Ministry of Higher Education and Scientific Research

Northern Technical University

Kirkuk Polytechnic College

Department of Oil Equipment Inspection and Welding Technologies

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Course Description: Oil Equipment Inspection and Welding Technologies

Vision

The Department of Oil Equipment Inspection and Welding Technologies aspires to become a leading center for education, training, and scientific research. Our vision is to prepare highly skilled technical and professional personnel proficient in advanced inspection and welding techniques. We aim to meet the requirements of the local and international oil and industrial sectors while

adhering to the highest standards of quality, occupational safety, and sustainable development.

Mission

To produce graduates who are academically and practically qualified in the field of oil equipment inspection and welding. This is achieved by providing distinguished technical education and advanced training programs focused on meeting the demands of the local and regional labor markets. The department is committed to developing and utilizing modern technologies to enhance the efficiency and sustainability of oil operations, emphasizing the application of international quality standards, occupational safety, and environmental protection.

Objectives

The department seeks to achieve a sustainable positive impact on the oil sector through the following core objectives:

1. **Preparation of Qualified Personnel:** Graduating specialists equipped with the technical knowledge and practical skills necessary for the oil and industrial sectors.
2. **Enhancing Quality and Safety:** Implementing international standards for quality and safety in inspection and welding processes to ensure equipment efficiency and risk mitigation.
3. **Community Service:** Providing consultancy and training services to institutions and companies to strengthen local capabilities.
4. **Labor Market Integration:** Keeping pace with global technological advancements and developing curricula that meet evolving local and regional market needs.

5. **Professional Skills Development:** Organizing workshops and courses to enhance the readiness of students, graduates, and professionals to handle the latest industry technologies.

Graduate Job Description

Graduates play a vital role in the sustainability of the oil sector by ensuring the efficiency and safety of equipment, thereby supporting the national economy. A graduate is a qualified technical specialist capable of performing tasks related to the inspection, maintenance, and repair of oil equipment using state-of-the-art technologies, including:

1. Inspection and Evaluation

Conducting **Non-Destructive Testing (NDT)** to detect defects, corrosion, or cracks using:

- **Radiographic Testing (RT)**

- **Ultrasonic Testing (UT)**
- **Magnetic Particle Testing (MT)**
- **Liquid Penetrant Testing (PT)**
- Evaluating equipment condition and recommending repairs or replacements.

2. Welding Operations

- Executing advanced welding processes such as **Shielded Metal Arc Welding (SMAW)**, **Gas Metal Arc Welding (GMAW)**, and **Gas Tungsten Arc Welding (TIG)**.
- Repairing oil equipment, pipelines, and tanks in accordance with international standards (**ASME, AWS, API**).

Study Plan | First Semester | First Stage

#	Course Title	Course Type	Theoretical (Hrs)	Practical (Hrs)	Total Hours	Total Credits
1	Welding Fundamentals	Specialized	2	2	4	4
2	Engineering Inspection	Specialized	2	2	4	4
3	Mechanics*	Specialized	2	2	4	4
4	Welding Workshop	Specialized	-	10	10	10
5	Mathematics	Supportive	2	-	2	2

#	Course Title	Course Type	Theoretical (Hrs)	Practical (Hrs)	Total Hours	Total Credits
6	Computer Science	Supportive	1	1	2	2
7	English Language (1)	General	2	-	2	2
8	Democracy and Human Rights	General	2	-	2	2
9	Sport	General	1	1	2	2
Total			**14**	**18**	**32**	**32**

Study Plan | First Stage | Second Semester

#	Course Title	Course Type	Theory (Hrs)	Practical (Hrs)	Total Hours	Credits
1	Welding Technology	Specialized	2	2	4	4
2	Engineering Inspection in Oil Facilities	Specialized	2	2	4	4
3	Welding Machines	Specialized	2	2	4	4
4	Specialized Welding Workshop	Specialized	-	4	4	4
5	Corrosion	Specialized	2	0	2	2

#	Course Title	Course Type	Theory (Hrs)	Practical (Hrs)	Total Hours	Credits
6	Workshops	Specialized	-	6	6	6
7	Computer-Aided Design (CAD)	Supportive	-	2	2	2
8	Safety and Industrial Management	Supportive	2	-	2	2
9	Arabic Language	General	2	-	2	2
Total			**12**	**18**	**30**	**30**

Study Plan | Second Stage | First Semester

#	Course Title	Course Type	Theory (Hrs)	Practical (Hrs)	Total Hours	Credits
1	Welding Processes	Specialized	2	2	4	4
2	Oil Equipment Technology	Specialized	2	-	2	2
3	Welding Non-Destructive Testing (NDT)*	Specialized	2	2	4	4
4	Fundamentals of Oil Equipment	Specialized	-	10	10	10

#	Course Title	Course Type	Theory (Hrs)	Practical (Hrs)	Total Hours	Credits
	Welding Workshop					
5	Project (1)	Specialized	2	2	4	4
6	Computer Science	Supportive	1	1	2	2
7	English Language (2)	General	2	-	2	2
8	Crimes of the Baath Regime in Iraq	General	2	-	2	2

#	Course Title	Course Type	Theory (Hrs)	Practical (Hrs)	Total Hours	Credits
Total			**13**	**17**	**30**	**30**

Study Plan | Second Stage | Second Semester

#	Course Title	Course Type	Theory (Hrs)	Practical (Hrs)	Total Hours	Credits
1	Metallurgy	Specialized	2	2	4	4
2	Applications of Petroleum	Specialized	2	-	2	2

#	Course Title	Course Type	Theory (Hrs)	Practical (Hrs)	Total Hours	Credits
	Equipment Technology					
3	Applications of Nondestructive Welding Tests*	Specialized	2	2	4	4
4	Engineering & Technical Drawing for Welding Design	Specialized	-	2	2	2

#	Course Title	Course Type	Theory (Hrs)	Practical (Hrs)	Total Hours	Credits
5	Specialized Petroleum Equipment Welding Workshop	Specialized	-	10	10	10
6	Project (2)	Specialized	2	2	4	4
7	Occupational Ethics	General	2	-	2	2
8	Arabic Language (2)	General	2	-	2	2
Total			**12**	**18**	**30**	**30**

7. Summary Table (Statistical Overview)

Description	**Value / Metric**
Total hours for both levels (including French Language)	124 Hrs
Total hours for the First Level	62 Hrs
Total hours for the Second Level	60 Hrs
Total actual hours for both levels (excluding French)	**122 Hrs**
Total actual credits for both levels (excluding French)	**122 Credits**
Theory hours (Level 1, Semester 1)	14 Hrs
Practical hours (Level 1, Semester 1)	18 Hrs
Theory hours (Level 1, Semester 2)	12 Hrs
Practical hours (Level 1, Semester 2)	18 Hrs

Description	**Value / Metric**
Theory hours (Level 2, Semester 1)	13 Hrs
Practical hours (Level 2, Semester 1)	17 Hrs
Theory hours (Level 2, Semester 2)	12 Hrs
Practical hours (Level 2, Semester 2)	18 Hrs
Total actual theoretical hours for both levels	**51 Hrs**
Percentage of theoretical hours	**42%**
Total actual practical hours for both levels	**71 Hrs**
Percentage of practical hours	**58%**
Total hours of Specialized courses (Both levels)	82 Hrs
Percentage of Specialized courses	67%

Description	Value / Metric
Total hours of Supportive courses (Both levels)	20 Hrs
Percentage of Supportive courses	16%
Total hours of General courses (Both levels)	22 Hrs
Percentage of General courses	18%
Summer Training Hours	**270 Hrs**

First Stage Syllabus | First Semester

1. Welding Fundamentals

Course Goal: To introduce the student to the theoretical and practical foundations of various welding processes, enabling them to acquire the skills necessary to operate different welding machines and equipment.

Week	Theoretical Curriculum	Practical Curriculum
1	**Introduction to Welding & Safety:** Definition of welding, safety regulations: general precautions, ventilation, personal protective equipment (PPE), cylinder handling, connections, and fire safety rules.	Practical application of theoretical concepts.
2-3	**Welding Basics:** Types and applications, joint design, welding angles, edge preparation, weld pool dynamics, welding positions, welding maneuvers, and basic welding symbols.	Practical application of theoretical concepts.

Week	Theoretical Curriculum	Practical Curriculum
4-6	**Arc Welding (SMAW):** Theory of arc welding, metal transfer modes, advantages of arc welding, introduction to Shielded Metal Arc Welding (SMAW), currents used, equipment, machine adjustment, and technical methods (arc striking, stability, and re-striking).	Practical application of theoretical concepts.
7-9	**Electrodes (SMAW):** Definition and classification of electrodes, specifications, the function of Flux, and the relationship between metal	Practical application of theoretical concepts.

Week	Theoretical Curriculum	Practical Curriculum
	thickness, electrode diameter, and current intensity.	
10-11	**Gas Welding:** Principles, advantages/disadvantages, gases used, and equipment (cylinders, regulators, gauges, hoses, safety valves, and torches).	Preparing joints, practicing welding maneuvers, and performing lap joints on mild steel using Oxy-Acetylene.
12-15	**Flame & Techniques:** Flame types and zones, flame adjustment, weld pool and bead control, filler wire classification, fluxing agents, pipe	Practical: Butt joints, internal/external fillet welds on mild steel, copper pipe

Week	Theoretical Curriculum	Practical Curriculum
	welding, and oxy-fuel gas cutting.	welding, and metal cutting training.

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2. Engineering Inspection

Course Goal: By the end of the year, the student shall be able to classify destructive tests, evaluate mechanical properties, and identify international standards for engineering inspection.

Week	Theoretical Topics	Practical Application
1	Definition of Engineering Inspection, classification of engineering materials and tests, and engineering units.	Application of theory.

Week	Theoretical Topics	Practical Application
2-4	**Tensile Testing:** General concept, terminology, stress-strain curve, calculating mechanical properties, tensile testing machines, standard specimens, and evaluation of results.	

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| 5-6 | Compression Testing: Concept, terminology, stress-strain curve, standard specimens, procedure, and analysis of results. | Application of theory. |

| 7-10 | Hardness Testing: Brinell, Vickers, Rockwell, and Micro-hardness testing methods. | Application of theory. |

| 11-12 | Impact Testing: General concept, calculating impact energy, types of tests

(Charpy/Izod), standard specimens, and temperature effects. | |

| 13-15 | Bend Testing: General concept, standard specimens, evaluating results, and guided bend tests for welds. | Application of theory. |

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3. Welding Workshop (1)

Course Goal: To acquire manual skills in executing welding processes and the ability to operate machinery and equipment used in a professional welding environment.

Week	Practical Tasks and Details
1	**Occupational Safety:** PPE and safety protocols. Initial training on Shielded Metal Arc Welding (SMAW) equipment and electrode installation.
2-3	Flat position bead-on-plate (SMAW) and overlapping beads on mild steel.

Week	Practical Tasks and Details
4-5	Butt joint welding in the flat position (**1G**) using SMAW.
6-8	Butt joint welding in the horizontal position (**2G**) using SMAW.
9-10	Butt joint welding in the vertical-up position (**3G**) using SMAW.
11-15	**Gas Welding (Oxy-Acetylene):** Equipment setup, flame adjustment (Neutral, Oxidizing, Carburizing), filler rods, and flux. Executing butt, fillet, and corner joints. Copper pipe welding and thermal cutting.

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4. Engineering Mechanics

Course Goal: To study the effects of forces on bodies in static and dynamic states, and to analyze stresses and strains resulting from various loads.

Week	Theoretical Subjects	Practical / Lab Topics
1-3	**Statics:** Scalars and vectors, force systems, Cartesian components, and 2D concurrent force resultants.	Lab safety, report writing, and graphical force resolution.
4-6	**Moments & Couples:** Moment of a force, couples, 3D non-concurrent force systems.	Analytical methods for 3D resultants and moment applications.
7-8	**Equilibrium & Friction:** Free body diagrams (FBD) and dry friction.	Equilibrium tests and friction experiments.
9-10	**Centroids & Inertia:** Center of gravity, centroids of	Finding centroids of composite shapes.

Week	Theoretical Subjects	Practical / Lab Topics
	simple/composite areas, and Moment of Inertia.	
11-12	**Dynamics:** Linear motion, Newton's Second Law.	Velocity and acceleration measurements.
13-15	**Strength of Materials:** Stress, strain, Hooke's Law, elasticity, plasticity, and types of beams/loads.	Beam testing and Stress-Strain analysis.

Administrative Notes for Workshops:

1. Students admitted late must complete missed exercises during the spring break.

2. Continuous assessment applies to workshops; there is no "Second Attempt" (الدور الثاني) for practical workshop grades.
3. Attendance: Students exceeding 10% unexcused absences (or 15% with a valid excuse).

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1. Computer Science

Course Name	Semester	Stage	Type	Weekly Hours	Credits
Computer Science	First	First	Supportive	Theory: 1	Practical: 1

Note: The detailed syllabus for this course was not provided in the text, but the administrative header and credit hours have been formatted accordingly.

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2. Mathematics

Course Goal: To introduce the student to the application of mathematics in scientific subjects, enhance logical thinking in problem-solving, and develop the ability to link data with mathematical knowledge to reach solutions.

Week	Theoretical Syllabus Details
1-2	**Fundamentals of Calculation:** Geometric theories - Areas and Volumes.
3-4	**Trigonometry:** Fundamental concepts and applications in engineering.
5-6	**Determinants:** Properties and solving simultaneous equations using Cramer's Rule (2x2 and 3x3 Determinants).
7-8	**Matrices:** Types of matrices, matrix addition/subtraction, multiplication, and properties of determinants.
9-11	**Differentiation:** Calculus of derivatives, derivative rules, and multivariate functions.

Week	Theoretical Syllabus Details
12	**Integration:** Basic laws, the relationship between differentiation and integration, definite and indefinite integrals.
13	**Implicit Integration:** Geometric applications of integration (calculating areas, volumes, and physical applications).
14-15	**Integration Techniques:** Advanced methods and final applications.

References:

1. Dr. Ramadan Mohammed & Dr. Ahmed Abdel-Ali, *Calculus*, 2001.
2. George B. Thomas, Jr., *Thomas' Calculus*, 12th Edition, 2010.

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3. English Language (1)

Course Goal: To develop the student's speaking, listening, and writing skills in English, enabling them

to handle basic work requirements that demand proficiency in the language.

Week	Theoretical Syllabus (Topics based on "Headway" Series)
1-2	**Unit 1 & 2:** Greetings (Am/Are/Is), possessive adjectives (My/Your/His/Her), and questions about "Your World."
3-4	**Unit 3 & 4:** Family and Friends, possessive nouns, Has/Have, and Adjective + Noun structures.
5-6	**Unit 5 & 6:** Present Simple (I/You/We/They/He/She), articles (A/An), questions, negatives, and Adverbs of Frequency.
7-8	**Unit 7 & 8:** Question words, pronouns, demonstratives (This/That), "There is/are," and Prepositions.

Week	Theoretical Syllabus (Topics based on "Headway" Series)
9-10	**Unit 9 & 10:** Past Simple (Regular/Irregular verbs), "Was/Were born," negatives, and the use of "Ago."
11-12	**Unit 11 & 12:** Modal verbs (Can/Can’t), requests, expressing desire (I’d like), and "Some/Any."
13-14	**Unit 13 & 14:** Present Continuous vs. Present Simple, and Future plans.
15	**Revision:** Writing emails and informal letters.

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4. Democracy and Human Rights

Course Goal: Students are expected to believe in the importance of human rights education, recognize their future role in promoting these rights, and internalize the values and ethics presented in the curriculum.

Week	Theoretical Syllabus Details
1-2	**Introduction:** Definition and goals. History in ancient civilizations (Mesopotamia) and in religions (Human Rights in Islam).
3-4	**Modern History:** International recognition (League of Nations & UN). Regional conventions (European 1950, American 1969, African 1981, Arab 1994).
5-6	**Organizations:** NGOs (ICRC, Amnesty International, HRW) and Human Rights in the Iraqi Constitutions.
7-8	**Rights & Freedoms:** Relationship between human rights and public freedoms. Economic, social, cultural vs. civil and political rights.
9	**Modern Rights:** Right to development, clean environment, solidarity, and religion.

Week	Theoretical Syllabus Details
10-11	**Safeguards (National & International):** Constitutional law, rule of law, press freedom, the role of the UN and regional unions (EU, Arab League, ASEAN).
12-13	**General Theory of Freedoms:** Origin of rights, legal classification, and the concept of the "Rule of Law State."
14-15	**Public Freedoms & Equality:** Historical evolution of equality, gender equality, and equality regardless of race or belief.

First Stage Syllabus | Second Semester

1. Welding Technology

Course Goal: To introduce students to advanced welding processes, enabling them to compare and select the most suitable techniques for specific industrial applications.

Week	Theoretical Curriculum	Practical Curriculum
1-3	**Brazing and Soldering:** Fundamentals, differences, filler metals, and application techniques.	Practical application of theoretical concepts.
4	**Resistance Welding:** Advantages and types (Spot Welding, Seam Welding, Projection Welding, and Flash Welding).	Training on Spot Welding of two mild steel sheets.
5	**Plasma Arc Cutting (PAC):** Principles, equipment, torch components, operation settings, safety protocols, and terminology.	Practical training on PAC operation and metal cutting exercises.
6-15	**Advanced Welding Processes:** Friction Welding, Electron Beam Welding	Practical application and observation of

Week	Theoretical Curriculum	Practical Curriculum
	(EBW), Electroslag Welding (ESW), Plastic Welding, Laser Beam Welding (LBW), Cold Pressure Welding, Explosive Welding, Ultrasonic Welding, Diffusion Welding, and Thermite Welding.	theoretical concepts.

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2. Engineering Inspection in Oil Facilities

Course Goal: To enable students to identify inspection types in the oil sector, evaluate mechanical properties of equipment, and master international inspection standards.

Week	Theoretical Syllabus	Practical Syllabus
1-2	Introduction to inspection in oil facilities; mechanical drawings for tanks and pipelines.	Reviewing mechanical drawings for tanks and piping systems.
3-5	**Documentation:** Welding Procedure Specification (**WPS**), Procedure Qualification Record (**PQR**), Welder Qualification Test (**WQT**), and Inspection and Test Plan (**ITP**).	Preparing and reviewing WPS, PQR, WQT, and ITP documents.
6	**Reporting:** Welding and Inspection Reports.	Generating Daily Welding Reports (DWR).
7-9	**Storage Tank Inspection:** Types of tanks, inspection	Engineering inspection

Week	Theoretical Syllabus	Practical Syllabus
	plans for tank bottoms, shells, and roofs.	reporting and documentation.
10-11	**Pipeline Inspection:** Terminology, classification, and Inspection & Test Plans (ITP) for pipelines.	Fit-up inspection for tank and pipeline joints.
12-13	**Boiler Inspection:** Types of boilers, damage mechanisms, safety procedures, and inspection plans.	ITP for pipeline joints and fit-up inspections.
14-15	**Furnaces and Chimneys:** Introduction to furnace inspection, types, and specialized inspection plans.	ITP for boilers and pressure vessels.

3. Welding Machines

Course Goal: To understand the technical principles of welding machines and electric motors, including operation, troubleshooting, and maintenance.

Week	Theoretical Syllabus	Practical Syllabus
1-4	Arc welding machines: safety, technical specifications (Nameplate), installation, control panel functions, and current selection.	Practical application and equipment setup.
5	Resistance welding machines and their technical specifications.	Machine identification and specification review.

Week	Theoretical Syllabus	Practical Syllabus
6	Protection devices: thermal protection, alarm screens, and error code interpretation.	Testing protection devices in welding machines.
7-8	Electrical tools: Using **AVO meters** (Current, Voltage, Resistance) and Soldering Iron for electrical connections.	Practical training on measurement and electrical soldering.
9-14	**Maintenance:** Maintaining coils, cores, resistors, capacitors, and diodes within welding units.	Troubleshooting and maintenance exercises.
15	Introduction to advanced machines	Practical demonstration.

Week	Theoretical Syllabus	Practical Syllabus
	(e.g., Laser Welding units).	

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4. Corrosion

Course Goal: To provide a comprehensive understanding of metallic corrosion, its causes, measurement methods, and protection techniques.

Week	Theoretical Syllabus Details
1-2	**Fundamentals:** Definition, terminology (Anode, Cathode, Electrolyte, Polarization), Faraday's Law, and Electrochemical cells.
3-5	**Impacts:** Industrial damage, economic costs, and factors influencing corrosion rates.
6-8	**Corrosion Types:** Uniform, Galvanic, Intergranular, Pitting, Stress Corrosion Cracking (SCC), Crevice, Selective Leaching,

Week	Theoretical Syllabus Details
	Erosion, Microbial (MIC), and Contact corrosion.
9-11	**Protection Methods:** Theoretical basics, **Cathodic Protection**, Anodic Protection, Coatings (properties and types), and Tape wrapping systems.
12-13	**Inhibitors & Insulation:** Types and characteristics of corrosion inhibitors; insulating joints and testing dielectric efficiency.
14-15	**Measurement & Survey:** Visual inspection, Weight Loss method, X-ray qualitative analysis, and selecting protection systems based on survey data.

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5. Welding Workshop (2)

Course Goal: To enhance manual dexterity in advanced welding positions and the operation of workshop machinery.

Week	Practical Tasks
1-3	Review of Oxy-Fuel gas welding (Flat, Vertical, and Inclined) and gas cutting.
4-5	SMAW: External Fillet (Flat position) and T-Joint Fillet (**1F**) in the flat position.
6-7	SMAW: Butt Joint in horizontal position (**2G**) and vertical-up position (**3G**).
8-9	SMAW: T-Joint Fillet in vertical-up position (**3F**) and V-Groove Butt Joint (**3G**).
10-15	**Pipe Welding (SMAW):** Welding steel pipes in Flat (**1G**) and Horizontal (**2G**) positions.

First Stage Syllabus | Second Semester (Continued)

1. General Workshops (Manufacturing Processes)

Course Goal: To acquire manual skills in manufacturing and machining using various hand tools and measuring instruments, and to operate production machinery with optimal efficiency.

Topic	Duration	Practical & Technical Details
Milling	3 Weeks	**Horizontal & Universal Milling:** Machine parts, speeds, feeds, and attachments (dividing heads, vises). **Cutters:** Cylindrical, shoulder, slotting, gear, and form cutters. Techniques for flat and inclined surfaces.

Topic	Duration	Practical & Technical Details
Foundry & Casting	3 Weeks	**Sand Casting:** Importance, safety, and mold types. Sand properties, additives, and mixing. **Practical:** Manual mold making for single-piece patterns, gating/riser systems, melting, pouring, and casting cleaning. **Furnaces:** Rotary, tilting, and stationary furnaces.

Topic	Duration	Practical & Technical Details
Benchwork & Maintenance	3 Weeks	**Measurement:** Vernier calipers (types and reading), depth gauges, and dividers. **Layout (Marking):** Surface plates, scribers, punches, squares, and protractors. **Operations:** Filing (types/cleaning), Hand sawing (blades/teeth), Chiseling, Drilling,

Topic	Duration	Practical & Technical Details
		Reaming, and Tapping/Threading.
Sheet Metal & Forging	3 Weeks	**Equipment:** Cutting shears, bending machines, and rolling machines. Manual sheet curving and seam types. **Developments:** Drawing simple developments for cylinders, intersecting shapes, and cones (full/truncated).

Topic	Duration	Practical & Technical Details
Turning (Lathe)	3 Weeks	**The Lathe:** Specifications, attachments, and tool types. **Operations:** Facing, straight turning, centering, step turning, and taper turning (various methods). **Threading:** Speed selection and cutting external triangular and square threads.

2. Computer-Aided Design (CAD)

Course Goal: By the end of the year, students shall be able to operate AutoCAD for engineering drawings, design models, configure interfaces, and analyze 3D shapes into 2D projections.

Week	Theoretical Syllabus (AutoCAD)	Practical Syllabus
1-2	**Introduction:** Interface, Ribbon, Workspace, ViewCube, and Navigation. File management: New, Open, Save, Zoom, and Pan. **Initial Setup:** Units and Limits.	Practical application of theory on AutoCAD software.
3-4	**Draw Commands:** Point, Line (coordinates), Multiline, Polyline, Rectangle, Polygon, Circle,	Exercises on basic shapes.

Week	Theoretical Syllabus (AutoCAD)	Practical Syllabus
	Arc, and Ellipse. Hatching and Sections.	
5-6	**Annotation & Styling:** Text (Single/Multiline), Styles, Line types, Line weight, and Colors. Properties modification.	Implementing technical drawing standards.
7-8	**Modify Commands:** Mirror, Array, Scale, Break, Extend, Fillet, Chamfer, Trim, and Explode.	Modifying complex geometries.
9	**Dimensioning:** Linear, Aligned, Radial, Angular, Baseline, Continuous, and Dimension Styles.	Adding full annotations to drawings.

Week	Theoretical Syllabus (AutoCAD)	Practical Syllabus
10-15	**Projection Theory:** Analyzing objects into projections. Drawing simple and complex engineering views (Front, Top, Side). Tests and practical evaluations.	

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3. Safety and Industrial Management

Course Goal: To preserve the safety and health of workers by providing a hazard-free environment and introducing students to industrial management concepts and their role in improving productivity.

Week	Theoretical Syllabus Details
1-2	**OSHA Standards:** Introduction, definitions, goals, site inspections, and violations. **Exit**

Week	Theoretical Syllabus Details
	Routes: Components, widths, and emergency exits.
3-5	**Hazard Management:** Electrical hazards, PPE for electrical work, Lockout/Tagout (LOTO). Equipment safety guards. **Noise Control:** OSHA hearing conservation program and PPE for head and hand protection.
6-8	**Fire Safety:** Fire types, extinguishers, and flammable liquids. **Hazardous Environments:** Gas cylinders (handling/storage), Confined space entry procedures.
9-11	**Industrial Tools:** Safety for forklifts, hand tools, and Chemical Hazard Communication (HazCom). **Welding Safety:** Specific precautions for various welding methods.
12-13	**Access & Lifting:** Ladders and Stairs rules. **Scaffolding:** Types, tying, and fall protection

Week	Theoretical Syllabus Details
	systems. Slings, chains, and lifting guidelines. **Radiation:** Types and protection.
14-15	**Industrial Management:** Administrative functions, Industrial Engineering, Factory layout (Product, Functional, and Mixed layouts), and site selection factors.

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4. Arabic Language

Course Goal: To familiarize students with the rules of the Arabic language specifically for administrative correspondence and professional discourse.

Week	Syllabus Details
1-3	**Orthography:** Common linguistic errors; rules for Taa (Marbuta, Tawila, Maftuha); Alif (Mamduuda, Maqsura); Sun and Moon

Week	Syllabus Details
	letters; and the distinction between Daad (ض) and Dhaa (ظ).
4-5	**Grammar & Punctuation:** Rules for writing the Hamza and punctuation marks.
6-8	**Syntax:** Distinguishing between Nouns and Verbs; the Objects (Mafa'eel); and the rules of Numbers (Adad).
9-11	Common linguistic errors; Nun and Tanween; meanings of Prepositions.
12-14	**Administrative Writing:** Formal structure of official letters; language of administrative discourse; and samples of official correspondence.

Summer Training (Field Internship)

The training period is **two months** within an industrial facility, where students rotate through various productive units, including:

1. **Welding Units:** Practical exposure to various welding techniques.
2. **Inspection Lines:** Observing and participating in NDT and quality control.
3. **Maintenance & Assembly:** Disassembly, repair, maintenance scheduling, and spare parts manufacturing.
4. **Machining Units:** Practical work in Lathe (Turning), Milling, and Benchwork units.
5. **Foundry & Forming:** Exposure to casting and metal forming processes.
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7. **Second Stage Syllabus | First Semester**
8. **1. Welding Processes**
9. **Course Goal:** To introduce Gas Metal Arc Welding (**GMAW**) and Gas Tungsten

Arc Welding (**GTAW**), their advantages, disadvantages, and main components, while developing the skill to execute various welding positions.

Week	Theoretical Syllabus	Practical Syllabus
1-3	**GMAW Fundamentals:** Definition, advantages/disadvantages, metal transfer modes, and equipment (Power source, wire feeder, welding guns, and gas units).	GMAW procedures: Assembly/disassembly of equipment and performing weld beads on mild steel.
4-7	**Shielding Gases & Consumables:** Types of gases, shielding properties, welding wires, and safety protocols for GMAW.	Practical training on lap joints, T-joints (Fillet), and external corner joints using GMAW.
8-15	**GTAW Fundamentals:**	Practical training on lap joints, fillet

Week	Theoretical Syllabus	Practical Syllabus
	Principles of Tungsten Inert Gas (TIG) welding, theory of operation, and currents used (AC/DC). **Equipment:** Cooling units (water/air), torches, and flow meters. **Electrodes:** Pure, Thoriated, and Zirconiated Tungsten. **Gases:** Argon, Helium, and mixtures.	welds, flange connections, and pipe welding using GTAW on mild steel.

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11. 2. Oil Equipment Technology (1)

12. **Course Goal:** To understand the mechanical operation of oil equipment (tanks, piping, etc.), identify common operational problems, and learn methods for mitigation and treatment.

Week	Theoretical Syllabus Details
1-2	**Storage Tanks:** Types (Fixed roof, Floating roof), high-pressure tanks, LPG tanks, tank accessories, calibration, and industrial safety.
3-4	**Piping Systems:** Piping networks, connections, gaskets, and valve types.
5-6	**Accessories & Support:** Filters, pipeline strainers, flares, lifting equipment, and scaffolding.
7-8	**Corrosion in Oil Units:** Types, protection methods, and treating corrosion in operational units (Light/Heavy oil units, distillation towers, and tanks).
9-12	**Chemical Reactors:** Reaction kinetics, types of chemical reactions, catalysts (poisoning and activation), and reactor designs (Fixed bed, fluidized bed, slurry).
13-15	**Separators:** Purpose of gas-gathering stations, types of separators, factors affecting the separation process, and troubleshooting.

13.

14. 3. Welding Nondestructive Testing (NDT) (1)

15. **Course Goal:** To define acceptance and rejection criteria for welded joints and gain the ability to perform NDT methods to detect and analyze welding defects.

Week	Theoretical Syllabus (International Standards)
1	Introduction to Non-Destructive Testing (NDT) methods.
2-5	**Visual Testing (VT):** Tools, inspection before/after welding, and Evaluation of welding joints (Acceptance Criteria).
6-10	**Penetrant Testing (PT):** Techniques, examination procedures, interpretation of results, and documentation of acceptance criteria.
11-15	**Magnetic Particle Testing (MT):** Written procedure requirements, magnetization techniques, method of examination, and acceptance criteria.

Week	Theoretical Syllabus (International Standards)
Note:	All theoretical topics include practical application in the NDT Laboratory.

16. ---

17. 4. Welding Workshop (3)

18. **Course Goal:** To master the setup and operation of GMAW and GTAW equipment and gain high proficiency in welding plates (Bevel/Groove) in various positions.

Week	Practical Tasks (GTAW & GMAW)
1-4	**GTAW:** Straight lines on plates; Lap joints (Flat & Horizontal positions).
5-8	**GTAW:** Fillet welds (**1F + 2F**) and Butt welds (**1G + 2G**).
9-10	**GTAW:** Advanced Butt welds in vertical and overhead positions (**3G + 4G**).
11-12	**GMAW:** Straight line exercises and Lap joints (Flat & Horizontal).
13-15	**GMAW:** Butt welds in various positions (**1G, 2G, 3G, 4G**).

19. ---

20. 5. Project (1)

21. **Course Goal:** To engage students in integrated production work, teaching teamwork and project management by applying theoretical knowledge to manufacture laboratory or mechanical equipment.

Week	Project Implementation Steps
1-2	Discussing project selection, defining the workflow plan, and distributing responsibilities and timelines.
3	Preparing engineering drawings and operation cards for the workshops.
4-14	Execution in the workshops, preparing progress reports, and monitoring production rates and obstacles.
15	Final discussion and evaluation of the first-semester project phase by a committee.

22. ---

23. **6. English Language (2)**

24. **Course Goal:** To advance the student's speaking, listening, and writing skills for professional environments.

Week	Syllabus (Topic Based)
1	**Unit 1:** Getting to know you (Review of tenses, Question words).
2	**Unit 2:** The way we live (Present Simple, Present Continuous, Have/Have got).
3	**Unit 3:** It all went wrong (Past Simple, Past Continuous).
4	**Unit 4:** Let's go shopping (Quantifiers: Much/Many, Some/Any, Few/Little, Articles)

Second Stage Syllabus | Second Semester

1. English Language (2) - Continued

Week	Syllabus (Topic Based)
5	**Unit 5:** Future intentions, Verb patterns (1), and "Going to" vs. "Will".
6	**Unit 6:** Adjectives, Comparative, and Superlative forms.

Week	Syllabus (Topic Based)
7	**Unit 7:** Present Perfect vs. Past Simple; usage of "For" and "Since".
8	**Unit 8:** Modals of obligation and advice: "Have (got) to", "Should", and "Must".
9-11	**Units 9-11:** Conditionals (What if?), Infinitive patterns, and Passive Voice.
12-14	**Units 12-14:** Second Conditional, Present Perfect Continuous, and Reported Speech.
15	Comprehensive Revision.

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2. Metallurgy

Course Goal: To enable students to classify engineering materials, understand the crystalline structure of metals, master heat treatment processes, and identify composite materials.

Week	Theoretical Syllabus	Practical Syllabus
1-3	**Crystal Structure:** Atomic bonds, crystallization, unit cells, density calculation, Miller indices, and crystalline defects.	**Lab Orientation:** Safety in strength, heat treatment, and metallography labs.
4-5	**Defects & HAZ:** Cracks in microstructure, Heat Affected Zone (**HAZ**) types, lack of fusion, and penetration.	**Sample Preparation:** Grinding, polishing, etching, and microscopic examination.
6-7	**Phase Diagrams:** Phase rule, binary systems, and the **Iron-Carbon ($Fe-C$) Equilibrium Diagram**.	Microscopic examination of aluminum and carbon steel; recovery and

Week	Theoretical Syllabus	Practical Syllabus
		recrystallization tests.
8-9	**Mechanical Properties:** Stress-strain relationships, hardness, and toughness.	**Tensile Testing:** Stress-strain curves, elastic/plastic deformation, and UTS.
10-11	**Heat Treatment:** Cooling rates, surface hardening, annealing, and tempering of carbon steel.	**Hardness Testing:** Brinell, Vickers, and Rockwell (B & C) methods.
12-13	**Alloys:** Ferrous (Cast iron, tool steel, stainless) and Non-ferrous (Al, Mg, Cu, Ni, Ti alloys).	Impact testing (**Charpy & Izod**), Torsion, and Shear tests.

Week	Theoretical Syllabus	Practical Syllabus
14-15	**Polymers & Composites:** Thermoplastics vs. Thermosets; classification and manufacturing of composite materials.	Constructing thermal equilibrium curves for binary alloys.

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3. Oil Equipment Technology (2)

Course Goal: To master the mechanical operation, troubleshooting, and maintenance of dynamic oil equipment like pumps, compressors, and turbines.

Week	Theoretical Syllabus Details
1-3	**Pumps:** Positive displacement and Centrifugal pumps. Reciprocating pumps (single/double acting), main components, protection systems, and common failures.

Week	Theoretical Syllabus Details
4-7	**Compressors:** Reciprocating and Centrifugal compressors. Operational systems: Lubrication, Sealing, and Cooling systems.
8-9	**Vacuum Systems:** Pressure penetration devices, vacuum pumps, and ejectors.
10-15	**Rotating Electrical & Thermal Machines:** Electric motors/generators, Steam Turbines, Gas Turbines, and Diesel Engines (4-stroke cycle). Operation, control systems, and routine inspections.

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4. Welding Nondestructive Testing (NDT) (2)

Course Goal: Advanced study of volumetric NDT methods to detect internal defects and apply international acceptance/rejection codes.

Week	Theoretical Syllabus (Volumetric Methods)
1-5	**Radiographic Testing (RT):** Introduction, X-ray/Gamma-ray techniques, film interpretation, and **ASME** acceptance criteria.
6-10	**Ultrasonic Testing (UT):** Principles, wave propagation, testing techniques, signal interpretation, and documentation.
11-15	**Eddy Current Testing (ET):** Principles, written procedure requirements, probe techniques, and weld inspection applications.
Note:	Includes practical laboratory application for each method.

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5. Engineering & Technical Drawing for Welding Design

Course Goal: To master 3D modeling in AutoCAD, assembly drawing, and the application of international welding and NDT symbols.

Week	Topics & AutoCAD Application
1-4	**3D Perspectives:** Drawing isometric views and basic rules for dimensioning in AutoCAD.
5-7	**Projections & Assembly:** Sectional views, cylindrical projections, and full assembly drawings.
8-10	**3D Modeling:** Transitioning from 2D to 3D, User Coordinate System (**UCS**), and solid commands (**Extrude, Revolve, Union, Subtract**).
11-13	**Welding Symbols:** Drawing **AWS** standard symbols, weld penetration symbols, and joint design representation.
14-15	**NDT Symbols:** Representing inspection methods on drawings and creating final

Week	Topics & AutoCAD Application
	execution sheets for storage tank assembly according to **AWS** standards.

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1. Welding Workshop (4) - Pipe Welding

Course Goal: This course aims to familiarize the student with **GMAW** and **GTAW** equipment, including their setup and adjustment. It focuses on providing the necessary skills to execute pipe welding in various standard positions with high proficiency.

Week	Welding Process	Practical Tasks & Positions
1	**GTAW (TIG)**	Running straight weld beads on pipes.
2	**GTAW (TIG)**	Pipe-to-pipe Butt Weld in **1G** position (Rotated).

Week	Welding Process	Practical Tasks & Positions
3-4	**GTAW (TIG)**	Pipe-to-pipe Butt Weld in **2G** position (Horizontal Fixed).
5-6	**GTAW (TIG)**	Pipe Butt Weld in **5G** (Vertical Fixed) and **6G** (Inclined 45°) positions.
7-10	**GTAW + SMAW**	Combined welding: Root pass using **GTAW** and filling/capping using **SMAW** in **5G & 6G** positions.
11	**GMAW (MIG/MAG)**	Running straight weld beads on pipes.
12	**GMAW (MIG/MAG)**	Pipe-to-pipe Butt Weld in **1G** and **2G** positions.
13-14	**GMAW (MIG/MAG)**	Pipe Butt Weld in **5G** and **6G** positions.

Week	Welding Process	Practical Tasks & Positions
15	**GMAW + SMAW**	Combined Pipe Butt Weld: **GMAW** root and **SMAW** completion in **6G** position.

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2. Project (2)

Course Goal: Students execute integrated production works to learn collective production methods. This involves applying the theoretical and practical knowledge gained throughout the previous academic periods.

Week	Project Phase	Details
1-12	**Implementation**	Resuming project execution steps and completing all practical manufacturing tasks.

Week	Project Phase	Details
13	**Reporting**	Discussing project details and guiding students on drafting the final technical report (2nd semester evaluation).
14	**Finalization**	Completing both theoretical and practical components; preparing for the final defense.
15	**Defense**	Final project discussion and evaluation by the committee.

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3. Occupational Ethics

General Goal: To introduce technical students to professional ethics according to their specialization

and instill the ethical rules that enhance their commitment in their future careers.

Week	Unit	Core Topics
1-2	**Unit 1: Ethics**	Concepts, origins, general rules, and the importance of ethics for individuals and society.
3	**Unit 2: Work & Profession**	Work importance, professional behavior, and the difference between "Work," "Profession," and "Craft."
4	**Unit 3: Professional Ethics**	The nature of occupational ethics, positive impacts of commitment, and acceptable ethical levels.

Week	Unit	Core Topics
5-6	**Unit 4: Values**	Core values: Integrity, Honesty, Sincerity, Justice, and Work Mastery (Itqan).
7-8	**Unit 5: Unethical Behavior**	Administrative corruption, Bribery (Gift vs. Bribe), and Cheating in workplace performance.
9-10	**Unit 6: Consolidation**	Methods and levels of consolidating ethical values; drafting a "Professional Code of Conduct."
11-15	**Unit 7-9: Engineering Ethics**	**Engineering specific:** Professional technical standards, Arab Engineers Union Code, relationships with colleagues/employers, and the role of ethics in

Week	Unit	Core Topics
		continuous training and environmental sustainability.

Important Academic Notes (Workshop & Lab):

- **Absence Policy:** Students are considered "Failed" if absences exceed **10%** without an excuse or **15%** with a valid excuse.
- **No Second Round:** Workshop subjects are based on continuous assessment; there is no second-round (re-sit) exam for these subjects.
- **Late Joiners:** Students admitted after the start of the year must compensate for missed exercises during the Spring break.