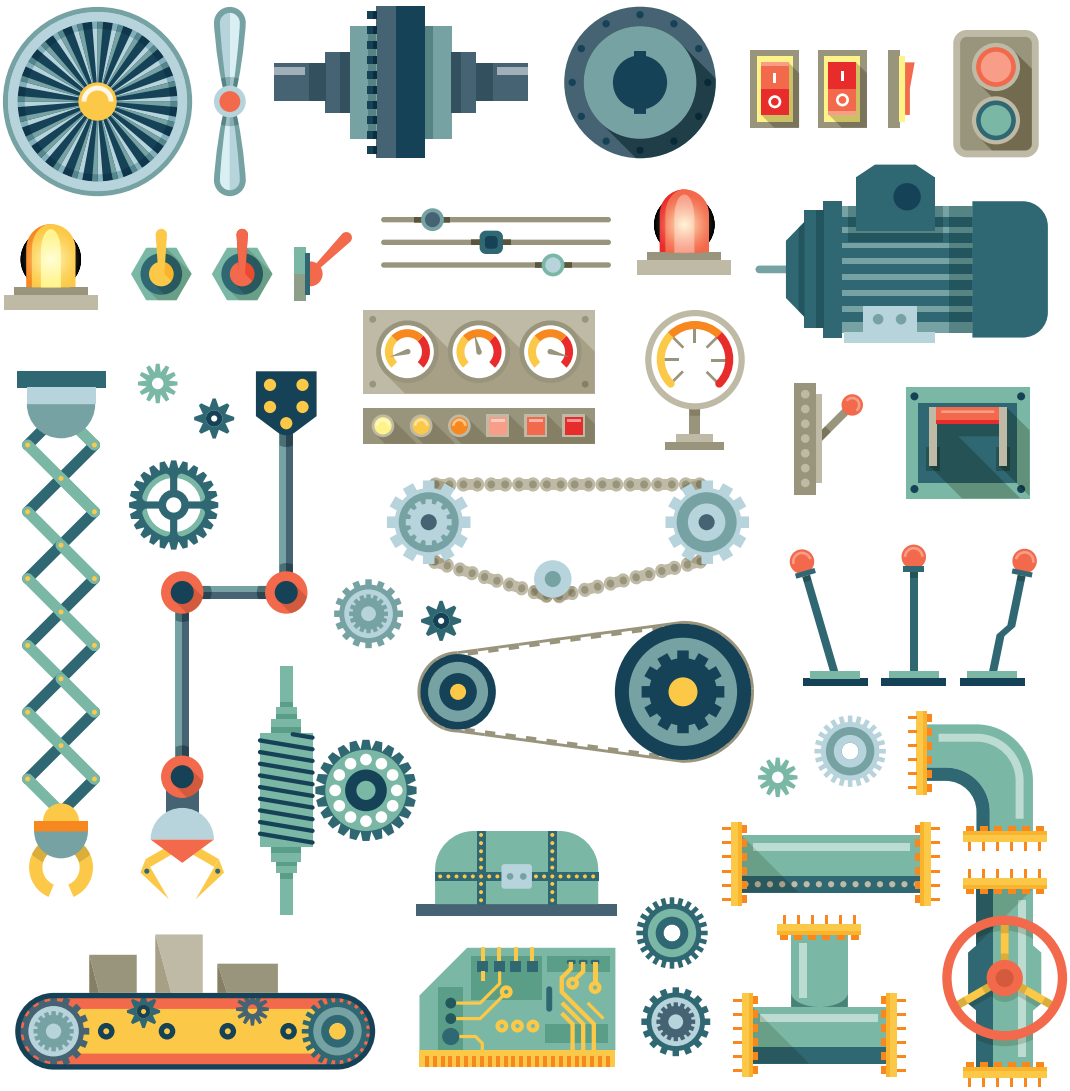
National Curriculum of Pakistan
2022-23

TECHNICAL EDUCATION

MOTOR WINDING

Grades 9-10



NATIONAL CURRICULUM COUNCIL SECRETARIAT
MINISTRY OF FEDERAL EDUCATION AND
PROFESSIONAL TRAINING, ISLAMABAD
GOVERNMENT OF PAKISTAN

بسم الله الرحمن الرحيم

National Curriculum of Pakistan
2022-23

TECHNICAL EDUCATION

MOTOR WINDING

Grades 9-10

NATIONAL CURRICULUM COUNCIL SECRETARIAT
MINISTRY OF FEDERAL EDUCATION AND
PROFESSIONAL TRAINING, ISLAMABAD
GOVERNMENT OF PAKISTAN

It is with great pride that we, at the National Curriculum Council Secretariat, present the first core curriculum in Pakistan's 75-year history. Consistent with the right to education guaranteed by Article 25-A of our Constitution, the National Curriculum of Pakistan (2022-23) aspires to equip every child with the necessary tools required to thrive in and adapt to an ever-evolving globalized world.

The National Curriculum is in line with international benchmarks, yet sensitive to the economic, religious, and social needs of young scholars across Pakistan. As such, the National Curriculum aims to shift classroom instruction from rote learning to concept-based learning.

Concept-based learning permeates all aspects of the National Curriculum, aligning textbooks, teaching, classroom practice, and assessments to ensure compliance with contemplated student learning outcomes. Drawing on a rich tapestry of critical thinking exercises, students will acquire the confidence to embark on a journey of lifelong learning. They will further be able to acknowledge their weaknesses and develop an eagerness to build upon their strengths.

The National Curriculum was developed through a nationwide consultative process involving a wide range of stakeholders, including curriculum experts from the public, private, and non-governmental sectors. Representatives from provincial education departments, textbook boards, assessment departments, teacher training departments, *deeni madaris*, public and private publishers, private schools, and private school associations all contributed their expertise to ensure that the National Curriculum could meet the needs of all Pakistani students.

The experiences and collective wisdom of these diverse stakeholders enrich the National Curriculum, fostering the core, nation-building values of inclusion, harmony, and peace, making the National Curriculum truly representative of our nation's educational aspirations and diversity.

I take this opportunity to thank all stakeholders, including students, teachers, and parents who contributed to developing the National Curriculum of Pakistan (2022-23)

Dr. Mariam Chughtai
Director
National Curriculum Council Secretariat
Ministry of Federal Education and Professional Training

Motor Winding

Progression Grid

Grades 9-10

Domain A: Concepts of Electricity

Standard:

- Introduce students to the fundamentals of electricity, electromagnetism, and basic motor principles through hands-on activities and interactive learning.
- Develop a deeper understanding of electromagnetism, motor principles, and practical motor winding techniques to encourage critical thinking and hands-on application.

Grade 9	**Grade 10**
Benchmark I: Students will be able to describe electricity, from its fundamental nature and safety measures to advanced concepts like electric and magnetic fields, enabling students to apply this knowledge in real-world scenarios.	
Student Learning Outcomes	
Students will be able to… [SLO:MW-09-A-01]: Explain what electricity is and its importance in our daily lives. [SLO:MW-09-A-02]:	Students will be able to… [SLO:MW-10-A-01]: Explore advanced concepts related to electricity: I. Electric field Ii. Magnetic field

List and explain the basic safety measures when dealing with electricity with respect to safety of equipment and individual: I. Electric discharge wristband Ii. Concept of Shielding Iii. Concept of bonding [SLO:MW-09-A-03]: Conduct simple experiments showcasing static electricity and its effects.	Iii. Electrostatic discharge Iv. AC/DC current [SLO:MW-10-A-02]: Discuss the concepts of voltage, current, resistance, and Ohm's Law. [SLO:MW-10-A-03]: Conduct experiments illustrating these concepts using circuits.
Benchmark II: Students will be able to conduct ahands-on exploration of advanced concepts like electromagnetism, electric and magnetic fields, while emphasizing safety measures in handling electricity to cultivate a well-rounded and practical knowledge base.	
Student Learning Outcomes	
Students will be able to [SLO:MW-09-A-04]: ExploreCircuits and Circuit Components: [SLO:MW-09-A-05]: Describe Electrical circuits, including components like resistors, capacitors, and conductors.	Students will be able to [SLO:MW-09-A-04]: Understand Voltage, Current, and Resistance Relationships: [SLO:MW-10-A-05]: Explore in detail, the fundamental electrical concepts and their relationships, introducing Ohm's Law.

[SLO:MW-09-A-06]: Explore Electrostatic Discharge (ESD): [SLO:MW-09-A-07]: Describe the phenomenon of static electricity and its potential effects on electronic devices. [SLO:MW-09-A-08]: Describe Safety Measures in Handling Electricity: [SLO:MW-09-A-09]: Describe safety precautions, including the use of electric discharge wristbands, shielding, and bonding to ensure safe practices with electrical equipment.	[SLO:MW-09-A-06]: Use Direct Current (DC) and Alternating Current (AC): [SLO:MW-10-A-07]: Differentiate between DC and AC, understanding their applications in everyday devices. [SLO:MW-09-A-08]: Explore Electromagnetism: [SLO:MW-10-A-09]: Describe the relationship between electricity and magnetism, including the concept of electromagnets. Electric Fields: [SLO:MW-10-A-10]: Describe the concept of electric fields and their influence on charged particles.

Domain B: Electromagnetism

Grade 9	**Grade 10**

Benchmark I: Students will be able to explain the relationship between magnetic fields and electric currents, demonstrating an understanding of the principles of electromagnetic induction, Faraday's law, and Lenz's law.

Student Learning Outcomes	
Students will be able to: Demonstrate the understanding of Magnets and Magnetism: [SLO:MW-09-B-01]]: • Identify and explain the basic principles of magnetism. [SLO:MW-09-B-02]: • Differentiate between materials that are magnetic and non-magnetic. [SLO:MW-09-B-03]: • Describe how magnets can attract or repel certain objects. Classify and Analyze Types of Magnets and Their Properties: [SLO:MW-09-B-04]: • Classify magnets into different types based on their shapes and sizes. [SLO:MW-09-B-05]:	Students will be able to: Understand the Principles of Electromagnetic Induction: • [SLO:MW-10-B-01]: Define electromagnetic induction and explain how it is related to the interaction between magnetic fields and electric currents. [SLO:MW-10-B-02]: • Identify the key components involved in electromagnetic induction processes. [SLO:MW-10-B-03]: • Illustrate the concept of Faraday's law and Lenz's law in the context of electromagnetic induction. Demonstrate the Relationship Between Electricity and Magnetism: [SLO:MW-10-B-04]: • Conduct experiments to show the generation of an electric current through electromagnetic induction. [SLO:MW-10-B-05]: • Relate the movement of a magnet or changing magnetic fields to the production of electric current.

• Explain the properties of various types of magnets, including permanent and temporary magnets. [SLO:MW-09-B-06]: • Analyze how the magnetic strength of a magnet is influenced by its size and material.	[SLO:MW-10-B-06]: • Explore and explain the factors that affect the magnitude of induced electromotive force (EMF) in a conductor.
Benchmark II: Students will be able to describedesign and conduct experiments showcasing the conversion of magnetic energy into electrical energy, effectively illustrating the practical applications of electromagnetic induction in generators and transformers, and evaluating their efficiency in real-world contexts.	
Student Learning Outcomes 9th	**Student Learning Outcomes 10th**
Students will be able to: Explore Magnetic Poles, Attraction, and Repulsion: [SLO:MW-09-B-07]: • Define and differentiate between magnetic poles (north and south). [SLO:MW-09-B-08]: • Explain the concept of magnetic attraction and repulsion. [SLO:MW-09-B-09]:	Students will be able to: Apply Electromagnetic Induction in Real-World Applications: [SLO:MW-10-B-07]: Identify and analyze practical applications of electromagnetic induction in everyday life and technology. [SLO:MW-10-B-08]: Design experiments to demonstrate specific applications of electromagnetic induction, such as generators or transformers. [SLO:MW-10-B-09]:

• Predict and observe the behavior of magnets when brought close to each other, considering the poles involved. Conduct Experiments Demonstrating Magnetic Fields and Their Effects: [SLO:MW-09-B-10]: • Design and conduct experiments to illustrate the presence of a magnetic field around a magnet. [SLO:MW-09-B-11]: • Analyze the effects of magnetic fields on various materials, such as iron filings or other magnets. [SLO:MW-09-B-12]: • Draw conclusions from experiments about the nature and strength of magnetic fields.	Evaluate the efficiency and effectiveness of electromagnetic induction-based devices in various contexts.

Domain C: Understanding Motors

Grade 9	**Grade 10**

Benchmark I: **Students will be able to accurately diagram and explain the operating principles of motors and generators, demonstrating a deep understanding of the conversion processes between electrical and mechanical energy**

Student Learning Outcomes	
Students will be able to: **Understand the Concept of Motors:** [SLO:MW-09-C-01]: Explain the fundamental concept of motors, defining what a motor is and its primary purpose in various devices and systems. **Comprehend Electromagnetic Principles in Motors:** [SLO:MW-09-C-02]: Describe and illustrate the functioning of motors based on the principles of electromagnetism, including how the interaction of magnetic fields and electric current generates motion.	Students will be able to: **Grasp Principles of Motors and Generators:** [SLO:MW-10-C-01]: Describe the fundamental principles underlying the operation of both motors and generators, including the conversion of electrical and mechanical energy. **Compare and Contrast Motors and Generators:** [SLO:MW-10-C-02]: Analyze and articulate the similarities and differences between motors and generators, highlighting their distinct functions and applications in various contexts.

Benchmark II: Students should be able to create a comprehensive comparative analysis highlighting the key distinctions between motors and generators, showcasing their ability to critically evaluate and communicate the functional differences and applications of each

Student Learning Outcomes 9th	Student Learning Outcomes 10th
Students will be able to: Identify and Describe Motor Components: [SLO:MW-09-C-03]: Recognize and articulate the different parts of a motor, elucidating the specific functions of each component in the context of motor operation. Demonstrate Basic Motor Construction: [SLO:MW-09-C-04]: Build and demonstrate a simple motor using magnets and wires, showcasing a practical understanding of how the interaction between magnetic and electrical forces results in motor movement.	Students will be able to: Explore Applications in Devices and Industries: [SLO:MW-10-C-03]: Examine and discuss the diverse roles of motors and generators in different devices and industries, recognizing their significance in powering machinery, appliances, and systems. Conduct Hands-On Experiments: [SLO:MW-10-C-04]: Plan and conduct hands-on experiments that illustrate the principles of both motors and generators, demonstrating the ability to apply theoretical knowledge to practical scenarios.

Domain D: Motor Winding

Grade 9	Grade 10
Benchmark I: Students will be able to describe the basics of motor winding to apply that knowledge through a hands-on activity.	

Student Learning Outcomes	
Students will be able to:	Students will be able to:
Understand Motor Winding Basics: [SLO:MW-09-D-01]: Demonstrate a clear understanding of the fundamental principles of motor winding, including the purpose and significance of winding in the functioning of electric motors.	**Grasp Advanced Motor Winding Concepts:** [SLO:MW-10-D-01]: Develop a comprehensive understanding of advanced motor winding techniques, including different wire gauges, winding patterns, and their impact on motor performance.
Explain the Role of Coils and Wire Winding: [SLO:MW-09-D-02]: Articulate the role of coils and wire winding in motors, detailing how these components contribute to the generation of magnetic fields and the conversion of electrical energy into mechanical motion.	**Discuss Factors Affecting Motor Performance:** [SLO:MW-10-D-02]: Analyze and discuss the various factors that influence motor efficiency and power output, considering the role of advanced winding techniques in optimizing motor functionality.
Benchmark II: Students will be able to applycritical thinking and analysis in assessing motor efficiency and power output.	
Student Learning Outcomes 9th	**Student Learning Outcomes 10th**
Students will be able to:	Students will be able to:

Apply Knowledge through Hands-On Activity: [SLO:MW-09-D-03]: Engage in a hands-on activity by building a simple electromagnet, demonstrating the ability to apply theoretical knowledge of motor winding to practical construction. [SLO:MW-09-D-04]: **Illustrate the relationship between** coils, wire turns, and magnetic strength.	**Apply Advanced Winding Techniques:** [SLO:MW-10-D-03]: Demonstrate the ability to apply advanced winding concepts through a hands-on activity, constructing a more complex motor with varied winding techniques, showcasing practical skills in motor design. **Evaluate Motor Efficiency and Power Output**: [SLO:MW-10-D-04]: Assess and evaluate the efficiency and power output of motors based on advanced winding techniques, demonstrating the capacity to critically analyze and draw conclusions about motor performance.

Domain E: **Building a Simple Motor**

Grade 9	**Grade 10**
Benchmark I: Students will be able to apply motor construction skills in practical projects for specific applications, showcasing their ability to translate theoretical knowledge into hands-on applications. They will explore and discuss the societal and industrial impact of motor technology, recognizing the diverse applications and contributions of motors in technological advancements.	
Student Learning Outcomes	

Students will be able to: Assemble a Basic Motor: [SLO:MW-09-E-01]: Successfully build a basic motor using step-by-step instructions and common materials, such as a battery, magnets, wire, and a coil. Demonstrate Understanding of Motor Components: [SLO:MW-09-E-02]: Explain the role and function of each component used in the construction of the simple motor, illustrating a comprehensive understanding of the assembly process.	Students will be able to: Apply Motor Construction Skills: [SLO:MW-10-E-01]: Engage in practical projects involving motor construction for specific applications, such as fans, small vehicles, or model machinery, demonstrating the ability to apply motor-building skills in real-world contexts. Discuss Practical Implications of Motor Technology: [SLO:MW-10-E-02]: Explore and discuss the impact of motor technology on society and various industries, recognizing the diverse applications and contributions of motors in enhancing technological advancements.
Benchmark II: Students will be able to critically analyze the design and functionality of motor-based projects, evaluating their effectiveness and efficiency. Collaborative skills will be emphasized as students work together on motor-based projects, fostering effective communication, problem-solving, and project management abilities.	
Student Learning Outcomes 9th	**Student Learning Outcomes 10th**
Students will be able to: Understand the Connection between Motor Winding and Electromagnetism:	Students will be able to: Analyze Motor Project Design: [SLO:MW-10-E-03]:

[SLO:MW-09-E-03]: Articulate the connection between motor winding, electromagnetism, and motor movement, elucidating the principles that drive the functionality of the assembled motor. Apply Knowledge in Motor Construction: [SLO:MW-09-E-04]: Apply acquired knowledge in a practical context by successfully assembling a simple motor, showcasing the ability to integrate theoretical understanding with hands-on construction skills.	Critically analyze and evaluate the design and functionality of motor-based projects, showcasing the ability to assess the effectiveness and efficiency of motor applications in specific contexts. Collaborate on Motor-Based Projects: [SLO:MW-10-E-04]: Work collaboratively in groups or individually on motor-based projects, demonstrating effective communication, problem-solving, and project management skills in the context of practical applications.

Domain F: Safety and Maintenance

Grade 9	**Grade 10**
Benchmark I: Students will be able to identify and resolve complex motor issues, showcasing advanced problem-solving skills. Students will be able to demonstrate the application of advanced troubleshooting techniques in addressing intricate motor problems through hands-on exercises and case studies.	

Student Learning Outcomes	
Students will be able to:	Students will be able to:
Demonstrate Safety Protocols: [SLO:MW-09-F-01]: Exhibit a comprehensive understanding of safety precautions when working with electrical components, emphasizing the importance of safe handling practices to prevent accidents and injuries.	Develop Problem-Solving Skills for Motor Issues: [SLO:MW-10-F-01]: Cultivate effective problem-solving skills related to motor issues, demonstrating the ability to identify, analyze, and resolve complex problems encountered in motor operation.
Apply Basic Maintenance Skills: [SLO:MW-09-F-02]: Discuss and apply basic maintenance procedures for motors, showcasing the ability to conduct routine checks and adjustments to ensure optimal motor performance and longevity.	Apply Advanced Troubleshooting Techniques: [SLO:MW-10-F-02]: Utilize advanced troubleshooting techniques to address intricate motor problems, showcasing a deeper understanding of diagnostic methods and solutions beyond basic maintenance.
Benchmark II: Students will be able to successfully implement various maintenance strategies, and showcase their ability to enhance motor performance and prevent potential issues. Through critical analysis and improvement projects, students should exhibit a comprehensive understanding of motor performance, applying strategies to optimize efficiency and longevity.	
Student Learning Outcomes 9th	**Student Learning Outcomes 10th**

Students will be able to: Troubleshoot and Repair Motor Issues:	Students will be able to: Implement Maintenance Strategies:
[SLO:MW-09-F-03]:	[SLO:MW-10-F-03]:
Identify and troubleshoot common motor issues, demonstrating the capacity to diagnose problems and implement simple fixes, fostering problem-solving skills in the context of motor maintenance. Highlight Significance of Regular Maintenance:	Explore and implement various methods for maintaining and improving motor performance, demonstrating proficiency in preventive measures and enhancement techniques to optimize motor functionality. Analyze and Improve Motor Performance:
[SLO:MW-09-F-04]:	[SLO:MW-10-F-04]:
Articulate the significance of regular motor maintenance in prolonging the lifespan of motors, emphasizing the role of preventive measures in avoiding issues and ensuring sustained functionality.	Critically analyze motor performance, identifying areas for improvement and implementing strategies to enhance efficiency and longevity, reflecting a comprehensive understanding of motor maintenance and optimization.

NATIONAL CURRICULUM COUNCIL SECRETARIAT
MINISTRY OF FEDERAL EDUCATION AND
PROFESSIONAL TRAINING, ISLAMABAD
GOVERNMENT OF PAKISTAN