in electrical equipment.

<b>Year &amp; Sem:</b>	I & I
<b>Course Code:</b>	N105
<b>Course Title:</b>	Basic Engineering

### Course Outcome:

CO	After completing the course, the students will be able to,
C105.1	Explain the construction materials, foundation and structures of civil engineering
C105.2	Describe the fundamentals of computer, computer network and communication
C105.3	Explain the basic concept of circuit elements and circuit laws
C105.4	Explain the basic concept of types of materials and semi-conductor materials
C105.5	Explain the fundamentals of internal combustion engine, refrigeration and air conditioning system

### CO-PO, PSO Matrices:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
C105.1	3	2	2	1	2	1	1	2	2
C105.2	3	3	2	2	2	1	2	2	2
C105.3	3	3	2	2	2	1	2	3	2
C105.4	3	2	2	2	2	1	2	3	2
C105.5	3	2	3	3	3	2	2	3	3
<b>C105</b>	<b>3</b>	<b>2.4</b>	<b>2</b>	<b>2</b>	<b>2.2</b>	<b>1.2</b>	<b>1.8</b>	<b>2.6</b>	<b>2.2</b>

### Justifications for CO-PO-PSO Mapping

#### C105.1 – Explain the construction materials, foundation and structures of civil engineering

- PO1 (3): Strong use of basic science and engineering fundamentals.
- PO2 (2): Involves problem analysis related to construction.
- PO3 (2): Basic design aspects of structures.
- PO4 (1): Limited tool usage, possibly CAD tools.
- PO5 (2): Construction must consider sustainability and society.
- PO6 (1): Some relevance to project management.

- PO7 (1): Updates needed in materials/techniques.
- PSO1 (2): Applies indirectly to system-level understanding.
- PSO2 (2): Knowledge aids safe and sustainable construction work.

**C105.2 – Describe the fundamentals of computer, computer network and communication**

- PO1 (3): Involves fundamental knowledge of technology.
- PO2 (3): Students analyze how networks and systems work.
- PO3 (2): Can support design of communication systems.
- PO4 (2): Modern tools used in networking and troubleshooting.
- PO5 (2): Communication tech supports society; ethical concerns.
- PO6 (1): Slight relevance to communication in projects.
- PO7 (2): Rapid tech changes necessitate life-long learning.
- PSO1 (2): Supports automation and communication aspects.
- PSO2 (2): Important in operation and maintenance settings.

**C105.3 – Explain the basic concept of circuit elements and circuit laws**

- PO1 (3): Core electrical knowledge application.
- PO2 (3): Strong need for circuit analysis skills.
- PO3 (2): Basic design for electrical circuits.
- PO4 (2): Tools like multimeters, simulation tools are used.
- PO5 (2): Indirectly supports ethical use of electrical energy.
- PO6 (1): Minor role in managing tasks related to circuits.
- PO7 (2): Electrical technology evolves—lifelong learning needed.
- PSO1 (3): Essential for solving electrical engineering problems.
- PSO2 (2): Required in equipment testing and operation.

**C105.4 – Explain the basic concept of types of materials and semi-conductor materials**

- PO1 (3): Requires solid understanding of engineering science.
- PO2 (2): Analyze material properties and behavior.

- PO3 (2): Assists in designing with appropriate materials.
- PO4 (2): Testing tools like semiconductor analyzers involved.
- PO5 (2): Sustainable material selection is critical.
- PO6 (1): Not central to management tasks.
- PO7 (2): New materials require ongoing learning.
- PSO1 (3): Semiconductor knowledge crucial in automation.
- PSO2 (2): Key for safe operation and maintenance.

**C105.5 – Explain the fundamentals of internal combustion engine, refrigeration and air conditioning system**

- PO1 (3): Strong use of engineering fundamentals.
- PO2 (2): Analyze working of thermal systems.
- PO3 (3): Design and understanding of systems required.
- PO4 (3): Measurements/testing (e.g., pressure, temperature).
- PO5 (3): Direct environmental and sustainability impact.
- PO6 (2): Related to managing HVAC/engine projects.
- PO7 (2): Rapid changes in HVAC technology.
- PSO1 (3): Highly relevant to power systems knowledge.
- PSO2 (3): Involves testing, operation, and safety adherence.

<b>Year &amp; Sem:</b>	I & I
<b>Course Code:</b>	N106
<b>Course Title:</b>	Applied Science Practical I

### Course Outcome:

CO	After completing the course, the students will be able to,
C106.1	Determine the thickness, area and volume of the given glass plate
C106.2	Determine the length, diameter and volume of the given solid cylinder
C106.3	Test the parallelogram law concept using concurrent force.
C106.4	Determine the coefficient of viscosity of a highly viscous liquid.
C106.5	Determine the frequency of the given tuning fork

### CO-PO, PSO Matrices:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
C106.1	3	2	1	3	1	1	2	2	2
C106.2	3	2	1	3	1	1	2	2	2
C106.3	2	3	2	3	1	2	2	2	2
C106.4	3	3	2	3	1	2	2	3	3
C106.5	3	2	1	3	1	1	2	2	2
<b>C106</b>	<b>2.8</b>	<b>2.4</b>	<b>1.4</b>	<b>3</b>	<b>1</b>	<b>1.4</b>	<b>2</b>	<b>2.2</b>	<b>2.2</b>

### Justification for CO-PO-PSO Mapping

#### C106.1: Determine the thickness, area and volume of the given glass plate

- PO1 (3): Strongly applies basic math and measurement principles.
- PO2 (2): Analyses measurements using standard methods.
- PO3 (1): Basic level of design or formulation.
- PO4 (3): Uses measurement tools and techniques effectively.
- PO5 (1): Slight relevance to sustainability via material handling.
- PO6 (1): Basic teamwork and reporting involved.
- PO7 (2): Encourages updates in measurement technology.
- PSO1 (2): Applies measurement to electrical components indirectly.
- PSO2 (2): Promotes testing practices.

**C106.2: Determine the length, diameter and volume of the given solid cylinder**

- PO1 (3): Strongly applies basic math and measurement principles.
- PO2 (2): Analyses measurements using standard methods.
- PO3 (1): Basic level of design or formulation.
- PO4 (3): Uses measurement tools and techniques effectively.
- PO5 (1): Slight relevance to sustainability via material handling.
- PO6 (1): Basic teamwork and reporting involved.
- PO7 (2): Encourages updates in measurement technology.
- PSO1 (2): Applies measurement to electrical components indirectly.
- PSO2 (2): Promotes testing practices.

**C106.3: Test the parallelogram law concept using concurrent force.**

- PO1 (2): Applies basic mechanics.
- PO2 (3): Involves analysis of force systems.
- PO3 (2): Assists in designing experimental setup.
- PO4 (3): Uses tools like force tables and pulleys.
- PO5 (1): Some ethical handling of equipment.
- PO6 (2): Group collaboration and documentation.
- PO7 (2): Exposure to classical physics promotes learning.
- PSO1 (2): Understanding mechanical forces in electrical contexts.
- PSO2 (2): Reinforces safety and procedure in lab work.

**C106.4: Determine the coefficient of viscosity of a highly viscous liquid.**

- PO1 (3): Strong scientific and mathematical application.
- PO2 (3): Critical analysis and data interpretation.
- PO3 (2): Assists with setup and design.
- PO4 (3): Uses precise measuring tools and test procedures.
- PO5 (1): Disposal and use of viscous liquids requires awareness.
- PO6 (2): Report preparation and team dynamics.

- PO7 (2): Encourages understanding of material science evolution.
- PSO1 (3): Fluid behaviour relates to electrical insulation and cooling systems.
- PSO2 (3): Emphasizes safe lab practices.

**C106.5: Determine the frequency of the given tuning fork**

- PO1 (3): Applies concepts of waves and vibration.
- PO2 (2): Identifies patterns and measurements.
- PO3 (1): Basic level of experimental design.
- PO4 (3): Uses frequency-measuring devices.
- PO5 (1): Minor ethical/environmental connection.
- PO6 (1): Minimal group coordination needed.
- PO7 (2): Relevance of acoustics and measurement encourages curiosity.
- PSO1 (2): Foundation for understanding electrical signal processing.
- PSO2 (2): Trains in handling frequency-related instruments.

<b>Year &amp; Sem:</b>	I & I
<b>Course Code:</b>	N107B
<b>Course Title:</b>	Workshop Practice

**Course Outcome:**

<b>CO</b>	<b>After completing the course, the students will be able to,</b>
C107B.1	Perform various wiring connection for relevant applications
C107B.2	Perform various plumbing connection for relevant applications

**CO-PO, PSO Matrices:**

<b>CO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PSO1</b>	<b>PSO2</b>
C107B.1	3	2	2	3	1	1	1	3	2
C107B.2	3	2	2	3	1	1	1	3	2
<b>C107B</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>2</b>

**Justification for CO-PO-PSO Correlation**

**C107B.1 - Perform various wiring connections for relevant applications**

- PO1 (3): Strongly related as performing wiring connections requires fundamental knowledge of electrical engineering principles and mathematics.
- PO2 (2): Moderate relationship since wiring tasks require problem analysis and troubleshooting.
- PO3 (2): Moderate because wiring involves designing or planning connection schemes.
- PO4 (3): Strong correlation as modern tools and testing are essential for verifying wiring connections.
- PO5 (1): Basic understanding of ethical and sustainable practices is needed, but less direct.
- PO6 (1): Minimal relation; project management skills might be lightly used.
- PO7 (1): Life-long learning is encouraged but not directly linked here.
- PSO1 (3): Strongly aligned with the ability to provide technical solutions in electrical systems.
- PSO2 (2): Moderate, as safe operation and maintenance relate to wiring tasks.

**C107B.2 - Perform various plumbing connections for relevant applications**

- PO1 (3): Strong knowledge of engineering fundamentals is required.

- PO2 (2): Moderate problem-solving skills needed for installation and troubleshooting.
- PO3 (2): Moderate design input in plumbing layouts and connection design.
- PO4 (3): Strong because experimentation and testing verify system integrity.
- PO5 (1): Basic environmental and ethical practices apply.
- PO6 (1): Some project management skills may be used.
- PO7 (1): Encouraged but indirect.
- PSO1 (3): Strong connection as technical solutions include systems integrating plumbing with electrical aspects.
- PSO2 (2): Moderate relation to operation, maintenance, and safety in installations.

<b>Year &amp; Sem:</b>	I & II
<b>Course Code:</b>	N201
<b>Course Title:</b>	Communication English II

**Course Outcome:**

<b>CO</b>	<b>After completing the course, the students will be able to,</b>
C201.1	Apply functional grammar for effective communication
C201.2	Apply basic grammar for effective communication
C201.3	Apply situational English for effective communication
C201.4	Apply creative English for effective communication
C201.5	Explain the English necessary for Scholarly presentation/ Fluency

**CO-PO, PSO Matrices:**

<b>CO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PSO1</b>	<b>PSO2</b>
C201.1	3	2	1	1	2	2	3	2	1
C201.2	3	2	1	1	2	2	3	2	1
C201.3	2	3	2	1	3	3	3	2	2
C201.4	2	2	2	1	3	3	3	1	2
C201.5	1	2	2	1	3	3	3	1	2
<b>C201</b>	<b>2.2</b>	<b>2.2</b>	<b>1.6</b>	<b>1</b>	<b>2.6</b>	<b>2.6</b>	<b>3</b>	<b>1.6</b>	<b>1.6</b>

**Justification for CO-PO-PSO**

**C201.1 – Apply functional grammar for effective communication**

- PO1 (3): Strongly related as functional grammar is foundational for understanding and applying communication skills in technical and academic contexts.
- PO2 (2): Moderately related since proper grammar aids in analysing and interpreting technical problems and communicating findings.
- PO3 (1): Slight relevance as it may help in documenting design ideas or instructions.
- PO4 (1): Minimal link; may assist in drafting reports or test procedures.
- PO5 (2): Moderate alignment, promoting responsible communication in social and environmental contexts.
- PO6 (2): Moderate, as clear grammar enhances teamwork and professional communication.
- PO7 (3): Strongly related since mastering grammar supports lifelong learning and skill refinement.
- PSO1 (2): Moderate, as it helps in writing clear technical documentation and solutions.
- PSO2 (1): Slightly related through better safety instruction and operation manuals.

### **C201.2 – Apply basic grammar for effective communication**

- PO1 (3): Strongly related as basic grammar is essential for technical language proficiency.
- PO2 (2): Moderately related due to its role in structured communication of analysis and problems.
- PO3 (1): Slight relevance in documenting and describing design components.
- PO4 (1): Minimal; may assist in writing procedures or observations.
- PO5 (2): Moderate, fostering ethical and sustainable communication practices.
- PO6 (2): Moderate, enabling effective team and project-related discussions.
- PO7 (3): Strongly linked to lifelong learning and continuous improvement of communication skills.
- PSO1 (2): Moderate, helping express technical issues and solutions clearly.
- PSO2 (1): Slightly relevant in safe and clear communication during field tasks.

### **C201.3 – Apply situational English for effective communication**

- PO1 (2): Moderately related as it enables use of core knowledge in real-life contexts.
- PO2 (3): Strongly linked; situational English is vital for understanding and addressing problems in workplace settings.
- PO3 (2): Moderate, as it assists in articulating technical needs and designs in practical scenarios.
- PO4 (1): Slight relevance in communicating procedures during testing.
- PO5 (3): Strong, since effective communication is key in social, ethical, and environmental situations.
- PO6 (3): Strongly related; improves collaboration, leadership, and project execution through real-time communication.
- PO7 (3): Strong link as this outcome supports continual learning and adaptability.
- PSO1 (2): Moderate, enabling better communication during system analysis and troubleshooting.
- PSO2 (2): Moderate, supporting effective communication during equipment operation and maintenance.

### **C201.4 – Apply creative English for effective communication**

- PO1 (2): Moderately related; creative expression supports a deeper understanding of technical concepts.
- PO2 (2): Moderate; encourages innovative thinking when analyzing problems.
- PO3 (2): Moderate relationship as creativity aids in presenting design solutions and alternatives.
- PO4 (1): Slight relevance, mainly in writing or presenting test results.

- PO5 (3): Strongly related; creative language use can promote social, ethical, and sustainable ideas.
- PO6 (3): Strong alignment in facilitating dynamic interaction and leadership through expressive communication.
- PO7 (3): Strong, as creativity fosters curiosity and lifelong development.
- PSO1 (1): Slight, possibly supports innovation in documentation or solutions.
- PSO2 (2): Moderate, supporting better expression of safety protocols and technical practices.

**C201.5 – Explain the English necessary for Scholarly presentation/ Fluency**

- PO1 (1): Slight relationship, as grammar supports basic technical knowledge presentation.
- PO2 (2): Moderate; assists in effectively explaining analytical findings.
- PO3 (2): Moderate; useful in presenting solutions and designs fluently.
- PO4 (1): Slight, related to drafting test reports or observations.
- PO5 (3): Strong alignment in expressing ethical and sustainable ideas fluently in presentations.
- PO6 (3): Strong; necessary for project discussions, leadership, and teamwork.
- PO7 (3): Strongly related; improves self-presentation skills and supports professional growth.
- PSO1 (1): Slightly relevant to presenting technical problems and solutions effectively.
- PSO2 (2): Moderate, helping articulate maintenance steps and safety protocols fluently.

<b>Year &amp; Sem:</b>	I & II
<b>Course Code:</b>	N202
<b>Course Title:</b>	Engineering Mathematics II

**Course Outcome:**

<b>CO</b>	<b>After completing the course, the students will be able to,</b>
C202.1	Calculate the scalar & vector products for the given problem
C202.2	Apply discrete random variable concept to fit a straight line
C202.3	Calculate the values of velocity, acceleration, tangent, normal, maxima & minima

C202.4	Calculate area of a circle and Volume of a sphere and cone using bernoulli's formula
C202.5	Solve First order differentiation equation I, Second order differentiation equation II, Second order differentiation equation II

**CO-PO, PSO Matrices:**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
C202.1	3	2	1	2	1	1	1	2	1
C202.2	3	3	2	2	1	1	2	2	1
C202.3	3	2	2	2	1	1	1	3	2
C202.4	3	2	2	2	2	1	2	3	2
C202.5	3	3	3	2	2	2	2	3	2
<b>C202</b>	<b>3</b>	<b>2.4</b>	<b>2</b>	<b>2</b>	<b>1.4</b>	<b>1.2</b>	<b>1.6</b>	<b>2.6</b>	<b>1.6</b>

**Justification for CO-PO-PSO**

**C202.1 – Calculate scalar and vector products for the given problems**

- PO1: (3) Involves fundamental mathematics and vector algebra.
- PO2: (2) Requires identifying mathematical structure of problems.
- PO3: (1) Limited design involvement.
- PO4: (2) Vector concepts may be tested using simulation tools.
- PO5: (1) Minor relevance in sustainability.
- PO6: (1) Applies to team-based problem solving at a basic level.
- PO7: (1) May trigger curiosity to learn further in applied math.
- PSO1: (2) Vectors are applied in electrical machines and fields.
- PSO2: (1) Basic skill needed for operation and testing.

**◇ C202.2 – Apply discrete random variables to fit a straight line**

- PO1: (3) Strong use of mathematics and statistics.
- PO2: (3) Involves problem identification and analysis with data.
- PO3: (2) Basic design via curve fitting models.
- PO4: (2) Possible use of tools like Excel/Matlab.
- PO5: (1) Some environmental data modeling applications.
- PO6: (1) Group work or presentation aspects.

- PO7: (2) Encourages ongoing learning in data science/statistics.
- PSO1: (2) Applicable in automation system modeling.
- PSO2: (1) Minor impact on equipment operation.

◇ **C202.3 – Compute velocity, acceleration, tangent, normal, maxima, and minima**

- PO1: (3) Core calculus and kinematics knowledge.
- PO2: (2) Analytical problem-solving required.
- PO3: (2) Useful in system or motion design.
- PO4: (2) Tools may simulate dynamics.
- PO5: (1) May relate to motion efficiency.
- PO6: (1) Team activity for calculations or experiments.
- PO7: (1) Builds foundation for deeper study.
- PSO1: (3) Important in electromechanical analysis.
- PSO2: (2) Applicable in machine motion control.

◇ **C202.4 – Calculate area and volume using Bernoulli's formula**

- PO1: (3) Strong math and physics foundation needed.
- PO2: (2) Involves mathematical modeling and physical analysis.
- PO3: (2) Supports design through fluid/energy systems understanding.
- PO4: (2) Use of CAD or analytical tools.
- PO5: (2) Relates to sustainable design of systems.
- PO6: (1) Collaborative lab work or projects.
- PO7: (2) Encourages applying formulas in new contexts.
- PSO1: (3) Highly applicable in power systems.
- PSO2: (2) Supports understanding of energy conservation systems.

◇ **C202.5 – Solve first and second-order differential equations**

- PO1: (3) Core mathematical modelling.
- PO2: (3) Deep analytical thinking required.
- PO3: (3) Supports advanced system modelling.

- PO4: (2) Tools like MATLAB or Simulink may be used.
- PO5: (2) Useful in modelling sustainable energy systems.
- PO6: (2) Encourages collaborative problem solving.
- PO7: (2) Lifelong learning in math tools and applications.
- PSO1: (3) Direct use in electrical systems and control.
- PSO2: (2) Applicable in testing dynamic systems.

<b>Year &amp; Sem:</b>	I & II
<b>Course Code:</b>	N203
<b>Course Title:</b>	Engineering Physics II

**Course Outcome:**

<b>CO</b>	<b>After completing the course, the students will be able to,</b>
C203.1	Interpret the relation between pressure, volume and temperature of gas.
C203.2	Explain the process of isothermal and Adiabatic changes of gas and basic laws of thermodynamics
C203.3	Explain the characteristics and properties of LASER, Optical fiber and its

	applications
C203.4	Explain the characteristics, properties and production of X-Rays, Photoelectric effect & Ultrasonics and its applications.
C203.5	Explain the concept of heating, chemical and magnetic effect of electric current.

**CO-PO, PSO Matrices:**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
C203.1	3	2	1	1	1	1	2	2	1
C203.2	3	3	2	1	1	1	2	2	1
C203.3	3	2	2	2	1	1	2	2	2
C203.4	3	2	2	3	2	2	2	3	3
C203.5	3	2	2	2	3	2	2	3	3
<b>C203</b>	<b>3</b>	<b>2.2</b>	<b>1.8</b>	<b>1.8</b>	<b>1.6</b>	<b>1.4</b>	<b>2</b>	<b>2.4</b>	<b>2</b>

**Justification for CO-PO-PSO Mapping**

**C203.1 – Interpret the relationship between pressure, volume, and temperature of gases.**

- PO1: High – Requires strong fundamentals in physics and thermodynamics.
- PO2: Medium – Involves analysis of gas laws.
- PO3: Low – Basic conceptual application, not a design-oriented outcome.
- PO4: Low – Some measurements or graphical interpretations may be used.
- PO5: Low – Basic environmental or ethical impact implied.
- PO6: Low – May contribute to discussions in teams or projects.
- PO7: Medium – Concept forms the foundation for lifelong learning in thermodynamics.
- PSO1: Medium – Thermodynamic properties are used in electrical systems.
- PSO2: Low – Limited direct application in maintenance or safety.

**C203.2 – Explain the process of isothermal and Adiabatic changes of gas and basic laws of thermodynamics**

- PO1: High – Requires application of scientific laws and engineering basics.
- PO2: High – Analysing different processes is a core analytical skill.
- PO3: Medium – Partial design or modelling of ideal processes.
- PO4: Low – Limited standard testing.
- PO5: Low – Concepts linked to energy efficiency and sustainability.

- PO6: Low – Can be used to manage energy projects.
- PO7: Medium – Important for further learning in thermal systems.
- PSO1: Medium – Thermodynamics impacts machines and power systems.
- PSO2: Low – Less direct connection to operation/maintenance.

**C203.3 – Explain the characteristics and properties of LASER, Optical fibre and its applications**

- PO1: High – Fundamental knowledge of optics and electronics.
- PO2: Medium – Requires interpretation of properties and principles.
- PO3: Medium – Includes application-based understanding.
- PO4: Medium – May involve tools for measurement and signal testing.
- PO5: Low – Some societal applications like communication technology.
- PO6: Low – Communication systems may require teamwork and documentation.
- PO7: Medium – Technological area evolves rapidly; lifelong learning important.
- PSO1: Medium – Applicable in automation and signal processing.
- PSO2: Medium – Used in communication maintenance and troubleshooting.

**C203.4 – Explain the characteristics, properties and production of X-Rays, Photoelectric effect & Ultrasonics and its applications.**

- PO1: High – Relies on strong understanding of modern physics.
- PO2: Medium – Analyzing different phenomena and their uses.
- PO3: Medium – Involves application in systems or medical/electrical tools.
- PO4: High – Tools and instruments (e.g., X-ray machines) require testing.
- PO5: Medium – Significant ethical/safety implications.
- PO6: Medium – Communication and project roles in technology-based industries.
- PO7: Medium – Need to update as applications evolve.
- PSO1: High – Technologies used in electrical/electronic systems.
- PSO2: High – Safety and testing of related instruments is critical.

**C203.5 – Explain the concept of heating, chemical and magnetic effect of electric current**

- PO1: High – Core electrical concepts.
- PO2: Medium – Analyse behaviours of electric currents in different conditions.
- PO3: Medium – Application in designing safety or energy systems.
- PO4: Medium – Testing of heating and magnetic devices.
- PO5: High – Strong implications for safety, sustainability.
- PO6: Medium – Project-based work and teamwork skills needed.
- PO7: Medium – Keeps engineers updated with power safety standards.
- PSO1: High – Strongly linked to machine operation and automation.
- PSO2: High – Related to testing, safety, and sustainability.

<b>Year &amp; Sem:</b>	I & II
<b>Course Code:</b>	N204
<b>Course Title:</b>	Engineering Chemistry II

**Course Outcome:**

<b>CO</b>	<b>After completing the course, the students will be able to,</b>
C204.1	Explain the concept of Environmental chemistry
C204.2	Explain about the combustion of fuel with its advantages
C204.3	Explain about the extraction of metal-iron, steel manufacture, powder metallurgy and refractory

C204.4	Explain about polymer, composite material and photochemistry
C204.5	Explain about the fundamental of nuclear chemistry and engineering materials

**CO-PO, PSO Matrices:**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
C204.1	3	2	1	1	3	1	2	1	2
C204.2	3	3	2	1	3	1	2	2	3
C204.3	3	2	2	2	2	2	2	3	3
C204.4	3	2	2	2	2	1	2	2	2
C204.5	3	2	1	1	3	2	3	2	3
C204.1	<b>3</b>	<b>2.2</b>	<b>1.6</b>	<b>1.4</b>	<b>2.6</b>	<b>1.4</b>	<b>2.2</b>	<b>2</b>	<b>2.6</b>

**Justification for CO-PO-PSO Mapping**

**C204.1 – Explain the concept of Environmental chemistry**

- PO1 (3): Strong foundation in science is needed to understand environmental chemistry.
- PO2 (2): Analytical thinking for interpreting pollution data and chemical interactions.
- PO3 (1): Limited role in design, but may assist with basic environmental systems.
- PO4 (1): Minor application in testing pollution parameters.
- PO5 (3): Direct link with environmental and sustainability awareness.
- PO6 (1): Basic team/project involvement in environmental context.
- PO7 (2): Encourages continued learning in environmental standards.
- PSO1 (1): Basic relevance to technical understanding.
- PSO2 (2): Promotes sustainable practices in electrical field.

**C204.2 – Explain about the combustion of fuel with its advantages**

- PO1 (3): Fundamental knowledge of combustion and chemistry involved.
- PO2 (3): Strong analytical thinking to evaluate efficiency and emissions.
- PO3 (2): Assists in designing systems considering combustion efficiency.
- PO4 (1): Some experimental combustion studies may apply.
- PO5 (3): Essential for understanding impact on environment.
- PO6 (1): Minor application in team/project scope.

- PO7 (2): Need to update with new fuel technologies.
- PSO1 (2): Relates to energy systems and power.
- PSO2 (3): Strong relevance to safe and sustainable fuel use.

**C204.3 – Explain about the extraction of metal-iron, steel manufacture, powder metallurgy and refractory**

- PO1 (3): Strong requirement of technical fundamentals.
- PO2 (2): Analyse processes and problem-solving in metallurgy.
- PO3 (2): Design of processes and systems in metallurgy.
- PO4 (2): Experiments and tools are involved in testing materials.
- PO5 (2): Materials selection considering environmental impact.
- PO6 (2): Work in project teams related to metallurgy.
- PO7 (2): Need for updated knowledge on advanced materials.
- PSO1 (3): Relevant in industrial systems and power.
- PSO2 (3): Equipment handling and safe practices essential.

**C204.4 – Explain about polymer, composite material and photochemistry**

- PO1 (3): Strong grounding in chemical principles.
- PO2 (2): Involves analysing structure and function of materials.
- PO3 (2): Assists in creating materials for specified needs.
- PO4 (2): Involves characterization and testing of materials.
- PO5 (2): Considerations for environment-friendly materials.
- PO6 (1): Basic participation in project work.
- PO7 (2): Updating with modern material science is critical.
- PSO1 (2): Technical material knowledge useful in automation.
- PSO2 (2): Materials selection and testing relevance.

**C204.5 – Explain about the fundamental of nuclear chemistry and engineering materials**

- PO1 (3): Strong science base needed to understand nuclear principles.

- PO2 (2): Analytical approach for safety and application.
- PO3 (1): Limited design but understanding material behaviour is useful.
- PO4 (1): Testing may apply in nuclear materials.
- PO5 (3): Essential for safety, sustainability, and ethics in nuclear tech.
- PO6 (2): May participate in nuclear-related team projects.
- PO7 (3): Lifelong learning needed due to rapid developments.
- PSO1 (2): Applies to energy and power sectors.
- PSO2 (3): Emphasis on safety and sustainable material use.

<b>Year &amp; Sem:</b>	I & II
<b>Course Code:</b>	N3205
<b>Course Title:</b>	Electronics Devices and Circuits

**Course Outcome:**

<b>CO</b>	<b>After completing the course, the students will be able to,</b>
N3205.1	Explain the working principle of diodes, rectifiers and transistor configurations.
N3205.2	Explain the operation of FET, UJT, SCR, TRIAC, DIAC.
N3205.3	Explain the working principle of transistor oscillator.
N3205.4	Describe the operation of Optoelectronic devices.

N3205.5	Explain the function and application of various logic gates.
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**CO-PO, PSO Matrices:**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
N3205.1	3	2	2	2	1	1	1	3	2
N3205.2	3	3	2	2	1	1	1	3	3
N3205.3	3	2	3	2	1	1	1	3	2
N3205.4	2	1	1	2	2	1	1	2	2
N3205.5	2	2	2	2	2	2	2	2	2
N3205	<b>2.6</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>1.4</b>	<b>1.2</b>	<b>1.2</b>	<b>2.6</b>	<b>2.2</b>

**Justification for CO-PO-PSO Mapping**

**N3205.1 – Explain the working principle of diodes, rectifiers and transistor configurations**

- PO1 (3): Strong fundamental knowledge of semiconductor devices and circuits is essential.
- PO2 (2): Requires analysis of device characteristics and working principles.
- PO3 (2): Some design aspects related to circuit configurations.
- PO4 (2): Involves practical understanding and testing of devices.
- PO5 (1): Limited direct impact on society, sustainability or ethics.
- PO6 (1): Minimal project management involvement at this level.
- PO7 (1): Foundation knowledge but less emphasis on lifelong learning here.
- PSO1 (3): Core knowledge critical for solving problems in electrical machines and systems.
- PSO2 (2): Relevant for operating and maintaining semiconductor-based equipment.

**N3205.2 – Explain the operation of FET, UJT, SCR, TRIAC, DIAC**

- PO1 (3): In-depth knowledge of a variety of semiconductor devices required.
- PO2 (3): Strong analytical skills needed to understand device operation.
- PO3 (2): Basic design and application of devices in circuits.
- PO4 (2): Testing and experimentation on semiconductor devices emphasized.
- PO5 (1): Minor direct influence on sustainability or ethics.
- PO6 (1): Limited team/project management exposure.
- PO7 (1): Mostly fundamental knowledge, less focus on continual learning.
- PSO1 (3): Direct application in industrial automation and power systems.
- PSO2 (3): Important for safe operation, testing, and maintenance of equipment.

### **N3205.3 – Explain the working principle of transistor oscillator.**

- PO1 (3): Strong knowledge of transistor operation and oscillator circuits necessary.
- PO2 (2): Analytical skills to understand oscillator behaviour.
- PO3 (3): Significant design aspects involved in oscillator circuit development.
- PO4 (2): Requires practical testing and measurement skills.
- PO5 (1): Limited direct societal or sustainability impact.
- PO6 (1): Minimal project or team leadership role at this stage.
- PO7 (1): Foundation knowledge with less emphasis on updating skills.
- PSO1 (3): Essential for developing technical solutions involving electronic circuits.
- PSO2 (2): Relevant to testing and maintaining oscillatory circuits in systems.

### **N3205.4 – Describe the operation of Optoelectronic devices.**

- PO1 (2): Basic understanding of optoelectronic principles needed.
- PO2 (1): Limited problem analysis; more conceptual understanding.
- PO3 (1): Minimal design involvement at this level.
- PO4 (2): Practical testing and operation of optoelectronic devices included.
- PO5 (2): Some impact on sustainability and ethical use of technology.
- PO6 (1): Low involvement in project management or teamwork.
- PO7 (1): Foundational knowledge, moderate lifelong learning relevance.
- PSO1 (2): Applies moderately to electrical engineering solutions.
- PSO2 (2): Relevant to equipment operation and safety practices.

### **N3205.5 – Explain the function and application of various logic gates.**

- PO1 (2): Basic digital electronics knowledge required.
- PO2 (2): Analytical skills needed to understand logic operations.
- PO3 (2): Basic design of logic circuits and systems.
- PO4 (2): Practical testing of digital circuits involved.
- PO5 (2): Moderate relevance to societal and sustainability aspects in technology.
- PO6 (2): Some teamwork and communication involved in design projects.
- PO7 (2): Encourages continual learning in evolving digital technologies.
- PSO1 (2): Useful for problem solving in automation and control systems.
- PSO2 (2): Relevant for operation and maintenance of digital equipment.

<b>Year &amp; Sem:</b>	I & II
<b>Course Code:</b>	N206
<b>Course Title:</b>	Applied Science Practical II

**Course Outcome:**

<b>CO</b>	<b>After completing the course, the students will be able to,</b>
N206.1	Determine the refractive index of a transparent liquid (water) using travelling microscope
N206.2	Measure the angle of the prism using spectrometer.

N206.3	Plot the V – I characteristics of the solar cell
N206.4	Determine the specific heat capacity of water.
N206.5	Determine the electro chemical equivalent (e.c.e.) of copper.

**CO-PO, PSO Matrices:**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
N206.1	3	2	1	3	1	1	1	2	2
N206.2	2	2	2	3	2	1	2	3	2
N206.3	3	2	1	3	1	1	1	2	2
N206.4	3	2	1	3	1	1	2	2	3
N206.5	3	2	1	3	1	1	1	2	2
N206	<b>2.8</b>	<b>2</b>	<b>1.2</b>	<b>3</b>	<b>1.2</b>	<b>1</b>	<b>1.4</b>	<b>2.2</b>	<b>2.2</b>

**Justification for CO-PO-PSO Mapping**

**N206.1 – Determine the refractive index of a transparent liquid using a travelling microscope**

- PO1 (3): Requires fundamental physics and math knowledge.
- PO2 (2): Involves analytical thinking to set up and interpret experiments.
- PO3 (1): Minimal design; mainly follows established procedures.
- PO4 (3): Uses standard tools like the travelling microscope.
- PO5 (1): Low environmental/societal relevance.
- PO6 (1): Requires teamwork and reporting of findings.
- PO7 (1): Builds experimental learning habits.
- PSO1 (2): Applies optical principles relevant to electrical/electronic contexts.
- PSO2 (2): Emphasizes accurate measurement and maintenance of lab instruments.

**N206.2 – Measure the angle of a prism using a spectrometer**

- PO1 (2): Requires understanding of wave optics and geometry.
- PO2 (2): Involves calculation and angle-based analysis.
- PO3 (2): Some level of planning and execution in aligning and observing.
- PO4 (3): Utilizes precise optical tools like the spectrometer.
- PO5 (2): Supports learning of light-based energy transmission, with moderate societal impact.

- PO6 (1): Encourages collaboration and sharing of observations.
- PO7 (2): Reinforces habit of keeping up with practical, evolving instrumentation.
- PSO1 (3): Strongly aligned with learning in optical/electronic systems.
- PSO2 (2): Improves proficiency in experimental setups involving precision tools.

### **N206.3 – Plot the V–I characteristics of the solar cell**

- PO1 (3): Involves understanding of electrical properties and semiconductors.
- PO2 (2): Requires plotting and interpreting electrical characteristics.
- PO3 (1): Limited design; mostly analysis-based activity.
- PO4 (3): Uses meters, solar cells, and graphical tools.
- PO5 (1): Promotes awareness of renewable energy with minimal direct analysis.
- PO6 (1): Students work in teams to complete and document experiments.
- PO7 (1): Introduces sustainable energy concepts that motivate lifelong learning.
- PSO1 (2): Supports fundamentals of solar energy systems in electrical engineering.
- PSO2 (2): Enhances testing skills relevant to photovoltaic technologies.

### **CO: N206.4 – Determine the specific heat capacity of water**

- PO1 (3): Applies thermodynamic principles to practical situations.
- PO2 (2): Involves interpreting heat and temperature data.
- PO3 (1): Standard experiment with little to no design required.
- PO4 (3): Uses calorimeter and time-temperature measurement tools.
- PO5 (1): Introduces energy usage awareness with limited societal connection.
- PO6 (1): Requires coordination in conducting and recording results.
- PO7 (2): Builds understanding of energy transfer, fostering curiosity.
- PSO1 (2): Useful in applications involving electrical heating or cooling.
- PSO2 (3): Strongly supports practical skills in thermal measurements.

### **CO: N206.5 – Determine the electrochemical equivalent (e.c.e.) of copper**

- PO1 (3): Involves laws of electrolysis and fundamental electrochemistry.
- PO2 (2): Analytical thinking required to relate current, time, and mass deposited.

- PO3 (1): Well-defined steps with minimal design aspect.
- PO4 (3): Uses voltmeters, balances, and electrolytic cells.
- PO5 (1): Introduces basic environmental relevance (e.g., material use).
- PO6 (1): Encourages teamwork and procedural documentation.
- PO7 (1): Foundation for future battery and material science learning.
- PSO1 (2): Relevant to understanding electrical materials and systems.
- PSO2 (2): Builds essential testing and lab management skills.

<b>Year &amp; Sem:</b>	I & II
<b>Course Code:</b>	N3207
<b>Course Title:</b>	Electronics Devices and Circuits Laboratory

**Course Outcome:**

<b>CO</b>	<b>After completing the course, the students will be able to,</b>
N3207.1	Test the working condition of passive & active components and switches.
N3207.2	Test the performance characteristics of various electronic devices
N3207.3	Test the performance of electronic circuit for various application

**CO-PO, PSO Matrices:**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
N3207.1	2	2	1	3	1	1	2	3	3
N3207.2	2	2	2	3	2	1	2	3	3
N3207.3	2	3	3	3	2	2	2	3	3
N3207	<b>2</b>	<b>2.3</b>	<b>2</b>	<b>3</b>	<b>1.6</b>	<b>1.3</b>	<b>2</b>	<b>3</b>	<b>3</b>

**N3207.1 – Test the working condition of passive and active components and switches.**

- PO1 (2): Requires foundational knowledge of electronics to understand component behaviour.
- PO2 (2): Involves identifying faults or behaviours through standard testing techniques.
- PO3 (1): Minimal design involved, but awareness of proper connection in circuits is required.
- PO4 (3): Direct application of tools (multimeter, LCR meter) for testing.
- PO5 (1): Limited sustainability concerns but must be aware of proper disposal of faulty components.
- PO6 (1): Requires communication and coordination when testing as a team.
- PO7 (2): Lifelong learning needed to stay updated on component technologies.
- PSO1 (3): Strong relation to identifying issues in electrical systems.
- PSO2 (3): Directly involves testing equipment and safety practices.

**N3207.2 – Test the performance characteristics of various electronic devices**

- PO1 (2): Applies knowledge of device theory to understand performance.
- PO2 (2): Requires analysing readings and interpreting device characteristics.
- PO3 (2): Some involvement in constructing test circuits for evaluations.
- PO4 (3): High use of engineering tools for evaluating performance.
- PO5 (2): Understanding device efficiency contributes to sustainability.
- PO6 (1): Some team involvement in lab-based evaluation.
- PO7 (2): Continuous tech upgrades necessitate ongoing learning.
- PSO1 (3): Critical for technical assessment of electrical systems.
- PSO2 (3): Tightly related to operational testing and maintenance.

**N3207.3 – Test the performance of electronic circuit for various application**

- PO1 (2): Requires engineering knowledge to interpret complex circuit functions.
- PO2 (3): Strong emphasis on analysing circuit behaviour under various conditions.
- PO3 (3): Involves designing test scenarios and selecting appropriate parameters.
- PO4 (3): Essential use of instruments and software tools for testing.
- PO5 (2): Evaluating efficient and safe operation contributes to sustainable practice.
- PO6 (2): Teamwork and project reporting during performance analysis.
- PO7 (2): Keeping up with circuit design innovations demands lifelong learning.
- PSO1 (3): In-depth engagement with performance-based assessment in systems.
- PSO2 (3): Strongly supports operation and maintenance of tested systems.

### Course Details

<b>Year &amp; Sem:</b>	II & III
<b>Course Code:</b>	N331
<b>Course Title:</b>	Electrical Circuit Theory

### Course Outcome:

CO	After completing the course, the students will be able to,
N331.1	Apply electric laws to solve the given electric circuits
N331.2	Apply network theorem to solve the given electric circuits
N331.3	Solve the problems related to single phase and three phase AC circuits
N331.4	Determine the given parameters related to series and parallel resonance circuits

N331.5	Explain the construction and working of different types of batteries
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**CO-PO, PSO Matrices:**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
N331.1	3	3	2	2	1	1	1	3	2
N331.2	3	3	2	2	1	1	1	3	2
N331.3	3	3	2	2	1	1	1	3	3
N331.4	3	2	2	2	1	1	1	2	2
N331.5	2	1	1	1	2	2	2	1	3
N331	<b>2.8</b>	<b>2.4</b>	<b>1.8</b>	<b>1.8</b>	<b>1.2</b>	<b>1.2</b>	<b>1.2</b>	<b>2.4</b>	<b>2.4</b>

**Justification for CO-PO-PSO Mapping**

**N331.1 – Apply electric laws to solve the given electric circuits**

- PO1 (3): Strong application of basic electrical engineering and mathematics.
- PO2 (3): Involves identifying and analysing circuit-related problems.
- PO3 (2): Requires basic design thinking for circuit solutions.
- PO4 (2): Involves using tools like multimeters, simulators for verification.
- PO5 (1): Marginally considers safety and environmental practices.
- PO6 (1): Includes teamwork during lab sessions.
- PO7 (1): Encourages updating knowledge for solving new circuit problems.
- PSO1 (3): Directly supports technical problem-solving in electrical systems.
- PSO2 (2): Understanding foundational circuits aids in maintenance tasks.

**N331.2 – Apply network theorem to solve the given electric circuits**

- PO1 (3): Requires in-depth knowledge of electrical theory.
- PO2 (3): Focuses on analysing problems using standard network theorems.
- PO3 (2): Involves designing equivalent circuits for analysis.
- PO4 (2): Includes the use of simulation tools or physical measurements.
- PO5 (1), PO6 (1), PO7 (1): Minimal but present in the context of labs and continued learning.
- PSO1 (3): Strong relevance to solving electrical network problems.
- PSO2 (2): Supports accurate analysis and safety in implementation.

### **N331.3 – Solve the problems related to single phase and three phase AC circuits**

- PO1 (3): High-level application of AC circuit theory.
- PO2 (3): Involves complex problem-solving.
- PO3 (2): May include designing simple AC-based systems.
- PO4 (2): Application of lab tools for AC measurements.
- PO5, PO6, PO7 (1): Applies indirectly through lab work and team tasks.
- PSO1 (3): AC circuit knowledge is foundational in power systems.
- PSO2 (3): Helps in operation and maintenance of AC equipment.

### **N331.4 – Determine the given parameters related to series and parallel resonance circuits**

- PO1 (3): Based on core electrical knowledge.
- PO2 (2): Requires interpretation of resonance phenomena.
- PO3 (2): Supports circuit design decisions in resonance applications.
- PO4 (2): Conducting experiments to identify resonant frequencies.
- PO5, PO6, PO7 (1): Involves safe lab practices and learning updates.
- PSO1 (2): Helps in understanding and solving resonance issues.
- PSO2 (2): Related to testing and maintenance of systems under resonance conditions.

### **N331.5 – Explain the construction and working of different types of batteries**

- PO1 (2): Theoretical knowledge of electrochemistry and materials.
- PO2 (1): Minor analytical application.
- PO3 (1): Some relevance in selection and design of power sources.
- PO4 (1): Minimal testing and demonstration of battery types.
- PO5 (2): Emphasizes sustainability and safe disposal.
- PO6 (2): Includes communication and documentation aspects.
- PO7 (2): Encourages keeping up with modern battery technologies.
- PSO1 (1): Indirect support through battery uses in automation/power.
- PSO2 (3): Directly supports battery operation, maintenance, and safety.

<b>Year &amp; Sem:</b>	II & III
<b>Course Code:</b>	N332
<b>Course Title:</b>	Electrical Machines-I

**Course Outcome:**

<b>CO</b>	<b>After completing the course, the students will be able to,</b>
N332.1	Explain the construction, working principle, types, EMF equation and application of DC Generator
N332.2	Explain the construction, working principle, types, testing of DC Motor
N332.3	Explain the construction, working principle, types, equivalent circuit of single-phase transformer
N332.4	Explain the construction, working principle, types, testing of three phase

	transformer
N332.5	Explain the construction and working principle of single-phase motor

**CO-PO, PSO Matrices:**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
N332.1	3	2	2	1	1	1	2	3	2
N332.2	3	3	2	2	1	2	2	3	3
N332.3	3	2	2	2	1	1	2	3	2
N332.4	3	2	2	2	1	2	2	3	2
N332.5	3	2	2	1	1	1	2	2	2
N332	<b>3</b>	<b>2.2</b>	<b>2</b>	<b>1.6</b>	<b>1</b>	<b>1.4</b>	<b>2</b>	<b>2.8</b>	<b>2.2</b>

**Justification for CO-PO-PSO Mapping**

**N332.1 – Explain the construction, working principle, types, EMF equation and application of DC Generator**

- PO1 (3): Requires understanding of basic science and engineering principles.
- PO2 (2): Involves analysing generator types and applications.
- PO3 (2): Helps in basic design understanding.
- PO4 (1): Limited testing concepts.
- PO5 (1): Some aspects related to sustainable generation.
- PO6 (1): Communication and documentation of generator principles.
- PO7 (2): Students may need continuous updates as generator tech evolves.
- PSO1 (3): Strong relevance in machine-based problem-solving.
- PSO2 (2): Maintenance and safety lightly addressed.

**N332.2 – Explain the construction, working principle, types, testing of DC Motor**

- PO1 (3): Strong foundation in engineering concepts.
- PO2 (3): Detailed analysis of testing and performance.
- PO3 (2): Students assist in developing or troubleshooting motor systems.
- PO4 (2): Emphasis on conducting tests on motors.
- PO5 (1): Touches sustainability and motor efficiency.
- PO6 (2): Team-based testing and reporting is common.
- PO7 (2): Students encouraged to keep up with motor tech.

- PSO1 (3): Deep technical application in machines.
- PSO2 (3): Operation, testing, and safety are core.

**N332.3 – Explain the construction, working principle, types, equivalent circuit of single phase transformer**

- PO1 (3): Solid theoretical grounding is essential.
- PO2 (2): Analysis of equivalent circuit and working principle.
- PO3 (2): Supports design thinking in circuits.
- PO4 (2): Transformer testing is part of lab work.
- PO5 (1): Efficiency and losses have minor environmental implications.
- PO6 (1): Basic project management in labs.
- PO7 (2): Requires technological updating.
- PSO1 (3): Strong link to electrical machine understanding.
- PSO2 (2): Addresses safety and maintenance concepts.

**N332.4 – Explain the construction, working principle, types, testing of three phase transformer**

- PO1 (3): In-depth understanding required.
- PO2 (2): Analysing different types and tests.
- PO3 (2): Some system-level design exposure.
- PO4 (2): Includes practical testing and fault detection.
- PO5 (1): Relevant for grid stability and sustainability.
- PO6 (2): Collaboration and project-based learning applicable.
- PO7 (2): Important to stay updated with three-phase systems.
- PSO1 (3): Technical solution provider for transformer issues.
- PSO2 (2): Maintenance and sustainable usage is relevant.

**N332.5 – Explain the construction and working principle of single phase motor**

- PO1 (3): Clear link to foundational engineering knowledge.
- PO2 (2): Involves analysing construction and working.

- PO3 (2): Contributes to understanding system components.
- PO4 (1): Limited focus on testing in this CO.
- PO5 (1): Indirect influence on sustainable motor selection.
- PO6 (1): Communication and teamwork are secondary.
- PO7 (2): Motor tech evolves – lifelong learning is key.
- PSO1 (2): Technical application is moderate.
- PSO2 (2): Safety and operation covered in brief.

<b>Year &amp; Sem:</b>	II & III
<b>Course Code:</b>	N333
<b>Course Title:</b>	Digital Electronics

**Course Outcome:**

<b>CO</b>	<b>After completing the course, the students will be able to,</b>
N333.1	Examine the logic families and apply binary operation on number system
N333.2	Solve the given code conversion and Boolean algebra related problems
N333.3	Describe the working of combination digital circuits
N333.4	Explain the working of flip flop, counter and shift register
N333.5	Explain the concept of memory devices, timer and operational amplifier

### CO-PO, PSO Matrices:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
N333.1	3	2	1	2	1	1	2	3	2
N333.2	3	3	2	2	1	1	2	2	2
N333.3	2	2	3	3	2	2	2	3	2
N333.4	2	2	3	3	2	2	2	3	3
N333.5	2	2	2	2	3	2	2	3	3
<b>N333</b>	<b>2.4</b>	<b>2.2</b>	<b>2.2</b>	<b>2.4</b>	<b>1.8</b>	<b>1.6</b>	<b>2</b>	<b>2.8</b>	<b>2.4</b>

### Justification for CO-PO-PSO Mapping

#### **N333.1 Examine various logic families and perform binary operations in different number systems.**

- PO1 (3): Strongly applies basic mathematics and electronics principles.
- PO2 (2): Analytical skills are moderately required for interpreting number systems.
- PO3 (1): Basic conceptual knowledge; limited design role.
- PO4 (2): Moderate use of tools to verify binary logic operations.
- PO5 (1): Ethical/social connection minimal, though sustainability can be slightly touched.
- PO6 (1): Communication is basic; not central to this CO.
- PO7 (2): Requires learning adaptability to evolving number system conventions.
- PSO1 (3): Direct application to logical and circuit design problems.
- PSO2 (2): Helps in understanding and maintaining control logic in equipment.

#### **N333.2 Solve the given code conversion and Boolean algebra related problems**

- PO1 (3): Involves strong fundamentals in mathematics and logic.
- PO2 (3): High level of problem analysis needed for Boolean simplification.
- PO3 (2): Supports design of logic circuits via Boolean expressions.
- PO4 (2): Simulation tools often used for Boolean logic.
- PO5 (1): Indirect relevance to ethics or environment.
- PO6 (1): Minimal project management, low communication demands.
- PO7 (2): Requires learning updates in logic reduction methods/tools.
- PSO1 (2): Relevant for digital system problem solving.

- PSO2 (2): Indirectly supports test/setup in automation systems.

### **N333.3 Describe the working of combination digital circuits**

- PO1 (2): Applies foundational knowledge.
- PO2 (2): Problem analysis of logic circuits is moderately involved.
- PO3 (3): Strong role in designing combinational systems.
- PO4 (3): High use of simulation/testing tools like Multisim or LogicSim.
- PO5 (2): Device application may reflect on sustainable design.
- PO6 (2): Some coordination required in lab/project environment.
- PO7 (2): Requires updating as technology evolves.
- PSO1 (3): Strong fit with designing logic for automation.
- PSO2 (2): Indirect application in maintenance and troubleshooting.

### **N333.4 Explain the working of flip flop, counter and shift register**

- PO1 (2): Uses specific engineering fundamentals.
- PO2 (2): Analysing timing and sequence logic is essential.
- PO3 (3): Key components in digital design.
- PO4 (3): Practical testing of flip-flop timing in labs.
- PO5 (2): Moderately relevant to societal/ethical system use.
- PO6 (2): Supports team-based circuit design and testing.
- PO7 (2): Technology changes often affect device implementation.
- PSO1 (3): Crucial in automation and sequential circuit design.
- PSO2 (3): Vital for maintenance and testing.

### **N333.5 Explain the concept of memory devices, timer and operational amplifier**

- PO1 (2): Requires foundational electronic knowledge.
- PO2 (2): Analysis of timing and memory systems is moderate.
- PO3 (2): Supports system design with memory/timing components.
- PO4 (2): Practical use of tools to test memory/op-amp circuits.
- PO5 (3): Promotes efficient, ethical, and sustainable system designs.

- PO6 (2): Team management required in lab/project settings.
- PO7 (2): Encourages upskilling due to evolving electronic components.
- PSO1 (3): Strongly relates to power systems and automation applications.
- PSO2 (3): Supports testing, maintaining memory-based devices.

<b>Year &amp; Sem:</b>	II & III
<b>Course Code:</b>	N334
<b>Course Title:</b>	Electrical Machines I Practical

**Course Outcome:**

<b>CO</b>	<b>After completing the course, the students will be able to,</b>
N334.1	Trace the performance characteristics curve for the given DC Machines by conducting suitable experiments
N334.2	Trace the performance characteristics curve for the given single-phase transformers by conducting suitable experiments.
N334.3	Trace the performance characteristics curve for the given single phase induction motor by conducting suitable experiments
N334.4	Test the performance of Series Resonance RLC Circuit.

### CO-PO, PSO Matrices:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
N334.1	2	3	2	3	2	1	1	3	3
N334.2	2	3	2	3	2	1	1	3	3
N334.3	2	3	2	3	2	1	1	3	3
N334.4	2	3	2	3	2	1	1	2	3
<b>N334</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>2.2</b>	<b>3</b>

### Justification for CO-PO-PSO Mapping

#### **N334.1 – Trace the performance characteristics curve for the given DC Machines by conducting suitable experiments**

- PO1 (2): Applies foundational knowledge of electrical and magnetic principles.
- PO2 (3): Involves analysis of performance characteristics through experimental data.
- PO3 (2): Supports circuit and system setup for testing purposes.
- PO4 (3): Requires hands-on use of electrical instruments for performance testing.
- PO5 (2): Encourages understanding of machine efficiency and sustainable usage.
- PO6 (1): Involves basic teamwork and communication during lab activities.
- PO7 (1): Promotes basic awareness of machine advancements.
- PSO1 (3): Strongly relates to technical solutions involving electrical machines.
- PSO2 (3): Supports operation, testing, and maintenance with safety protocols.

#### **N334.2 – Trace the performance characteristics curve for the given single-phase transformers by conducting suitable experiments.**

- PO1 (2): Uses knowledge of electromagnetic induction and transformer operation.
- PO2 (3): Involves analysing load conditions and voltage regulation.
- PO3 (2): Assists in configuring test benches and transformer experiments.
- PO4 (3): Employs instruments like wattmeters, voltmeters in practical testing.
- PO5 (2): Highlights the importance of minimizing losses and ethical use of energy.
- PO6 (1): Encourages teamwork and project planning at a basic level.
- PO7 (1): Supports the need to stay updated with evolving transformer technologies.
- PSO1 (3): Directly addresses core areas of transformer analysis and testing.

- PSO2 (3): Reinforces safe operation and sustainable practices in labs.

**N334.3 – Trace the performance characteristics curve for the given single phase induction motor by conducting suitable experiments**

- PO1 (2): Applies knowledge of induction motor theory and principles.
- PO2 (3): Demands detailed analysis of motor characteristics under various loads.
- PO3 (2): Supports setup and testing of motors in lab conditions.
- PO4 (3): Involves practical use of testing equipment like tachometers and voltmeters.
- PO5 (2): Encourages understanding of energy-efficient operation.
- PO6 (1): Engages students in basic collaborative lab tasks.
- PO7 (1): Stimulates interest in learning about modern motor control methods.
- PSO1 (3): Strongly relates to core electrical systems in industrial applications.
- PSO2 (3): Promotes motor testing, maintenance, and safety compliance.

**N334.4 – Test the performance of Series Resonance RLC Circuit.**

- PO1 (2): Uses fundamental circuit theory in analysing resonance behaviour.
- PO2 (3): Requires evaluation of circuit response at resonant frequency.
- PO3 (2): Aids in designing and assembling resonance experiments.
- PO4 (3): Practical use of instruments like signal generators and oscilloscopes.
- PO5 (2): Promotes efficient circuit design and minimal energy loss.
- PO6 (1): Involves basic coordination in laboratory experiments.
- PO7 (1): Encourages awareness of changes in measurement techniques and tools.
- PSO1 (2): Partially supports system analysis within electrical domains.
- PSO2 (3): Directly supports practical testing and safety in electrical circuits

<b>Year &amp; Sem:</b>	II & III
<b>Course Code:</b>	N335
<b>Course Title:</b>	Digital Electronics Practical

**Course Outcome:**

<b>CO</b>	<b>After completing the course, the students will be able to,</b>
N335.1	Test the operation of Combinational circuit by conducting suitable experiment
N335.2	Test the operation of sequential circuit by conducting suitable experiment
N335.3	Test the operation of OP-AMP for various application by conducting suitable experiments

**CO-PO, PSO Matrices:**

<b>CO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PSO1</b>	<b>PSO2</b>
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N335.1	2	2	1	3	1	1	1	3	2
N335.2	2	2	2	3	1	1	1	3	3
N335.3	2	2	2	3	2	1	1	3	3
<b>N335</b>	<b>2</b>	<b>2</b>	<b>1.6</b>	<b>3</b>	<b>1.3</b>	<b>1</b>	<b>1</b>	<b>3</b>	<b>2.6</b>

### Justification for CO-PO-PSO Mapping

#### **N335.1 – Test the operation of combinational circuits by conducting suitable experiments**

- PO1 (2): Applies basic digital logic and circuit theory to understand combinational logic.
- PO2 (2): Involves analysis of input-output behaviour in logic gates and circuits.
- PO3 (1): Minor design work involved in selecting and assembling logic circuits.
- PO4 (3): Requires hands-on use of breadboards, logic probes, and testing equipment.
- PO5 (1): Introduces basic awareness of safe and ethical experimentation practices.
- PO6 (1): Involves teamwork and communication in lab settings.
- PO7 (1): Encourages continued learning through experimentation with new logic ICs.
- PSO1 (3): Directly enhances ability to analyze and troubleshoot logic systems.
- PSO2 (2): Supports practical operation and testing of circuits with safety practices.

#### **N335.2 – Test the operation of sequential circuits by conducting suitable experiments**

- PO1 (2): Uses foundational knowledge to understand clocked and memory-based logic.
- PO2 (2): Involves analysis of time-based circuit behaviour like counters and registers.
- PO3 (2): Supports basic design and setup of sequential circuit-based systems.
- PO4 (3): Engages in practical testing with equipment like logic analyzers and oscilloscopes.
- PO5 (1): Promotes responsible handling of components and adherence to lab ethics.
- PO6 (1): Encourages coordination within teams during testing sessions.
- PO7 (1): Fosters adaptation to updated sequential logic technologies.
- PSO1 (3): Strongly aligned with technical problem-solving in automation and logic systems.
- PSO2 (3): Fully supports equipment testing, maintenance, and safety procedures.

#### **N335.3 – Test the operation of OP-AMP for various applications by conducting suitable experiments**

- PO1 (2): Applies analog electronics and mathematical concepts to OP-AMP circuits.

- PO2 (2): Requires analysis of output behaviour in amplifiers, filters, and comparators.
- PO3 (2): Involves creating application-specific OP-AMP configurations.
- PO4 (3): Utilizes instruments like function generators and multimeters for measurement.
- PO5 (2): Encourages energy-efficient designs and safe handling of analog components.
- PO6 (1): Promotes collaborative lab work and experiment reporting.
- PO7 (1): Stimulates continuous learning in evolving analog applications.
- PSO1 (3): Directly enhances capability to apply OP-AMPs in technical electrical problems.
- PSO2 (3): Strongly supports practical lab testing with emphasis on safety and maintenance.

<b>Year &amp; Sem:</b>	II & III
<b>Course Code:</b>	N336
<b>Course Title:</b>	Electrical Workshop I Practical

**Course Outcome:**

<b>CO</b>	<b>After completing the course, the students will be able to,</b>
N336.1	Test the given wiring connections
N336.2	Dismantle and test the performance of the given electrical home appliances

**CO-PO, PSO Matrices:**

<b>CO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PSO1</b>	<b>PSO2</b>
N336.1	2	2	1	3	1	2	1	3	3
N336.2	2	2	2	3	2	2	2	3	3
<b>N336</b>	<b>2</b>	<b>2</b>	<b>1.5</b>	<b>3</b>	<b>1.5</b>	<b>2</b>	<b>1.5</b>	<b>3</b>	<b>3</b>

**Justification for CO-PO-PSO Mapping**

**N336.1 – Test the given wiring connections**

- PO1 (2): Applies basic electrical and mathematical knowledge to interpret wiring diagrams and connections.
- PO2 (2): Requires analysis of wiring layouts to ensure correct and safe implementation.
- PO3 (1): Involves assisting in the setup and design of basic electrical connections as per the task.
- PO4 (3): Utilizes tools like multimeters, testers, and installation instruments for verification and testing.
- PO5 (1): Promotes safe and ethical handling of wiring materials within societal and environmental norms.
- PO6 (2): Encourages teamwork and project coordination during lab work and practical wiring exercises.
- PO7 (1): Fosters awareness of modern wiring standards and encourages adaptation to new techniques.
- PSO1 (3): Directly enhances technical ability to solve wiring-related issues using appropriate tools.
- PSO2 (3): Strengthens skills in testing, implementing, and maintaining electrical installations safely.

### **N336.2 – Dismantle and test the performance of the given electrical home appliances**

- PO1 (2): Applies fundamental electrical and scientific concepts to understand appliance operation.
- PO2 (2): Involves analysis of faults and performance characteristics using standard methods.
- PO3 (2): Requires basic design understanding to assist in identifying improvements or modifications.
- PO4 (3): Uses testing tools and diagnostic equipment to assess appliance functionality.
- PO5 (2): Encourages safe dismantling practices and promotes sustainable handling of appliance parts.
- PO6 (2): Develops collaborative skills in performance testing and maintenance reporting.
- PO7 (2): Motivates continuous learning of new technologies in home appliances and diagnostic tools.
- PSO1 (3): Improves competency in diagnosing and solving problems in electrical appliances using correct techniques.
- PSO2 (3): Strongly supports safe maintenance and testing practices aligned with industry standards

<b>Year &amp; Sem:</b>	II & III
<b>Course Code:</b>	N337
<b>Course Title:</b>	Computer Applications Practical

**Course Outcome:**

<b>CO</b>	<b>After completing the course, the students will be able to,</b>
N337.1	Apply display and folder manipulations
N337.2	Perform different operations in Microsoft office word document
N337.3	Execute the different operations in Microsoft office excel
N337.4	Examine the Microsoft office access
N337.5	Prepare Microsoft office presentation
N337.6	Create e-mail id and perform different operations with Google Account

**CO-PO, PSO Matrices:**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
N337.1	2	1	1	2	2	1	2	1	2
N337.2	3	2	2	3	2	1	2	1	2
N337.3	3	2	2	3	2	2	2	2	3
N337.4	2	2	2	3	2	2	2	2	3
N337.5	2	1	2	2	3	3	2	1	2
N337.6	2	2	1	2	3	3	3	1	2
<b>N337</b>	<b>2.3</b>	<b>1.6</b>	<b>1.6</b>	<b>2.5</b>	<b>2.3</b>	<b>2</b>	<b>2.17</b>	<b>1.3</b>	<b>2.3</b>

**Justification for CO-PO-PSO Mapping**

**N337.1 – Apply display and folder manipulations**

- PO1 (2): Basic computing knowledge is needed to understand folder structure.
- PO2 (1): Minimal analysis needed to identify file types and locations.

- PO3 (1): Simple structured task, small-scale design thinking.
- PO4 (2): Use of OS tools (like File Explorer).
- PO5 (2): Addresses ethical and sustainable file storage/organization.
- PO6 (1): Involves teamwork or instruction sharing in labs.
- PO7 (2): Reflects need for continuous skill updates with new OS versions.
- PSO1 (1): Very basic link to systems usage.
- PSO2 (2): Ensures equipment and systems are managed properly.

### **N337.2 – Perform different operations in Microsoft office word document**

- PO1 (3): High level of discipline-specific skills in documentation.
- PO2 (2): Document layout and structure involves basic problem analysis.
- PO3 (2): Structured document formatting = design-based thinking.
- PO4 (3): Uses office tools effectively.
- PO5 (2): Formatting for clarity impacts communication and societal contexts.
- PO6 (1): Team reports or presentations.
- PO7 (2): Must learn updated features regularly.
- PSO1 (1): Supportive documentation for engineering tasks.
- PSO2 (2): Prepares reports and maintenance logs effectively.

### **N337.3 – Execute the different operations in Microsoft office excel**

- PO1 (3): Core skill for data management, electrical calculations.
- PO2 (2): Use formulas/charts to analyse engineering data.
- PO3 (2): Designing spreadsheets meets problem-specific needs.
- PO4 (3): Extensive use of Excel for simulations, tables, etc.
- PO5 (2): Data tracking supports sustainability practices.
- PO6 (2): Used in project planning.
- PO7 (2): Continuous tool updates require life-long learning.
- PSO1 (2): Analyse technical data related to machines/systems.
- PSO2 (3): Use Excel to log and maintain data for testing and operation.

#### **N337.4 – Examine the Microsoft office access**

- PO1 (2): Applies structured database concepts.
- PO2 (2): Analyzes how to organize and retrieve data.
- PO3 (2): Designs simple data management systems.
- PO4 (3): Database tool handling.
- PO5 (2): Helps organize societal information (e.g., inventory).
- PO6 (2): Useful in team-based database work.
- PO7 (2): Adapts to changing versions of Access.
- PSO1 (2): Organizes technical data efficiently.
- PSO2 (3): Supports database-based testing or maintenance tracking.

#### **N337.5 – Prepare Microsoft office presentation**

- PO1 (2): Applies presentation design knowledge.
- PO2 (1): Analyzes audience needs and flow of information.
- PO3 (2): Designs slides to meet specific presentation goals.
- PO4 (2): Uses PowerPoint tools effectively.
- PO5 (3): Promotes communication of social/ethical topics.
- PO6 (3): Key for project presentations and teamwork.
- PO7 (2): Updating presentation skills is ongoing.
- PSO1 (1): Supports technical idea communication.
- PSO2 (2): Used to present testing or maintenance results.

#### **N337.6 – Create e-mail id and perform different operations with Google Account**

- PO1 (2): Knowledge of basic digital communication platforms.
- PO2 (2): Problem-solving for account setup and settings.
- PO3 (1): Minor design (setting filters, managing tools).
- PO4 (2): Use of modern digital tools.
- PO5 (3): Ethical use of communication tools, privacy settings.
- PO6 (3): Email is essential for team and project communication.
- PO7 (3): Email tools evolve, requiring continuous learning.
- PSO1 (1): Used for project coordination and updates.

- PSO2 (2): Supports digital reporting and sustainable communication.

<b>Year &amp; Sem:</b>	II & IV
<b>Course Code:</b>	N341
<b>Course Title:</b>	Electrical Machines – II

#### Course Outcome:

CO	After completing the course, the students will be able to,
N341.1	Explain the construction, working principle, types, EMF equation and application of Alternator
N341.2	Interpret the voltage regulation, testing and synchronization of alternator
N341.3	Explain the construction, working principle, testing, load characteristics and speed control of three phase induction motor
N341.4	Explain the performance characteristics of induction motor starters and synchronous motor
N341.5	Explain the construction, working principle of special AC Machines and special DC Machines

#### CO-PO, PSO Matrices:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
N341.1	3	2	1	1	1	1	2	3	2
N341.2	3	3	2	2	2	2	2	3	2
N341.3	3	3	3	2	2	2	2	3	3
N341.4	3	2	2	2	2	2	2	3	3
N341.5	3	2	2	2	2	2	2	3	2
<b>N341</b>	<b>3</b>	<b>2.4</b>	<b>2</b>	<b>1.8</b>	<b>1.8</b>	<b>1.8</b>	<b>1</b>	<b>3</b>	<b>2</b>

#### Justification for CO-PO-PSO Mapping

**N341.1 – Explain the construction, working principle, types, EMF equation and**

### **application of Alternator**

- PO1 (3): Strong fundamental concepts in EMF equation and construction align with basic engineering knowledge.
- PO2 (2): Understanding types and working of alternators involves analysis of operational problems.
- PO3 (1): Minor involvement in design, mostly theoretical.
- PO4 (1): Limited practical experimentation.
- PO5 (1): Basic awareness of energy sustainability through alternator use.
- PO6 (1): Minor contribution in communication/project handling.
- PO7 (2): Reinforces life-long learning via new alternator technologies.
- PSO1 (3): Direct application to electrical machines.
- PSO2 (2): Supports foundational operation and maintenance concepts.

### **N341.2 – Interpret the voltage regulation, testing and synchronization of alternator**

- PO1 (3): In-depth technical concepts require strong fundamentals.
- PO2 (3): High involvement in analysing voltage regulation and test results.
- PO3 (2): Contributes to developing basic system-level understanding.
- PO4 (2): Requires usage of instruments and tools for testing/sync.
- PO5 (2): Encourages awareness of power quality and ethical syncing.
- PO6 (2): Coordination and reporting during tests relate to project work.
- PO7 (2): Promotes learning evolving testing and synchronization techniques.
- PSO1 (3): High relevance to power systems and testing.
- PSO2 (2): Involves safety and operational understanding.

### **N341.3 – Explain the construction, working principle, testing, load characteristics and speed control of three phase induction motor**

- PO1 (3): Strong requirement of fundamental and core knowledge.
- PO2 (3): Detailed analysis of motor performance and load characteristics.
- PO3 (3): Involves speed control and performance improvement.
- PO4 (2): Needs tools for load testing, etc.
- PO5 (2): Application in energy-efficient industrial systems.
- PO6 (2): Handling motors and presenting test reports.

- PO7 (2): Motor tech rapidly evolves – continuous learning needed.
- PSO1 (3): Direct link with electrical machines and automation.
- PSO2 (3): Strong link with testing, operation, and safety.

**N341.4 – Explain the performance characteristics of induction motor starters and synchronous motor**

- PO1 (3): Understanding performance demands strong basics.
- PO2 (2): Analytical skills required to compare starter types and motor behaviours.
- PO3 (2): Focuses on system performance improvement.
- PO4 (2): Involves hands-on testing with starters.
- PO5 (2): Promotes efficiency, safety, and energy-conscious practice.
- PO6 (2): Group lab work and documentation support management skills.
- PO7 (2): Evolving starter tech (VFDs, soft starters) require ongoing updates.
- PSO1 (3): Core relevance to industrial motor control.
- PSO2 (3): Operational and safety aspects are central.

**N341.5 – Explain the construction, working principle of special AC Machines and special DC Machines**

- PO1 (3): Requires strong technical and domain-specific knowledge.
- PO2 (2): Some problem analysis in comparing machine types.
- PO3 (2): Minor design insight for special applications.
- PO4 (2): Testing and observing characteristics of special machines.
- PO5 (2): Often designed for efficient, ethical, or sustainable operation.
- PO6 (2): Project/lab tasks involve coordination and reporting.
- PO7 (2): New machine types (stepper, servo, BLDC) need continual learning.
- PSO1 (3): In-depth relevance to electrical machines specialization.
- PSO2 (2): Supports safe and effective handling of diverse machines.

<b>Year &amp; Sem:</b>	II & IV
<b>Course Code:</b>	N342
<b>Course Title:</b>	Measurements, Instrumentation and Transducers

**Course Outcome:**

<b>CO</b>	<b>After completing the course, the students will be able to,</b>
N342.1	Explain the characteristics of various measuring instruments.
N342.2	Determine the unknown electrical parameters using bridge circuits and CRO
N342.3	Explain the operation of the Analog & Digital Wattmeter and Energy meter
N342.4	Explain the operation and application of various sensor and transducer
N342.5	Explain the operation and application of various signal conditioning circuits.

**CO-PO, PSO Matrices:**

<b>CO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PSO1</b>	<b>PSO2</b>
N342.1	3	2	1	2	1	1	2	2	1
N342.2	3	3	2	3	1	2	2	3	2
N342.3	3	2	2	3	1	2	2	3	2
N342.4	3	2	2	2	2	1	2	2	2
N342.5	3	2	2	3	2	2	2	3	2
<b>N342</b>	<b>3</b>	<b>2.2</b>	<b>1.8</b>	<b>2.6</b>	<b>1.4</b>	<b>1.6</b>	<b>2</b>	<b>2.6</b>	<b>1.8</b>

**Justification for CO-PO-PSO Mappings**

**N342.1 – Explain the characteristics of various measuring instruments**

- PO1 (3): Strong application of engineering fundamentals to understand measurement systems.
- PO2 (2): Moderate analysis needed to interpret accuracy and limitations.
- PO3 (1): Basic involvement in designing measurement setups.
- PO4 (2): Instruments are tools; practical testing involved.

- PO5 (1): Some attention to environmental/safety norms.
- PO6 (1): Communication/reporting of measurements is minimal but relevant.
- PO7 (2): Continuous updates in instrumentation technology require lifelong learning.
- PSO1 (2): Applies to diagnostics in electrical systems.
- PSO2 (1): Moderate link to operation and maintenance.

#### **N342.2 – Determine the unknown electrical parameters using bridge circuits and CRO.**

- PO1 (3): Strong foundation of basic electrical and measurement principles needed.
- PO2 (3): High-level analysis of unknowns using circuits.
- PO3 (2): Involves designing bridge configurations.
- PO4 (3): Significant practical use of CRO and bridges.
- PO5 (1): Minor impact on sustainability/ethics.
- PO6 (2): Involves teamwork and project work in labs.
- PO7 (2): Technology like CROs changes, demanding updates.
- PSO1 (3): Direct application in diagnostics and automation.
- PSO2 (2): Operation/testing is a key outcome.

#### **N342.3 – Explain the operation of the Analog & Digital Wattmeter and Energy meter**

- PO1 (3): Strong conceptual knowledge required.
- PO2 (2): Analysing real-world energy measurements.
- PO3 (2): Some design aspects in selecting correct meters.
- PO4 (3): Practical testing and calibration.
- PO5 (1): Minor sustainable implications.
- PO6 (2): Useful in team lab settings.
- PO7 (2): Technology transition from analog to digital.
- PSO1 (3): Used in power systems.
- PSO2 (2): Strong link to maintenance/testing.

#### **N342.4 – Explain the operation and application of various sensor and transducer**

- PO1 (3): Involves physics and electrical principles.
- PO2 (2): Moderate analysis of transducer behaviour.
- PO3 (2): Selection/application design of sensors.
- PO4 (2): Practical understanding required.
- PO5 (2): Application in environmental/sustainable systems.
- PO6 (1): Project use, moderate communication.
- PO7 (2): Constant evolution in sensor tech.
- PSO1 (2): Applied in industrial automation.
- PSO2 (2): Regular in maintenance systems.

**N342.5 – Explain the operation and application of various signal conditioning circuits.**

- PO1 (3): Strong theoretical knowledge.
- PO2 (2): Analysis of signal variations and requirements.
- PO3 (2): Design and implementation aspects involved.
- PO4 (3): Extensive lab testing and usage.
- PO5 (2): Applied in energy-efficient and accurate systems.
- PO6 (2): Labs/projects involve teamwork and planning.
- PO7 (2): Requires updates in modern circuits and ICs.
- PSO1 (3): High relevance to automation and signal processing.
- PSO2 (2): Maintenance/testing through signal paths.

<b>Year &amp; Sem:</b>	II & IV
<b>Course Code:</b>	N343
<b>Course Title:</b>	Generation Transmission and Switchgear

### Course Outcome:

CO	After completing the course, the students will be able to,
N343.1	Explain the concept of Electric power generation from various power sources
N343.2	Explain the concept of A.C and H.V.D.C transmission system
N343.3	Explain the performance of line insulators and underground cable in Power Systems.
N343.4	Explain the operation of Circuit breakers and the concept of Overvoltage protection system
N343.5	Explain the operation of protective relay and the concept of grounding

### CO-PO, PSO Matrices:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
N343.1	3	2	1	1	2	1	2	3	2
N343.2	3	3	2	2	2	1	2	3	2
N343.3	3	2	2	3	2	2	2	3	3
N343.4	3	2	2	3	2	2	2	3	3
N343.5	3	2	2	3	3	2	3	3	3
<b>N343</b>	<b>3</b>	<b>2.2</b>	<b>1.8</b>	<b>2.4</b>	<b>2.2</b>	<b>1.6</b>	<b>2.2</b>	<b>3</b>	<b>2.6</b>

### Justification for CO-PO-PSO Mapping

#### N343.1 – Explain the concept of Electric power generation from various power sources

- PO1: (3) Requires foundational knowledge of physics and engineering science.
- PO2: (2) Involves analysis of different generation systems.
- PO3: (1) Minor design consideration in source integration.
- PO4: (1) Some tools used in simulating generation systems.

- PO5: (2) Involves awareness of environmental impact of sources (e.g., renewable vs. non-renewable).
- PO6: (1) Low-level management or communication.
- PO7: (2) Encourages updating knowledge about emerging energy technologies.
- PSO1: (3) Strong link to understanding system-level behaviour in power systems.
- PSO2: (2) Awareness of safe and sustainable generation methods.

### **N343.2 – Explain the concept of A.C and H.V.D.C transmission system**

- PO1: (3) Solid understanding of electrical fundamentals needed.
- PO2: (2) Involves analysis of system behaviour, advantages, and limitations.
- PO3: (1) Basic design elements (e.g., choice of system).
- PO4: (1) Understanding and simulation tools used occasionally.
- PO5: (2) Addresses sustainable and efficient transmission systems.
- PO6: (1) Involves teamwork in understanding system operations.
- PO7: (2) HVDC is evolving; continuous learning essential.
- PSO1: (3) Directly related to power system knowledge.
- PSO2: (2) HVDC involves safety and operational testing.

### **N343.3 – Explain the performance of line insulators and underground cable in Power Systems.**

- PO1: (2) Knowledge of materials science and system properties needed.
- PO2: (2) Analysis of faults, losses, and insulation types.
- PO3: (2) Selection and minor design of insulators/cables.
- PO4: (2) Tools and tests used for evaluating insulation.
- PO5: (3) High relevance due to environmental and safety issues in underground systems.
- PO6: (1) Basic teamwork or documentation.
- PO7: (2) New insulation materials demand continual learning.
- PSO1: (2) Applies to performance analysis in power systems.
- PSO2: (3) Strong focus on testing, safety, and maintenance.

**N343.4 – Explain the operation of Circuit breakers and the concept of Overvoltage protection system**

- PO1: (2) Requires electrical principles to understand operation.
- PO2: (3) Analysis of system behaviour during faults.
- PO3: (2) Selection and minor design of protection systems.
- PO4: (2) Usage of test equipment/tools for CBs.
- PO5: (2) Safety and environmental aspects tied to breaker use.
- PO6: (2) Often involves teams and documentation.
- PO7: (2) CB tech evolves; updating skills needed.
- PSO1: (3) Integral to power system safety/control.
- PSO2: (3) Strong link to testing and safe operation practices.

**N343.5 – Explain the operation of protective relay and the concept of grounding**

- PO1: (2) Electrical theory needed to understand relay logic.
- PO2: (3) High-level fault analysis and protection schemes.
- PO3: (2) Relay system design at basic level.
- PO4: (2) Practical testing and relay coordination.
- PO5: (3) Grounding and relay protection critical to safety and sustainability.
- PO6: (2) Requires coordination and team efforts in real-world use.
- PO7: (2) Continual evolution in protective devices.
- PSO1: (3) Core topic in system operation.
- PSO2: (3) Directly addresses safety, maintenance, and testing.

<b>Year &amp; Sem:</b>	II & IV
<b>Course Code:</b>	N344
<b>Course Title:</b>	Electrical Estimation and Energy Auditing

**Course Outcome:**

<b>CO</b>	<b>After completing the course, the students will be able to,</b>
N344.1	Explain the various systems of domestic wiring installations.
N344.2	Estimate the electrical installation of various domestic wiring.
N344.3	Explain about electrical energy management and energy auditing in electrical system.
N344.4	Explain the energy efficiency concepts in electric motors and lighting system.
N344.5	Explain about the diesel generating system and energy efficient technologies in electrical system.

**CO-PO, PSO Matrices:**

<b>CO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PSO1</b>	<b>PSO2</b>
N344.1	3	2	2	1	2	1	2	3	2
N344.2	3	3	3	2	2	2	2	3	3
N344.3	2	2	2	1	3	2	3	2	3
N344.4	2	2	2	2	3	2	3	3	3
N344.5	2	2	2	2	3	2	2	3	3
<b>N344</b>	<b>2.4</b>	<b>2.2</b>	<b>2.2</b>	<b>1.6</b>	<b>2.6</b>	<b>1.8</b>	<b>2.4</b>	<b>2.8</b>	<b>3.4</b>

**Justification for CO-PO-PSO Mapping**

**N344.1 – Explain the various systems used in domestic wiring installations.**

- PO1 (3): Requires application of fundamental electrical knowledge.
- PO2 (2): Involves identifying wiring systems based on code standards.
- PO3 (2): Supports design of basic wiring layouts.
- PO4 (1): Limited testing or tool application.
- PO5 (2): Relevance to household safety and sustainability.

- PO6 (1): Minor project management involvement.
- PO7 (2): Encourages learning wiring standards and updates.
- PSO1 (3): Strong relevance to technical understanding of wiring.
- PSO2 (2): Helps maintain and implement safe, efficient wiring.

**N344.2 – Estimate the requirements and cost for electrical installations in different types of domestic wiring.**

- PO1 (3): Utilizes math and fundamentals for estimation.
- PO2 (3): Analyses problems related to cost, load, and layout.
- PO3 (3): Supports design assistance in layout planning.
- PO4 (2): Involves selection of tools for estimation/testing.
- PO5 (2): Considers sustainable material choices.
- PO6 (2): Estimation is a project activity; involves teamwork and documentation.
- PO7 (2): Encourages learning costing methods with tech updates.
- PSO1 (3): Key skill in system planning and problem solving.
- PSO2 (3): Enables efficient and safe installations.

**N344.3 – Explain about electrical energy management and energy auditing in electrical system.**

- PO1 (2): Applies theoretical knowledge of power and energy.
- PO2 (2): Involves analysing energy-related issues.
- PO3 (2): Can assist in designing improvements based on audits.
- PO4 (1): Limited tool use for measurements.
- PO5 (3): Strong link to sustainability and ethical energy use.
- PO6 (2): Involves reporting and possibly team-based audits.
- PO7 (3): Promotes continuous learning in energy efficiency trends.
- PSO1 (2): Supports problem-solving in systems using audit data.
- PSO2 (3): Key for sustainable operation and maintenance.

**N344.4 – Explain energy efficiency concepts related to electric motors and lighting systems.**

- PO1 (2): Applies basic knowledge to energy-saving concepts.
- PO2 (2): Involves analysis of performance and efficiency.
- PO3 (2): Contributes to improving or modifying existing systems.
- PO4 (2): Uses tools/meters to test efficiency.
- PO5 (3): Energy saving is crucial to environment and society.
- PO6 (2): Possible team involvement for implementing practices.
- PO7 (3): Encourages updated learning in green tech.
- PSO1 (3): Direct link with understanding motor performance.
- PSO2 (3): Enhances sustainable maintenance practices.

**N344.5 – Explain the functioning of diesel generator systems and identify energy-efficient technologies.**

- PO1 (2): Applies core understanding of generation systems.
- PO2 (2): Analyses DG set components and issues.
- PO3 (2): Helps optimize systems for better efficiency.
- PO4 (2): Requires tools for testing and diagnostics.
- PO5 (3): Relates to energy-efficient and eco-friendly practices.
- PO6 (2): Involves management and team coordination.
- PO7 (2): Needs updating knowledge on DG tech and alternatives.
- PSO1 (3): Crucial for power system understanding.
- PSO2 (3): Strong link to testing and sustainable operation.

<b>Year &amp; Sem:</b>	II & IV
<b>Course Code:</b>	N345
<b>Course Title:</b>	Electrical Machines II Practical

**Course Outcome:**

<b>CO</b>	<b>After completing the course, the students will be able to,</b>
N345.1	Perform calibration of ammeter, voltmeter, wattmeter, single phase and three phase energy meters
N345.2	Test the performance characteristics of Alternator, slip ring induction motor, squirrel cage induction motor, synchronous motor by conducting suitable experiments
N345.3	Determine the value of unknown Resistance, Capacitance, Inductance using bridge circuit and measure linear displacement using LVDT

**CO-PO, PSO Matrices:**

<b>CO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PSO1</b>	<b>PSO2</b>
N345.1	2	1	1	3	1	1	1	2	3
N345.2	3	2	2	3	2	2	1	3	3
N345.3	3	2	1	3	1	1	1	2	2
<b>N345</b>	<b>2.6</b>	<b>1.6</b>	<b>1.3</b>	<b>3</b>	<b>1.3</b>	<b>1.3</b>	<b>1</b>	<b>2.3</b>	<b>2.6</b>

**Justification for CO-PO-PSO Mapping**

**N345.1 Perform calibration of ammeter, voltmeter, wattmeter, single-phase and three-phase energy meters.**

- PO1 (2): Requires fundamental knowledge of electrical engineering and measurement principles.
- PO2 (1): Involves basic problem identification during calibration.
- PO3 (1): Minor involvement in design; more procedural.
- PO4 (3): Involves hands-on use of instruments, testing, and calibration.
- PO5 (1): Slight relevance to societal/environmental impact through safe practices.

- PO6 (1): Limited team/project management, but basic reporting may be needed.
- PO7 (1): Awareness of updates in calibration tools may be involved.
- PSO1 (2): Technical solution involving meter calibration.
- PSO2 (3): Directly applies to testing and operation of electrical equipment with safety.

**N345.2 Test the performance characteristics of Alternator, Slip ring induction motor, Squirrel cage induction motor, and Synchronous motor.**

- PO1 (3): Requires deep understanding of machine theory and characteristics.
- PO2 (2): Involves identification and analysis of performance issues.
- PO3 (2): Assists in system design understanding and testing configurations.
- PO4 (3): Direct application of tools and measurements in motor testing.
- PO5 (2): Involves safety, sustainability (e.g., motor efficiency).
- PO6 (2): Likely conducted as a team experiment with project coordination.
- PO7 (1): Encourages continuous learning of testing techniques.
- PSO1 (3): Strong alignment with electrical machines and performance analysis.
- PSO2 (3): Direct relevance to testing, operation, and safety of equipment.

**N345.3 Determine the value of unknown Resistance, Capacitance, Inductance using bridge circuits and measure linear displacement using LVDT.**

- PO1 (3): Solid foundation in engineering science and electrical concepts required.
- PO2 (2): Involves analysis of measured parameters to verify values.
- PO3 (1): Limited design work, but understanding circuit behaviour is relevant.
- PO4 (3): Heavy use of modern instruments (bridge circuits, LVDT).
- PO5 (1): Minor relevance to sustainability/ethics.
- PO6 (1): Basic communication and reporting of experimental outcomes.
- PO7 (1): Some level of continuous learning on measurement tech expected.
- PSO1 (2): Applies to instrumentation techniques in electrical systems.
- PSO2 (2): Includes proper testing and measurement under safety norms.

<b>Year &amp; Sem:</b>	II & IV
<b>Course Code:</b>	N346
<b>Course Title:</b>	Electrical Work Shop II Practical

**Course Outcome:**

<b>CO</b>	<b>After completing the course, the students will be able to,</b>
N346.1	Test the Electrical wiring installation by conducting suitable experiment
N346.2	Dismantle and assemble the parts of Induction heater, Microwave oven and ceiling fan
N346.3	Perform Winding on AC electrical machines

**CO-PO, PSO Matrices:**

<b>CO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PSO1</b>	<b>PSO2</b>
N346.1	2	2	1	3	2	1	2	3	3
N346.2	2	2	2	2	2	2	2	3	3
N346.3	3	2	2	2	2	2	2	3	3
<b>N346</b>	<b>2.3</b>	<b>2</b>	<b>1.6</b>	<b>2.3</b>	<b>2</b>	<b>1.6</b>	<b>2</b>	<b>3</b>	<b>3</b>

**Justification for CO-PO-PSO Mapping**

**N346.1 – Test the Electrical wiring installation by conducting suitable experiment**

- PO1 (2): Requires application of basic electrical and engineering principles.
- PO2 (2): Involves identifying faults and verifying installation standards using standard methods.
- PO3 (1): Limited design work, but understanding the circuit layout is relevant.
- PO4 (3): Involves practical use of instruments and tools for testing wiring installations.
- PO5 (2): Ensures safety and ethical compliance in wiring systems as per regulations.
- PO6 (1): Includes basic documentation and communication of test results.
- PO7 (2): Requires awareness of updated wiring codes and evolving testing technologies.
- PSO1 (3): Strongly applies to diagnosing and troubleshooting electrical systems.
- PSO2 (3): Focuses on safety, operation, and sustainability in installation testing.

### **N346.2 – Dismantle and assemble the parts of Induction heater, Microwave oven and ceiling fan**

- PO1 (2): Basic understanding of the functioning of electrical and electronic components is necessary.
- PO2 (2): Involves identifying faults and reassembling for functional verification.
- PO3 (2): Requires assisting in reconstructing or modifying component layout.
- PO4 (2): Utilizes basic tools and instruments during dismantling/assembly.
- PO5 (2): Promotes awareness of handling e-waste, safety, and environmental concerns.
- PO6 (2): Encourages teamwork, time management, and clear communication.
- PO7 (2): Involves keeping up with new models and evolving appliance technologies.
- PSO1 (3): Strongly linked to hands-on troubleshooting and repair of systems.
- PSO2 (3): Emphasizes safety practices and sustainability during maintenance.

### **N346.3 – Perform Winding on AC electrical machines**

- PO1 (3): Solid foundation in electrical machines and electromagnetism is essential.
- PO2 (2): Requires understanding winding types and analysing faults.
- PO3 (2): Involves planning winding layout and assisting in configuration.
- PO4 (2): Engages modern winding tools, insulation testers, and measuring devices.
- PO5 (2): Encourages sustainable material use and environmentally sound practices.
- PO6 (2): Team-based activity requiring coordination and documentation.
- PO7 (2): Involves learning new winding techniques and industry standards.
- PSO1 (3): Highly applicable to core machine winding and maintenance skills.
- PSO2 (3): Encompasses proper execution, testing, and adherence to safe

<b>Year &amp; Sem:</b>	II & IV
<b>Course Code:</b>	N347
<b>Course Title:</b>	Life and Employability Skill Practical

### Course Outcome:

CO	After completing the course, the students will be able to,
N347.1	Use relevant techniques to improve reading skill for effective communication
N347.2	Use relevant techniques to improve Listening skill for effective communication
N347.3	Use relevant techniques to improve speaking skill for effective communication
N347.4	Use relevant techniques to improve writing skill for effective communication
N347.5	Use relevant techniques to improve computer aided skill for effective communication

### CO-PO, PSO Matrices:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
N347.1	3	2	1	2	1	2	2	1	1
N347.2	2	3	1	2	1	2	2	1	1
N347.3	2	3	2	2	2	3	2	1	1
N347.4	3	2	2	3	2	2	2	1	1
N347.5	3	2	2	3	2	3	2	2	2
<b>N347</b>	<b>2.6</b>	<b>2.4</b>	<b>1.6</b>	<b>2.4</b>	<b>1.6</b>	<b>2.4</b>	<b>2</b>	<b>1.2</b>	<b>1.2</b>

### Justification for CO-PO-PSO Matrix

#### N347.1 Use relevant techniques to improve reading skill for effective communication

- PO1 (3): Strong foundational knowledge needed to comprehend technical texts effectively.
- PO2 (2): Requires ability to analyse and interpret reading materials critically.
- PO3 (1): Basic contribution to designing communication materials.
- PO4 (2): Uses tools and techniques like reading software or digital documents.
- PO5 (1): Limited but some influence on ethical communication and societal impact.
- PO6 (2): Helps in project documentation and understanding communication flow.
- PO7 (2): Continuous improvement in reading is essential for lifelong learning.
- PSO1 (1): Supports understanding technical documents related to electrical engineering.

- PSO2 (1): Assists in reading manuals and safety guidelines.

#### **N347.2 Use relevant techniques to improve Listening skill for effective communication**

- PO1 (2): Basic knowledge required to follow spoken technical content.
- PO2 (3): Critical for identifying and analysing spoken problems and instructions.
- PO3 (1): Supports solution design through feedback and discussions.
- PO4 (2): Involves using listening devices or audio tools in experiments.
- PO5 (1): Limited role in ethical and sustainable communication.
- PO6 (2): Vital for teamwork and project meetings.
- PO7 (2): Encourages learning through auditory channels.
- PSO1 (1): Helps in understanding verbal instructions for technical tasks.
- PSO2 (1): Important for safe operations relying on oral communication.

#### **N347.3 Use relevant techniques to improve speaking skill for effective communication**

- PO1 (2): Knowledge needed to clearly articulate technical ideas.
- PO2 (3): Crucial for explaining problem analysis and solutions verbally.
- PO3 (2): Active role in communicating design plans and solutions.
- PO4 (2): Uses modern communication tools for presentations and discussions.
- PO5 (2): Enhances communication about social, ethical, and environmental issues.
- PO6 (3): Essential for leadership, coordination, and effective project communication.
- PO7 (2): Ongoing development of speaking skills supports lifelong learning.
- PSO1 (1): Assists in explaining technical solutions in teams.
- PSO2 (1): Important for verbal safety instructions and reporting.

#### **N347.4 Use relevant techniques to improve writing skill for effective communication**

- PO1 (3): Solid knowledge required for clear technical documentation.
- PO2 (2): Analyzing and reporting problems effectively in writing.
- PO3 (2): Designing reports, manuals, and documentation.
- PO4 (3): Utilizes software tools for technical writing and documentation.

- PO5 (2): Writing helps promote sustainable and ethical practices.
- PO6 (2): Documentation and communication aid in project management.
- PO7 (2): Writing skill improvement is key for continuous learning.
- PSO1 (1): Supports preparation of technical reports and manuals.
- PSO2 (1): Important for documenting maintenance and safety procedures.

**N347.5 Use relevant techniques to improve computer aided skill for effective communication**

- PO1 (3): Knowledge of computers and software critical for modern communication.
- PO2 (2): Using software tools to analyze and solve problems.
- PO3 (2): Design and develop communication materials using digital tools.
- PO4 (3): Extensive use of modern engineering software and communication platforms.
- PO5 (2): Promotes sustainable communication through digital means.
- PO6 (3): Crucial for managing projects and coordinating via digital tools.
- PO7 (2): Continuous adaptation to new technologies required.
- PSO1 (2): Directly applicable to technical solutions in automation and systems.
- PSO2 (2): Important for operating, maintaining, and testing using computerized systems.

<b>Year &amp; Sem:</b>	III & V
<b>Course Code:</b>	N351
<b>Course Title:</b>	Distribution and Utilization

**Course Outcome:**

CO	After completing the course, the students will be able to,
N351.1	Explain the schematic arrangements of substation.
N351.2	Explain the connection schemes and electric drive
N351.3	Explain about the traction mechanism.
N351.4	Explain the sources of lighting system and electric heating.
N351.5	Explain the working of electric furnaces and process of electric welding

**CO-PO, PSO Matrices:**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
N351.1	3	2	2	3	2	1		3	2
N351.2	3	3	2	2	2	2		3	3
N351.3	3	3	2	2	3	2	1	2	2
N351.4	3	2	1	2	3	1	2	2	3
N351.5	3	3	2	3	3	2	1	3	3
<b>N351</b>	<b>3</b>	<b>2.6</b>	<b>1.8</b>	<b>2.4</b>	<b>2.6</b>	<b>1.6</b>	<b>1.3</b>	<b>2.6</b>	<b>2.6</b>

**Justification for CO-PO-PSO Mapping**

**N351.1 – Explain the schematic arrangements of substation.**

- PO1 (3): Requires basic and domain knowledge to understand layout.
- PO2 (2): Analyse electrical layout challenges.
- PO3 (2): Support system layout design.
- PO4 (3): Use tools like AutoCAD, ETAP to simulate layout.
- PO5 (2): Sustainable and safe layout considerations.
- PO6 (1): Communication of layout in teams.
- PSO1 (3): Strongly related to substation systems.
- PSO2 (2): Maintenance perspective.

**N351.2 – Explain the connection schemes and electric drive**

- PO1 (3): Strong electrical fundamentals required.

- PO2 (3): Analyse schemes and drive performance.
- PO3 (2): Assist in designing drive systems.
- PO4 (2): Involves simulations and testing.
- PO5 (2): Efficiency and ethics in motor drives.
- PO6 (2): Collaboration in system integration.
- PSO1 (3): Core to power system and drives.
- PSO2 (3): Equipment operation and maintenance.

**N351.3 – Explain about the traction mechanism.**

- PO1 (3): Understanding mechanics and electrical integration.
- PO2 (3): Analyse working and problems in traction.
- PO3 (2): Assist in design/adaptation of systems.
- PO4 (2): Testing motors and performance.
- PO5 (3): Environmentally sustainable transport.
- PO6 (2): Team role in traction projects.
- PO7 (1): Need to keep up with advances.
- PSO1 (2): Technical problem solving in systems.
- PSO2 (2): Operating and safety in traction systems.

**N351.4 – Explain the sources of lighting system and electric heating.**

- PO1 (3): Strong electrical and thermal basics needed.
- PO2 (2): Analyse system efficiency.
- PO3 (1): Support design of simple setups.
- PO4 (2): Requires tool usage for testing.
- PO5 (3): Directly impacts sustainability.
- PO6 (1): Minor project management role.
- PO7 (2): Tech evolution in lighting and heating.
- PSO1 (2): Applicable to industrial automation.
- PSO2 (3): Key role in operation and maintenance.

**N351.5 – Explain the working of electric furnaces and process of electric welding**

- PO1 (3): Deep understanding of electrothermal systems.
- PO2 (3): Analyse complex heating/welding circuits.
- PO3 (2): Assist in setup and optimization.
- PO4 (3): Involves testing and measurements.
- PO5 (3): Energy efficiency and safe practices.
- PO6 (2): Requires coordination and documentation.
- PO7 (1): Updating skills for new welding tech.
- PSO1 (3): Core industrial process.
- PSO2 (3): Strong emphasis on safety, maintenance, and sustainability.

<b>Year &amp; Sem:</b>	III & V
<b>Course Code:</b>	N352
<b>Course Title:</b>	Operation and Maintenance of Electrical Equipments

**Course Outcome:**

<b>CO</b>	<b>After completing the course, the students will be able to,</b>
N352.1	Explain the concept of maintenance, Safe Working of Electrical Equipment, Building Electrical Installations
N352.2	Explain the operation and maintenance of transformer.
N352.3	Explain the operation and maintenance of generators, substation and circuit breakers.
N352.4	Explain the operation and maintenance of ac motors and starters.
N352.5	Explain the operation & maintenance of lighting, transmission and distribution lighting.

**CO-PO, PSO Matrices:**

<b>CO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PSO1</b>	<b>PSO2</b>
N352.1	3	2	2		3	2	2	2	3
N352.2	3	3	2	2	2	2	1	3	3
N352.3	3	3	2	2	3	2	2	3	3
N352.4	3	3	2	2	3	2	2	3	3
N352.5	3	2	2	2	3	2	2	3	3
<b>N352</b>	<b>3</b>	<b>2.6</b>	<b>2</b>	<b>2</b>	<b>2.8</b>	<b>2</b>	<b>1.8</b>	<b>2.8</b>	<b>3</b>

**N352.1 – Explain the concept of maintenance, safe working of electrical equipment, and building electrical installations.**

- PO1 (3): Strong understanding of electrical fundamentals and safety.
- PO2 (2): Identifying and analyzing common issues in installations.
- PO3 (2): Assisting in designing safe and reliable electrical setups.
- PO5 (3): Emphasis on sustainability, safety, and ethical practices.
- PO6 (2): Involves teamwork and documentation during maintenance.
- PO7 (2): Requires ongoing learning of safety norms and installation standards.
- PSO1 (2): Supports solving practical electrical system problems.

- PSO2 (3): Focuses on maintenance and safe operation.

### **N352.2 – Explain the operation and maintenance of transformers.**

- PO1 (3): Requires solid knowledge of electromagnetic and circuit principles.
- PO2 (3): Involves analysis of faults and performance issues.
- PO3 (2): Helps in planning maintenance procedures.
- PO4 (2): Includes use of testing tools for diagnostics.
- PO5 (2): Promotes responsible maintenance and environmental care.
- PO6 (2): Involves coordinated efforts for maintenance activities.
- PO7 (1): Basic updating on transformer tech advancements.
- PSO1 (3): Critical equipment in power systems.
- PSO2 (3): Strong focus on testing and safety compliance.

### **N352.3 – Explain the operation and maintenance of generators, substations, and circuit breakers.**

- PO1 (3): In-depth understanding of power generation and protection systems.
- PO2 (3): Analysis of operational faults and system behaviour.
- PO3 (2): Support in planning and executing maintenance routines.
- PO4 (2): Involves instrumentation and measurements.
- PO5 (3): Focus on safety and sustainability in power systems.
- PO6 (2): Requires collaborative operations and documentation.
- PO7 (2): Learning modern substation and breaker tech.
- PSO1 (3): Central to solving power system issues.
- PSO2 (3): Critical for safe, sustainable operation.

### **N352.4 – Explain the operation and maintenance of AC motors and starters.**

- PO1 (3): Strong foundation in electrical machines and motor theory.
- PO2 (3): Diagnosing faults and performance issues.
- PO3 (2): Aiding in starter selection and motor setup.
- PO4 (2): Requires testing and calibration using tools.

- PO5 (3): Promotes energy-efficient and safe usage.
- PO6 (2): Includes teamwork for motor installation and maintenance.
- PO7 (2): Updating knowledge on motor control technologies.
- PSO1 (3): Essential for machine-based technical problem-solving.
- PSO2 (3): Emphasizes safe operation and maintenance.

**N352.5 – Explain the operation and maintenance of lighting, transmission, and distribution systems.**

- PO1 (3): Basic and applied electrical knowledge is required.
- PO2 (2): Identifying lighting and distribution system issues.
- PO3 (2): Assist in design and system optimization.
- PO4 (2): Includes testing lighting systems and T&D networks.
- PO5 (3): Encourages sustainable and efficient lighting practices.
- PO6 (2): Teamwork and reporting involved in fieldwork.
- PO7 (2): Staying updated with smart lighting and grid tech.
- PSO1 (3): Applies to core power and lighting system solutions.
- PSO2 (3): Strong relevance to maintenance and sustainable practice.

<b>Year &amp; Sem:</b>	III & V
<b>Course Code:</b>	N353
<b>Course Title:</b>	Microprocessor and Micro Controller

**Course Outcome:**

<b>CO</b>	<b>After completing the course, the students will be able to,</b>
N353.1	Explain the architecture, instruction set and simple programs of 8085.
N353.2	Explain the architecture and instruction set of 8051.
N353.3	construct simple programs using 8051 for relevant application
N353.4	Explain the concepts of serial communication and interfacing using rs232.
N353.5	Explain the various applications of 8051 and 8085.

**CO-PO, PSO Matrices:**

<b>CO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PSO1</b>	<b>PSO2</b>
N353.1	3	2	1	2	1	1	1	3	2
N353.2	3	2	1	2	1	1	1	3	2
N353.3	2	3	3	3	1	2	2	3	3
N353.4	2	2	2	3	1	1	1	2	2
N353.5	2	2	2	2	2	1	2	2	3
<b>N353</b>	<b>2.4</b>	<b>2.2</b>	<b>1.8</b>	<b>2.4</b>	<b>1.2</b>	<b>1.2</b>	<b>1.4</b>	<b>2.6</b>	<b>2.4</b>

**Justification for CO-PO-PSO Mapping**

**N353.1: Explain the architecture, instruction set and simple programs of 8085.**

- PO1 (3): Basic and applied knowledge of microprocessor architecture is essential.
- PO2 (2): Requires analysis of instruction formats and operations.
- PO3 (1): Minimal design involvement; mainly theoretical understanding.
- PO4 (2): Use of tools or simulators to verify program logic and execution.
- PO5 (1): Indirect relevance; ethical or sustainability context is minimal.
- PO6 (1): Limited teamwork or project management relevance.
- PO7 (1): Some need for continuous learning in microprocessor evolution.
- PSO1 (3): Strongly aligned with core technical skills in processor systems.
- PSO2 (2): Moderate relevance to operation and maintenance in lab setups.

### **N353.2: Explain the architecture and instruction set of 8051.**

- PO1 (3): In-depth technical knowledge of microcontroller systems is required.
- PO2 (2): Involves identifying and interpreting microcontroller features.
- PO3 (1): Slight application to design-related understanding.
- PO4 (2): Tools like simulators used to explore instruction sets.
- PO5 (1): Low relevance to societal or environmental practices.
- PO6 (1): Minimal management or collaboration required.
- PO7 (1): Need to update with newer microcontrollers.
- PSO1 (3): Key to technical solutions in microcontrollers and automation fields.
- PSO2 (2): Useful for testing and operating microcontroller setups.

### **N353.3: Construct simple programs using 8051 for relevant applications.**

- PO1 (2): Applies basic and microcontroller programming knowledge.
- PO2 (3): Analysing and solving real-world problems using programs.
- PO3 (3): Involves designing and writing logical program structures.
- PO4 (3): Testing and debugging with microcontroller tools.
- PO5 (1): Slight relevance if application is socially oriented.
- PO6 (2): Collaboration in labs or mini projects is often required.
- PO7 (2): Staying current with modern microcontroller programming practices.
- PSO1 (3): Directly applies to developing automation system solutions.
- PSO2 (3): Strong relevance to programming, testing, and maintenance.

### **N353.4: Explain the concepts of serial communication and interfacing using RS232.**

- PO1 (2): Requires basic understanding of communication protocols.
- PO2 (2): Analysing and interpreting interfacing problems.
- PO3 (2): Some program-level design of communication logic.
- PO4 (3): Use of tools and hardware to test RS232 interfacing.
- PO5 (1): Limited connection to societal or sustainability factors.
- PO6 (1): Some teamwork involved in interfacing experiments.
- PO7 (1): Awareness of updated serial interfaces is useful.

- PSO1 (2): Supports interfacing in industrial systems.
- PSO2 (2): Applies to operating and testing communication setups.

**N353.5: Explain the various applications of 8051 and 8085.**

- PO1 (2): Applies foundational knowledge to practical usage scenarios.
- PO2 (2): Analysing processor/microcontroller use cases in systems.
- PO3 (2): Involves proposing solutions using processors/controllers.
- PO4 (2): Applications may require validation using tools.
- PO5 (2): Some applications relate to efficient and ethical practices.
- PO6 (1): Occasional group-based application analysis or presentations.
- PO7 (2): Emphasizes keeping up with newer microcontroller applications.
- PSO1 (2): Useful in real-world automation and electrical systems.
- PSO2 (3): Strong application in testing, maintenance, and sustainability.

<b>Year &amp; Sem:</b>	III & V
<b>Course Code:</b>	N3541
<b>Course Title:</b>	Control of Electrical Machines

**Course Outcome:**

<b>CO</b>	<b>After completing the course, the students will be able to,</b>
N3541.1	Explain the principal of operation of various electrical control circuit elements
N3541.2	Explain the operation of various control circuits for AC and DC motor
N3541.3	Explain the operation of control circuits for various industrial applications
N3541.4	Explain the various testing procedures of Transformers, Bus bar and Reactor
N3541.5	Explain the various testing procedures of Circuit breakers, Relays and Lightning arrestor

**CO-PO, PSO Matrices:**

<b>CO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PSO1</b>	<b>PSO2</b>
N3541.1	3	2	1	2	1	1	1	3	2
N3541.2	3	3	2	3	1	1	1	3	3
N3541.3	3	3	2	3	2	2	1	3	3
N3541.4	2	2	1	3	1	1	1	2	3
N3541.5	2	2	1	3	1	1	1	2	3
<b>N3541</b>	<b>2.6</b>	<b>2.4</b>	<b>1.4</b>	<b>2.8</b>	<b>1.2</b>	<b>1.2</b>	<b>1</b>	<b>2.6</b>	<b>2.8</b>

**Justifications for CO-PO-PSO Mapping**

**N3541.1 – Explain the principles of operation of various electrical control circuit elements**

- PO1 (3): Strongly involves fundamental knowledge of electrical engineering and control elements.
- PO2 (2): Requires analysis of circuit behaviour using standard methods.
- PO3 (1): Minimal design aspect.
- PO4 (2): Understanding circuit elements supports test and measurement tasks.
- PO5 (1): Some basic awareness of societal impact in using electrical devices.
- PO6 (1): Slight relevance to team projects or communication.
- PO7 (1): Encourages ongoing learning of electrical elements.
- PSO1 (3): Highly relevant to solving electrical system problems.
- PSO2 (2): Contributes to effective operation and maintenance knowledge.

### **N3541.2 – Describe the operation of various control circuits for AC and DC motors**

- PO1 (3): Core knowledge in motor control and operations.
- PO2 (3): Analysing motor circuits demands problem-solving skills.
- PO3 (2): Involves understanding design logic of control circuits.
- PO4 (3): Testing control circuits is essential for practical learning.
- PO5 (1): Limited but some relevance to energy-efficient operations.
- PO6 (1): Can be part of group lab/project work.
- PO7 (1): Motivates continuous learning due to evolving motor tech.
- PSO1 (3): Directly applies to technical solutions in motors and automation.
- PSO2 (3): Involves maintenance and testing with safety practices.

### **N3541.3 – Explain the operation of control circuits for various industrial applications**

- PO1 (3): Strong link with applied electrical and control systems.
- PO2 (3): Involves interpreting industrial control requirements.
- PO3 (2): Helps in designing or adapting existing systems.
- PO4 (3): Requires use of tools and testing methods.
- PO5 (2): Relevance in energy usage and automation sustainability.
- PO6 (2): Control circuits often handled in teams or project-based settings.
- PO7 (1): Lifelong learning due to rapid changes in industrial automation.
- PSO1 (3): Strongly supports solutions for industrial automation.
- PSO2 (3): Key for operating and maintaining industrial equipment.

### **N3541.4 – Explain the various testing procedures of transformers, bus bars, and reactors**

- PO1 (2): Involves understanding electrical fundamentals and systems.
- PO2 (2): Problem analysis related to test parameters and results.
- PO3 (1): Limited design aspect.
- PO4 (3): Emphasizes modern testing tools and procedures.
- PO5 (1): Minor relevance in environmental awareness.

- PO6 (1): Team coordination in testing setups.
- PO7 (1): Technological updates influence test procedures.
- PSO1 (2): Technical insight for solving transformer-related problems.
- PSO2 (3): Strong relevance in maintenance and testing skills.

**N3541.5 – Explain the various testing procedures of circuit breakers, relays, and lightning arresters**

- PO1 (2): Applies electrical protection and switching theory.
- PO2 (2): Identifying and analysing test-based issues.
- PO3 (1): Involves minimal design.
- PO4 (3): In-depth focus on measurement and testing tools.
- PO5 (1): Slight connection to safety and sustainability practices.
- PO6 (1): Testing often involves team-based execution.
- PO7 (1): Staying current with updated protection technologies.
- PSO1 (2): Supports solution development in power systems.
- PSO2 (3): Vital for testing, safety, and equipment maintenance.

<b>Year &amp; Sem:</b>	III & V
<b>Course Code:</b>	N355
<b>Course Title:</b>	Computer Aided Electrical Drawing Practical

**Course Outcome:**

<b>CO</b>	<b>After completing the course, the students will be able to,</b>
N355.1	Explain the features and various tool bars of AutoCAD Software
N355.2	Draw the Electrical Symbols used in Wirings, Machines and Electronic Circuits
N355.3	Construct various electrical circuits for various applications

**CO-PO, PSO Matrices:**

<b>CO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PSO1</b>	<b>PSO2</b>
N355.1	3	1	1	2	1	1	2	2	1
N355.2	2	2	2	1	2	1	2	3	2
N355.3	2	3	3	3	2	2	3	3	3
<b>N355</b>	<b>2.3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>1.6</b>	<b>1.3</b>	<b>2.3</b>	<b>2.6</b>	<b>2</b>

**N355.1 – Explain the features and various toolbars of AutoCAD software.**

- PO1 (3): High understanding of fundamental engineering software tools relates directly to discipline-specific knowledge.
- PO2 (1): Basic level of problem identification while exploring AutoCAD features.
- PO3 (1): Limited design activity involved, but relevant to layout planning.
- PO4 (2): Students learn to use a modern engineering tool (AutoCAD) effectively.
- PO5 (1): Awareness of sustainable design practices can be introduced.
- PO6 (1): Low-level project management in software usage.
- PO7 (2): Students need to upgrade and adapt to new versions of AutoCAD – a step toward lifelong learning.
- PSO1 (2): Tool use is crucial in creating solutions in electrical systems.
- PSO2 (1): Limited relevance to testing/maintenance but applicable in documentation and design.

**N355.2 – Draw electrical symbols used in wirings, machines, and electronic circuits.**

- PO1 (2): Moderate application of fundamental electrical knowledge.
- PO2 (2): Identification of symbols and their application enhances analytical thinking.
- PO3 (2): Involves technical drawing and developing circuit representations.

- PO4 (1): Basic tool usage in drawing symbols.
- PO5 (2): Design symbols that comply with standard practices and norms.
- PO6 (1): Teamwork may be involved in larger design assignments.
- PO7 (2): Symbol standards evolve—students must update with current IEC/IEEE symbols.
- PSO1 (3): Symbol literacy is vital in electrical machine and automation systems.
- PSO2 (2): Helps in reading and interpreting schematics for equipment operation and testing.

**N355.3 – Construct various electrical circuits for various applications.**

- PO1 (2): Applies engineering and scientific knowledge to real circuits.
- PO2 (3): In-depth analysis and selection of components, circuit behaviour.
- PO3 (3): High-level involvement in designing functional circuits.
- PO4 (3): Extensive use of tools for circuit construction and measurement.
- PO5 (2): Choice of components and design may affect sustainability and safety.
- PO6 (2): Often part of team-based projects with need for communication.
- PO7 (3): Circuit designs are ever-evolving—students must stay updated.
- PSO1 (3): Strongly aligned with developing solutions in electrical systems and automation.
- PSO2 (3): Direct involvement in building and testing equipment in safe, sustainable ways.

<b>Year &amp; Sem:</b>	III & V
<b>Course Code:</b>	N356
<b>Course Title:</b>	Microprocessor and Micro Controller Practical

**Course Outcome:**

CO	After completing the course, the students will be able to,
N356.1	Execute the simple programs using instruction set of 8085 for relevant application
N356.2	Execute the simple programs using instruction set of 8051 for relevant application
N356.3	Perform the peripheral connection with 8085 and 8051.

**CO-PO, PSO Matrices:**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
N356.1	3	3	2	3	1	1	2	3	2
N356.2	3	3	2	3	1	1	2	3	2
N356.3	2	2	3	3	2	2	2	3	3
<b>N356</b>	<b>2.6</b>	<b>2.6</b>	<b>2.3</b>	<b>3</b>	<b>1.3</b>	<b>1.3</b>	<b>2</b>	<b>3</b>	<b>2.3</b>

**Justification for CO-PO-PSO Mapping****N356.1 – Execute simple programs using the 8085-instruction set for relevant applications.**

- PO1(3): Strong foundation in number systems, logic design, and microprocessor fundamentals.
- PO2 (3): Requires logical thinking to analyse and structure assembly code.
- PO3 (2): Programs involve step-by-step design for computational tasks.
- PO4 (3): Uses simulators or kits for code testing and debugging.
- PO5 (1): Minimal but present when used in embedded or automation applications.
- PO6 (1): Programming tasks involve basic planning and execution.
- PO7 (2): Encourages learning newer tools and understanding of microprocessor evolution.
- PSO1 (3): Directly contributes by developing skills in basic processor programming.
- PSO2 (2): Supports equipment handling and embedded control systems understanding.

**N356.2 – Execute simple programs using the 8051-instruction set for relevant applications.**

- PO1 (3): Builds knowledge in microcontroller architecture and embedded systems.
- PO2 (3): Analyzing I/O handling and timer/counter problems.
- PO3 (2): Designing solutions to interact with external hardware via program logic.

- PO4 (3): Tools like Keil, Proteus or hardware boards are used for testing.
- PO5 (1): Indirectly impacts applications like home automation or IoT.
- PO6 (1): Helps in organizing simple microcontroller-based projects.
- PO7 (2): Motivates deeper exploration of embedded systems and upskilling.
- PSO1 (3): Strong application in automation and control systems.
- PSO2 (2): Supports practical skills through programming and peripheral interfacing.

**N356.3 – Perform the peripheral connection with 8085 and 8051.**

- PO1 (2): Requires knowledge of interfacing concepts and basic electronics.
- PO2 (2): Analyse compatibility and functioning of interfaced devices.
- PO3 (3): Designing simple interfacing circuits like ADCs, LCDs, or keypads.
- PO4 (3): Testing and measuring performance of interfaced peripherals.
- PO5 (2): Relevant in applications like energy meters, green tech systems.
- PO6 (2): Involves team effort in project-based peripheral interfacing.
- PO7 (2): Encourages learning advanced interfacing technologies.
- PSO1 (3): Very relevant for industrial automation using microcontrollers.
- PSO2 (3): Develops skills to operate and test microcontroller-based equipment safely.

<b>Year &amp; Sem:</b>	III & V
<b>Course Code:</b>	N3571
<b>Course Title:</b>	Control of Electrical Machines Practical

**Course Outcome:**

<b>CO</b>	<b>After completing the course, the students will be able to,</b>
N3571.1	Test the working of single phasing preventer

N3571.2	Test the timing characteristics of thermal overload relay
N3571.3	Test the operation of control circuits of AC motor
N3571.4	Test the control circuit for various Starters of AC Motor
N3571.5	Test the breakdown voltage and acidity level of the transformer oil

### CO-PO, PSO Matrices:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
N3571.1	2	2	1	3	2	1	2	3	2
N3571.2	2	2	2	3	2	1	2	3	3
N3571.3	2	2	2	3	2	2	2	3	3
N3571.4	2	2	3	3	2	2	2	3	3
N3571.5	2	2	2	3	3	1	2	2	3
<b>N3571</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>2.2</b>	<b>1.4</b>	<b>2</b>	<b>2.8</b>	<b>2.8</b>

### Justification for CO-PO-PSO Mapping

#### N3571.1 – Test the working of a single phasing preventer

- PO1-2: Requires basic knowledge of electrical faults and protection systems.
- PO2-2: Involves analysing fault conditions (single phasing) using standard methods.
- PO3-1: Design aspect is minimal but understanding circuit integration is needed.
- PO4-3: Involves using test equipment and tools to verify functionality.
- PO5-2: Understanding impact on safety and system protection.
- PO6-1: Minor project/management involvement.
- PO7-2: Encourages awareness of newer protection techniques.
- PSO1-3: Direct application of technical problem-solving in electrical protection.
- PSO2-2: Requires safe and proper handling and testing of equipment.

#### N3571.2 – Test the timing characteristics of a thermal overload relay

- PO1-2: Requires understanding of relay operation and thermal characteristics.
- PO2-2: Analyse tripping time under overload conditions.
- PO3-2: Some design understanding of relay application.
- PO4-3: Conduct tests with precision using appropriate tools.
- PO5-2: Ensures equipment safety and sustainability.
- PO6-1: Involves small-scale test planning and reporting.
- PO7-2: Stays updated with testing techniques and standards.

- PSO1-3: Strong technical skills in protective devices.
- PSO2-3: Involves testing and safety compliance.

### **N3571.3 – Test the operation of control circuits in an AC motor**

- PO1-2: Knowledge of motor control logic and components.
- PO2-2: Analyse control failure scenarios.
- PO3-2: Assists in modifying or troubleshooting circuit logic.
- PO4-3: Involves practical testing and measurements.
- PO5-2: Focuses on electrical safety and sustainable motor control.
- PO6-2: Requires some team coordination and documentation.
- PO7-2: Awareness of industry-standard practices and updates.
- PSO1-3: Strong alignment with control system troubleshooting.
- PSO2-3: Involves operation and safety testing of motor controls.

### **N3571.4 – Test control circuits for various starters of an AC motor**

- PO1-2: Applies knowledge of starter configurations (DOL, Star-Delta, etc.).
- PO2-2: Analyse performance across starter types.
- PO3-3: Assist in design and modification of starter circuits.
- PO4-3: Practical testing with tools and safety procedures.
- PO5-2: Involves sustainability (reducing inrush current) and safety.
- PO6-2: Collaborative activity with reports and circuit setup.
- PO7-2: Learning different starter technologies.
- PSO1-3: Deeply tied to industrial automation and motor systems.
- PSO2-3: Tests and validates starter equipment.

### **N3571.5 – Test the breakdown voltage and acidity level of transformer oil**

- PO1-2: Understands transformer functions and oil properties.
- PO2-2: Analyzes test data for insulation quality.
- PO3-2: Suggest maintenance/conditioning based on test results.
- PO4-3: Uses precise lab instruments and techniques.

- PO5-3: Strong sustainability focus — transformer oil reuse and disposal.
- PO6-1: Basic test reporting.
- PO7-2: Encourages tracking standards in oil testing.
- PSO1-2: Relevant to transformer maintenance practices.
- PSO2-3: Core testing and safety procedures involved.

<b>Year &amp; Sem:</b>	III & VI
<b>Course Code:</b>	N361
<b>Course Title:</b>	PLC and SCADA

**Course Outcome:**

<b>CO</b>	<b>After completing the course, the students will be able to,</b>
N361.1	Explain the block diagram, operation, memory, types and inputs of PLC

N361.2	Explain the operation of various I/O module of PLC
N361.3	Develop the PLC program using Ladder logic for various application
N361.4	Explain the Networking protocols and standards in industrial automation
N361.5	Explain the operation and application of SCADA

**CO-PO, PSO Matrices:**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
N361.1	3	2	1	1	2	1	2	3	1
N361.2	3	2	1	2	2	1	2	3	2
N361.3	3	3	3	3	2	2	2	3	3
N361.4	2	2	2	2	3	2	3	2	2
N361.5	2	2	2	2	3	2	2	3	3
<b>N361</b>	<b>2.6</b>	<b>2.2</b>	<b>1.8</b>	<b>2</b>	<b>2.4</b>	<b>1.6</b>	<b>2.2</b>	<b>2.8</b>	<b>2.2</b>

**Justification for CO-PO-PSO Mapping**

**N361.1 – Explain the block diagram, operation, memory, types and inputs of PLC**

- PO1 (3): Requires understanding of engineering fundamentals and core electrical concepts.
- PO2 (2): Students analyse the internal structure of PLCs.
- PO3 (1): Involves basic understanding of PLC-based systems.
- PO4 (1): May use simple tools or simulation software for explanation.
- PO5 (2): Knowledge is applied in real-world systems with environmental and ethical implications.
- PO6 (1): Requires communication of technical knowledge.
- PO7 (2): Encourages continued learning about evolving PLC systems.
- PSO1 (3): Strong relevance to industrial automation.
- PSO2 (1): Indirectly helps in system maintenance.

**N361.2 – Explain the operation of various I/O modules of PLC**

- PO1 (3): Requires detailed technical knowledge of modules.
- PO2 (2): Analysis of I/O module characteristics and functions.
- PO3 (1): Conceptual design understanding.
- PO4 (2): Involves use of testing/simulation tools to verify I/O operations.
- PO5 (2): Application in industrial environments.
- PO6 (1): Communication within team projects or maintenance.
- PO7 (2): Keeping pace with new I/O technologies.

- PSO1 (3): Central to automation tasks.
- PSO2 (2): Helps in testing and maintenance of modules.

### **N361.3 – Develop the PLC program using Ladder Logic for various applications**

- PO1 (3): Applies programming and control logic fundamentals.
- PO2 (3): Identifies and solves logic-based automation problems.
- PO3 (3): Involves complete solution design using Ladder Logic.
- PO4 (3): Uses PLC programming tools and software extensively.
- PO5 (2): Applications often deal with sustainability or safety concerns.
- PO6 (2): Requires team work and communication during project work.
- PO7 (2): Encourages learning new programming approaches.
- PSO1 (3): Core skill for automation systems.
- PSO2 (3): Strong application in equipment operation and testing.

### **N361.4 – Explain networking protocols and standards in industrial automation**

- PO1 (2): Uses foundational technical knowledge.
- PO2 (2): Analyse network protocols and data transmission.
- PO3 (2): Understanding design of communication networks.
- PO4 (2): Applies tools like Modbus simulators or protocol analyzers.
- PO5 (3): Vital for ethical, safe, and sustainable communication design.
- PO6 (2): Communication is key in teamwork and documentation.
- PO7 (3): Rapid changes in industrial communication standards demand lifelong learning.
- PSO1 (2): Relevant to system communication setups.
- PSO2 (2): Supports maintenance and protocol testing.

### **N361.5 – Explain the operation and application of SCADA**

- PO1 (2): Requires core understanding of SCADA systems.
- PO2 (2): Analyse how SCADA manages industrial processes.
- PO3 (2): Involves conceptual system design in monitoring systems.
- PO4 (2): Involves working with SCADA software tools.
- PO5 (3): SCADA is essential in safe, ethical, and sustainable operations.

- PO6 (2): Used in team-based system monitoring projects.
- PO7 (2): SCADA tools evolve; demands continuous learning.
- PSO1 (3): Strong industrial relevance.
- PSO2 (3): Used in equipment monitoring and operational safety.

<b>Year &amp; Sem:</b>	III & VI
<b>Course Code:</b>	N362
<b>Course Title:</b>	Power Electronics and Drives

**Course Outcome:**

<b>CO</b>	<b>After completing the course, the students will be able to,</b>
N362.1	Interpret the performance of switching devices, triggering and commutation circuits of SCR
N362.2	Explain the working of line commutated phase-controlled converter

N362.3	Explain the working of different types of choppers and inverter
N362.4	Explain the basic concepts of DC motor drive
N362.5	Explain the basic concepts of AC motor drive

**CO-PO, PSO Matrices:**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
N362.1	3	3	2	3	2	1	2	3	2
N362.2	3	3	3	2	2	1	1	3	2
N362.3	3	3	3	2	2	2	1	3	3
N362.4	2	2	2	2	2	1	1	3	3
N362.5	2	2	2	2	2	1	1	3	3
<b>N362</b>	<b>2.6</b>	<b>2.6</b>	<b>2.4</b>	<b>2.2</b>	<b>2</b>	<b>1.2</b>	<b>1.2</b>	<b>3</b>	<b>2.6</b>

**Justification for CO-PO-PSO Mapping**

**N362.1 Interpret the performance of switching devices, triggering and commutation**

**circuits of SCRs**

- PO1 (3): Requires core understanding of power electronics principles and SCR operation.
- PO2 (3): Analyse triggering and commutation circuits using standard engineering approaches.
- PO3 (2): Involves conceptual design of firing and commutation circuits.
- PO4 (3): Includes use of test benches and tools to verify switching behaviour.
- PO5 (2): Applies in designing safe and sustainable industrial circuits.
- PO6 (1): May involve teamwork during lab experimentation.
- PO7 (2): Evolving semiconductor technologies require continuous learning.
- PSO1 (3): Central to solving problems in power electronics applications.
- PSO2 (2): Applicable in safe testing and maintenance of SCR-based circuits.

**N362.2 Explain the working of line-commutated phase-controlled converters**

- PO1 (3): Strong foundation in electrical fundamentals needed for converter analysis.
- PO2 (3): Analyse waveforms, firing angles, and performance of controlled converters.
- PO3 (3): Helps in assisting converter design for specific load conditions.
- PO4 (2): Utilizes lab setups for performance testing of converters.
- PO5 (2): Supports sustainable energy conversion systems.
- PO6 (1): Minor involvement in managing converter-based projects.
- PO7 (1): Basic need for updating on newer converter control techniques.

- PSO1 (3): Directly related to power system control and rectification.
- PSO2 (2): Involves operation and testing under safety constraints.

### **N362.3 Explain the working of different types of choppers and inverters**

- PO1 (3): Requires strong conceptual knowledge of power conversion.
- PO2 (3): Analyse chopper and inverter behaviour under varying loads.
- PO3 (3): Supports design and configuration of inverter/chopper systems.
- PO4 (2): Uses lab tools for testing and waveform analysis.
- PO5 (2): Relevant to ethical and sustainable industrial applications.
- PO6 (2): Often used in project-based inverter/chopper labs.
- PO7 (1): Requires some awareness of modern power control methods.
- PSO1 (3): Highly applicable in industrial automation and drives.
- PSO2 (3): Involves safe testing, operation, and maintenance of converters.

### **N362. Explain the basic concepts of DC motor drives**

- PO1 (2): Requires fundamental knowledge of DC motor operation.
- PO2 (2): Analyse performance parameters such as torque and speed.
- PO3 (2): Involves selecting drive components for basic motor applications.
- PO4 (2): Uses lab tools for DC motor control and response testing.
- PO5 (2): Promotes safe use of drives in industry.
- PO6 (1): Low-level project or lab coordination possible.
- PO7 (1): Basic requirement for technological updates.
- PSO1 (3): Strong relevance to control of motor-based systems.
- PSO2 (3): Focused on equipment operation, safety, and troubleshooting.

### **N362.5 Explain the basic concepts of AC motor drives**

- PO1 (2): Core understanding of AC motor theory is essential.
- PO2 (2): Analyse parameters such as slip, power factor, and speed control.
- PO3 (2): Involves drive selection and basic system configuration.
- PO4 (2): Hands-on use of AC drive systems in lab settings.

- PO5 (2): Includes safe and ethical use in energy-efficient systems.
- PO6 (1): Some project involvement in AC motor drive labs.
- PO7 (1): Basic technological updates may be required.
- PSO1 (3): Key area in industrial motor control and automation.
- PSO2 (3): Drives safety, testing, and system integration in practice.

<b>Year &amp; Sem:</b>	III & VI
<b>Course Code:</b>	N3631
<b>Course Title:</b>	FACTS Devices

**Course Outcome:**

<b>CO</b>	<b>After completing the course, the students will be able to,</b>
N3631.1	Interpret the power flows and issues in transmission line.
N3631.2	Explain the reactive power compensation methods in transmission line
N3631.3	Explain the shunt compensation methods in transmission lines
N3631.4	Explain the series compensation methods in transmission lines.
N3631.5	Explain the reactive power and real power compensation techniques using advanced FACTS devices.

### CO-PO, PSO Matrices:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
N3631.1	3	3	2	2	2	1	2	3	2
N3631.2	3	3	2	2	2	1	2	3	2
N3631.3	3	2	2	2	2	1	2	3	2
N3631.4	3	2	2	2	2	1	2	3	2
N3631.5	3	3	3	3	2	2	3	3	3
<b>N3631</b>	<b>3</b>	<b>2.6</b>	<b>2.2</b>	<b>2.6</b>	<b>2</b>	<b>1.2</b>	<b>2.2</b>	<b>3</b>	<b>2.2</b>

#### **N3631.1 – Interpret power flow dynamics and associated issues in transmission lines.**

- PO1 (3): Strong understanding of electrical fundamentals is essential to interpret power flow and losses.
- PO2 (3): Analyse voltage, current, impedance, and power-related issues in transmission networks.
- PO3 (2): Involves suggesting basic solutions to manage or mitigate flow-related issues.
- PO4 (2): Use of simulation tools and instruments to analyse power flow in lab experiments.
- PO5 (2): Understanding power flow contributes to sustainable and reliable grid operations.
- PO6 (1): Limited but possible involvement in reporting and teamwork on power flow analysis.
- PO7 (2): Technological advancements in grid systems demand regular learning.
- PSO1 (3): Core aspect of power system operation and stability analysis.
- PSO2 (2): Supports testing and efficient operation of transmission systems.

#### **N3631.2 – Explain the reactive power compensation methods in transmission line**

- PO1 (3): Requires conceptual clarity on reactive power, power factor, and electrical behaviour.
- PO2 (3): Analyse compensation needs and effects on line voltage and system performance.
- PO3 (2): Suggest suitable compensation techniques for common scenarios.
- PO4 (2): Conduct practical testing of compensation effects using lab setups.
- PO5 (2): Compensation improves voltage profiles and system sustainability.
- PO6 (1): Some involvement in project activities involving compensation devices.
- PO7 (2): Stay updated with evolving compensation technologies and tools.
- PSO1 (3): Directly relates to solving reactive power issues in power systems.

- PSO2 (2): Enhances safe and efficient maintenance of compensated systems.

### **N3631.3 – Explain the shunt compensation methods in transmission lines**

- PO1 (3): Understanding system behaviour with shunt devices requires electrical fundamentals.
- PO2 (2): Analyse voltage support and load balancing through shunt compensation.
- PO3 (2): Supports configuration of shunt compensators like capacitors and reactors.
- PO4 (2): Perform measurements and simulations in lab to study compensation effects.
- PO5 (2): Aids in reducing losses and improving voltage regulation for sustainability.
- PO6 (1): May involve reporting findings and collaboration in practical labs.
- PO7 (2): Knowledge of latest compensation devices and techniques is beneficial.
- PSO1 (3): Vital for voltage control and reactive power management in power systems.
- PSO2 (2): Enhances skill in testing and maintaining compensation equipment.

### **N3631.4 – Explain the series compensation methods in transmission lines.**

- PO1 (3): Requires strong understanding of impedance control and line parameters.
- PO2 (2): Analyse impact on current flow and system stability due to compensation.
- PO3 (2): Supports design and implementation of basic series compensators.
- PO4 (2): Lab analysis of power flow changes due to series compensation.
- PO5 (2): Improves line efficiency and supports sustainable operation.
- PO6 (1): Some involvement in team activities during experiments.
- PO7 (2): Continuous learning of newer compensation technologies is required.
- PSO1 (3): Key skill in advanced power system operation and planning.
- PSO2 (2): Involved in safe operation and testing of line compensation schemes.

### **N3631.5 – Explain the reactive power and real power compensation techniques using advanced FACTS devices.**

- PO1 (3): Requires deep knowledge of electrical fundamentals and FACTS devices.
- PO2 (3): Analyse compensation techniques with advanced control strategies.
- PO3 (3): Involves designing solutions using FACTS for power flow and stability.
- PO4 (3): Use of advanced simulation tools and lab setups for FACTS-based studies.

- PO5 (2): FACTS devices promote energy efficiency and grid sustainability.
- PO6 (2): Involves managing projects or labs related to advanced compensation.
- PO7 (3): FACTS being an evolving field requires frequent knowledge updates.
- PSO1 (3): Directly contributes to advanced power system control and automation.
- PSO2 (3): Essential for safe handling, testing, and integration of modern equipment.

<b>Year &amp; Sem:</b>	III & VI
<b>Course Code:</b>	N364
<b>Course Title:</b>	PLC Practical

**Course Outcome:**

<b>CO</b>	<b>After completing the course, the students will be able to,</b>
N364.1	Execute PLC program using Ladder Logic Diagram with digital input
N364.2	Execute PLC program using Analog input instruction

**CO-PO, PSO Matrices:**

<b>CO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PSO1</b>	<b>PSO2</b>
N364.1	3	2	2	3	2	1	2	3	2
N364.2	3	2	2	3	2	1	2	3	2
<b>N364</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>2</b>

**Justification for CO-PO-PSO Mapping**

### **N364.1 – Execute PLC program using Ladder Logic Diagram with digital input**

- PO1 (3): Requires strong knowledge of electrical fundamentals, logic gates, and digital control systems.
- PO2 (2): Involves identifying and resolving issues in digital signal processing and PLC programming.
- PO3 (2): Students design basic ladder logic programs for specific digital input-output operations.
- PO4 (3): Uses modern PLC software and hardware to simulate and test ladder logic diagrams.
- PO5 (2): Encourages use of automation solutions that improve efficiency and adhere to ethical and sustainable practices.
- PO6 (1): Minor contribution in project collaboration or lab work requiring team coordination.
- PO7 (2): Involves learning updated tools and logic standards, fostering continued technical growth.
- PSO1 (3): Strongly supports technical proficiency in industrial automation and control systems.
- PSO2 (2): Reinforces safe and effective operation, maintenance, and testing of PLC-based equipment.

### **N364.2 – Execute PLC program using Analog input instruction**

- PO1 (3): Requires in-depth understanding of analog signals, transducers, and scaling in control systems.
- PO2 (2): Involves analysis and troubleshooting of signal variation, calibration, and sensor inputs.
- PO3 (2): Students design ladder logic integrating analog inputs for real-world applications like temperature or pressure control.
- PO4 (3): Uses PLC tools, analog input modules, and simulation platforms for accurate testing and validation.
- PO5 (2): Analog automation systems contribute to process optimization and environmental sustainability.
- PO6 (1): Minor application in organizing or managing basic project activities related to analog system integration.
- PO7 (2): Analog processing evolves with industry needs; students must stay current with changing tech.
- PSO1 (3): Directly linked to control system implementation using analog data in industrial environments.
- PSO2 (2): Prepares students to safely operate and maintain analog input systems and instruments.

<b>Year &amp; Sem:</b>	III & VI
<b>Course Code:</b>	N365
<b>Course Title:</b>	Electrical Circuits Simulation Practical

**Course Outcome:**

<b>CO</b>	<b>After completing the course, the students will be able to,</b>
N365.1	Simulate the basic circuits using simulation software
N365.2	Simulate the chopper and inverter circuit
N365.3	Simulate the power flow circuit of DC and AC Machines

**CO-PO, PSO Matrices:**

<b>CO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PSO1</b>	<b>PSO2</b>
N365.1	2	2	1	3	1	1	2	3	2
N365.2	2	2	2	3	1	1	2	3	2
N365.3	2	2	2	3	1	1	2	3	3
<b>N365</b>	<b>2</b>	<b>2</b>	<b>1.6</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>2.3</b>

**Justification for CO-PO-PSO Mapping**

**N365.1 – Simulate basic electrical circuits using simulation software**

- PO1 (2): Involves application of fundamental knowledge of electrical engineering and circuit theory.
- PO2 (2): Requires problem identification and analysis to simulate working circuits.

- PO3 (1): Basic level of design is involved in setting up simulations.
- PO4 (3): Strong use of modern simulation tools aligns directly with this PO.
- PO5 (1): Some exposure to simulation in sustainable/ethical context.
- PO6 (1): Minor project/task management may be involved.
- PO7 (2): Encourages engagement with evolving simulation technologies.
- PSO1 (3): Directly relates to technical problem-solving using appropriate tools.
- PSO2 (2): Simulations contribute to equipment understanding and safe practice.

### **N365.2 – Simulate chopper and inverter circuits**

- PO1 (2): Requires knowledge of power electronics and circuit theory.
- PO2 (2): Involves analysing specific switching and waveform behaviours.
- PO3 (2): Involves creating/modifying technical circuit configurations.
- PO4 (3): In-depth simulation and testing using engineering tools.
- PO5 (1): May explore efficient energy use in switching circuits.
- PO6 (1): Some project/task planning during simulations.
- PO7 (2): Continued learning of updated simulation techniques.
- PSO1 (3): Strong application of technical skills for chopper/inverter modelling.
- PSO2 (2): Enhances understanding of testing principles and safety.

### **N365.3 – Simulate power flow circuits of DC and AC machines**

- PO1 (2): Involves understanding of machines, electrical principles.
- PO2 (2): Power flow analysis involves problem-solving.
- PO3 (2): Configuring simulations for machine operations involves design elements.
- PO4 (3): Extensively uses modern simulation tools and techniques.
- PO5 (1): Can touch on energy sustainability in motor/load systems.
- PO6 (1): Minor involvement in planning/testing scenarios.
- PO7 (2): Learning about machine behaviour fosters life-long learning.
- PSO1 (3): Core skill of electrical engineers—machine circuit simulation.
- PSO2 (3): Closely ties to testing and maintaining machine systems.

<b>Year &amp; Sem:</b>	III & VI
<b>Course Code:</b>	N366
<b>Course Title:</b>	Power Electronics and Drives Practical

**Course Outcome:**

<b>CO</b>	<b>After completing the course, the students will be able to,</b>
N366.1	Apply the concept of AC & DC Drive for the relevant application
N366.2	Construct the trigger and commutation circuits of SCR
N366.3	Construct the rectifier, cyclo converter, inverter, chopper circuit

**CO-PO, PSO Matrices:**

<b>CO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PSO1</b>	<b>PSO2</b>
N366.1	3	2	2	2	2	1	2	3	3
N366.2	3	2	3	3	2	1	2	3	2
N366.3	3	2	3	3	2	1	2	3	2
<b>N366</b>	<b>3</b>	<b>2</b>	<b>2.6</b>	<b>2.6</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>2.3</b>

**Justification for CO-PO-PSO Mapping**

**CO N366.1 – Apply the concepts of AC and DC drives in relevant applications.**

- PO1 (3): Requires strong understanding of electrical fundamentals and machine principles.
- PO2 (2): Involves identifying appropriate drive systems and analysing their performance.
- PO3 (2): Drive applications may include configuration and basic design aspects.

- PO4 (2): Testing and analysis of drive circuits require standard tools and measurement techniques.
- PO5 (2): Drives play a key role in energy-efficient and sustainable systems.
- PO6 (1): Involves basic reporting and teamwork during lab/project activities.
- PO7 (2): Drives involve evolving technologies, supporting continual learning.
- PSO1 (3): Central to electrical engineering applications like motor control and automation.
- PSO2 (3): Directly linked to equipment operation, testing, and sustainable practices.

◇ **CO N366.2 – Construct the trigger and commutation circuits for SCRs.**

- PO1 (3): Requires application of electronics and circuit theory in SCR design.
- PO2 (2): Analysis of triggering conditions and commutation strategies is essential.
- PO3 (3): Involves designing and implementing functional circuit solutions.
- PO4 (3): Construction and testing require use of oscilloscopes, simulation tools, etc.
- PO5 (2): Encourages safe and efficient use of power components in systems.
- PO6 (1): Minor teamwork and communication involved during practical implementation.
- PO7 (2): Advances in semiconductor devices make continuous learning necessary.
- PSO1 (3): Strong relevance to solving industrial control circuit problems.
- PSO2 (2): Supports testing and validation of switching circuits with safety considerations.

**N366.3 – Construct the rectifier, cycloconverter, inverter, and chopper circuits.**

- PO1 (3): Requires deep understanding of power electronics and circuit operation.
- PO2 (2): Involves selection and analysis of appropriate converter configurations.
- PO3 (3): Includes full design and development of multiple power conversion circuits.
- PO4 (3): Utilizes advanced tools for simulation, construction, and measurement.
- PO5 (2): Emphasizes energy efficiency, safe operation, and sustainability in designs.
- PO6 (1): Requires limited project coordination and documentation.
- PO7 (2): Power electronics is a fast-evolving field, fostering lifelong learning.
- PSO1 (3): Key area for electrical engineers to provide industrial solutions.
- PSO2 (2): Enhances skills in operating and testing power conversion systems safely.

<b>Year &amp; Sem:</b>	III & VI
<b>Course Code:</b>	N367
<b>Course Title:</b>	Project Work

**Course Outcome:**

<b>CO</b>	<b>After completing the course, the students will be able to,</b>
N367.1	Apply theoretical concepts and principles learned during coursework to solve practical engineering problems encountered in the project.
N367.2	Demonstrate technical skills specific to the engineering domain relevant to the project.
N367.3	Utilize critical thinking and problem-solving abilities to identify, analyse, and develop solutions to engineering challenges throughout the project lifecycle.
N367.4	Develop project management competencies by planning, organizing, and executing tasks within defined timelines and resource constraints.
N367.5	Prepare and deliver project reports, presentations, and technical documentation that effectively communicate information to diverse stakeholders

**CO-PO, PSO Matrices:**

<b>CO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PSO1</b>	<b>PSO2</b>
N367.1	3	3	2	2	1	3	2	3	2
N367.2	3	2	2	3	1	3	1	3	3
N367.3	2	3	3	2	1	3	2	3	2
N367.4	1	2	2	1	2	3	1	2	3
N367.5	1	2	2	1	2	3	1	2	2
<b>N367</b>	<b>2</b>	<b>2.4</b>	<b>2.2</b>	<b>1.8</b>	<b>1.4</b>	<b>3</b>	<b>1.4</b>	<b>2.6</b>	<b>2.4</b>

**Justification for CO-PO-PSO Mapping**

**N367.1: Apply theoretical concepts and principles learned during coursework to solve practical engineering problems encountered in the project.**

- PO1 (3): Strong use of basic and specialized knowledge to address real-world engineering challenges.
- PO2 (3): Analyses practical problems using concepts learned during the course.
- PO3 (2): Moderate involvement in planning and proposing practical solutions.
- PO4 (2): Applies engineering tools and techniques to solve problems.
- PO5 (1): Limited relevance to sustainability and ethical aspects.
- PO6 (3): Demonstrates high involvement in analyzing societal and safety impacts.
- PO7 (2): Encourages adaptability and learning through real-world exposure.
- PSO1 (3): Direct application to electrical domain-related problems.
- PSO2 (2): Moderate involvement in implementing safe and standardized solutions.

**N367.2: Demonstrate technical skills specific to the engineering domain relevant to the project.**

- PO1 (3): Applies foundational and specialized knowledge in technical tasks.
- PO2 (2): Requires analysis of methods and processes in implementation.
- PO3 (2): Some involvement in planning and executing solutions.
- PO4 (3): High application of tools and techniques.
- PO5 (1): Marginal connection to sustainability or ethical concerns.
- PO6 (3): Strong focus on societal and health/safety considerations.
- PO7 (1): Basic level of self-improvement and learning adaptability required.
- PSO1 (3): Strong alignment with technical skills in the electrical domain.
- PSO2 (3): High focus on implementation under safety and technical norms.

**N367.3: Utilize critical thinking and problem-solving abilities to identify, analyse, and develop solutions to engineering challenges throughout the project lifecycle.**

- PO1 (2): Moderate application of core concepts.
- PO2 (3): High level of analytical skill in solving problems.
- PO3 (3): Strong emphasis on proposing and designing effective solutions.
- PO4 (2): Moderate use of modern tools and techniques.
- PO5 (1): Minor connection to sustainability or ethics.
- PO6 (3): High consideration of societal impacts and safety.

- PO7 (2): Encourages continuous learning and adaptability.
- PSO1 (3): Direct relevance to solving electrical domain issues.
- PSO2 (2): Moderate use of technical implementation within safe boundaries.

**N367.4: Develop project management competencies by planning, organizing, and executing tasks within defined timelines and resource constraints.**

- PO1 (1): Basic application of engineering knowledge in planning.
- PO2 (2): Moderate problem analysis for planning tasks.
- PO3 (2): Moderate involvement in planning and task allocation.
- PO4 (1): Limited use of tools; more focus on management.
- PO5 (2): Some awareness of sustainability and ethical planning.
- PO6 (3): Strong emphasis on safety, society, and resource constraints.
- PO7 (1): Low level of adaptability or learning required.
- PSO1 (2): Moderate relevance to planning in the electrical field.
- PSO2 (3): High adherence to safety and norms in execution.

**N367.5: Prepare and deliver project reports, presentations, and technical documentation that effectively communicate information to diverse stakeholders**

- PO1 (1): Minimal use of engineering knowledge; more focused on communication.
- PO2 (2): Involves some analytical presentation of results.
- PO3 (2): Documentation includes designing aspects to a moderate extent.
- PO4 (1): Minimal tool usage; more soft-skill oriented.
- PO5 (2): Some reflection on ethics and sustainability in reports.
- PO6 (3): Strong emphasis on communicating societal and safety impacts.
- PO7 (1): Minor need for self-improvement through learning.
- PSO1 (2): Moderate relevance to domain-specific reporting.
- PSO2 (2): Technical documentation supports safe implementation.