

**WELDING (ARC & GAS)
COURSE CONTENTS - 9TH CLASS
THEORY**

Text	Scope
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Chapter No. 1

1. Hand Tools: (02 Weeks/ periods)

2.1 Workshop Hand tools

2.2 Measuring tools

2.3 Marking tools

2.4 Cutting & Chipping tools

- Identify Common workshop hand tools their use, handling, and care..
- Describe measuring tools, their use, handling, and care.
- Describe marking tools, their use, handling, and care.
- Describe cutting and chipping tools, their use, handling, and care.

Chapter No. 2

2. Safety (02 weeks/ periods)

2.1 Safety Rules

2.2 Personal Safety

2.3 Safety for Tools & Equipment

2.4 Safety Lecture

- Describe general workshop safety rules.
- Describe personal safety.
- Describe safety precautions in tools and equipment handling.
- Describe the importance of daily safety lecture

Chapter No. 3

3. Introduction of common welding processes (04 weeks/ periods)

3.1 Fusion welding

3.2 Pressure welding

- Explain Fusion welding processes.
- Explain Pressure welding processes.

Chapter No. 4

4. Oxy-Acetylene Welding (07 weeks/ periods)

4.1 Equipment

4.1 Gases

4.2 Setting and Lightening

4.3 Flames

4.4 Back Fire and flash back

- Describe Oxy-Acetylene Equipment, accessories, care and handling
- Describe various gases used in gas welding
- Describe the procedure of setting of low and high pressure gas welding equipment.
- Describe the procedure of lightening of low and high pressure gas welding torch.
- Describe safety precautions in setting of equipment and lightening of torch.
- Describe types of flames and their application.
- Define back fire
- Describe causes of back fire
- Describe safety and controlling methods of back fire.
- Define flash back arrestor and its importance.

4.5 Filler Rods and Fluxes

- Describe filler rods used in gas welding
- Classify filler rods.
- List common fluxes used in gas welding.

Chapter No. 5

**5. Gas Welding Techniques
(07 Weeks/periods)**

- 5.1 Right-hand Welding Technique
- 5.2 Left-hand Welding Technique
- 5.3 Soldering
- 5.4 Brazing

- Describe Right-hand Welding Technique
- Describe Left-hand Welding Technique
- Describe soldering methods.
- Describe brazing of different metals.

Chapter No. 6

**6. Manual Metal Arc Welding
(02 weeks/periods)**

- 6.1 Definition
- 6.2 Principle

- Define Manual Metal Arc Welding (MMAW) process.
- State arc welding principle.

Chapter No. 7

**7. Technical Drawing
(06 weeks/periods)**

- 1.1 Introduction of drawing
- 1.2 Drawing Instruments
- 1.3 Basic and alphabet of lines
- 1.4 Geometrical construction
- 1.5 Free Hand sketching
- 1.6 Multi view Drawing
- 1.7 Pictorial Drawing
- 1.8 Symbols

- Describe meaning, importance and uses of technical drawing
- Describe drawing instruments, their construction, uses and cares.
- Describe the types of basic lines
- Describe the types of alphabet of lines with their weight, shape and proper construction
- Describe angles, triangles, quadrilateral, polygons and circle elements
- Describe the importance of sketching
- Describe the procedure of sketching for shapes, geometric figures and models
- Describe the concepts of orthographic drawing.
- Describe the procedures to draw the Front, Side and Top Views
- Describe the procedure to draw the Isometric and Oblique drawing of simple shapes and models.
- Describe various welding symbols

WELDING (ARC & GAS)
LIST OF PRACTICALS - Class IX
(30 Weeks = 180 Periods)

Geometrical & Technical Drawing

- 1.1 Draw basic lines and alphabet of drawing lines.
- 1.2 Draw different types of angles, triangles, quadrilateral and polygons
- 1.3 Draw elements of circle
- 1.4 Sketch geometric shapes and models
- 1.5 Draw Front, Side and Top views of simple wooden model
- 1.6 Draw simple Isometric and Oblique Drawings of simple models
- 1.7 Draw the different symbols relating to welding field.

General Workshop Practice

- 2.1 Identification and use of common tools their storage care and handling.
- 2.2 Filing Practice by using various types of files on different surfaces.
- 2.3 Marking practice by using different marking methods.
- 2.4 Metal cutting practice with chisel and hand hacksaw.
- 2.5 Related technical Drawing (Sketching and Reading).

Oxy-Acetylene Welding Practice

- 3.1 Setting up of oxy-acetylene gas welding equipment and its operation.
- 3.2 Flame making practice.
- 3.3 Welding pool-handling practice.
- 3.4 Common fusion practice on thin mild steel sheets.
- 3.5 Common fusion practice on thick mild steel plate.
- 3.6 Fusion practice by using filler rod.
- 3.7 Straight welding bead making practice in flat position.
- 3.8 Square edge-welding practice with out gap in flat position.
- 3.9 Fillet or T-Weld practice on MS sheet in flat position.
- 3.10 Over lap weld practice on M.S Sheet in flat position.
- 3.11 Corner weld practice on M.S sheet without filler rod in flat position.
- 3.12 Corner weld practice on M.S sheet with filler rod in flat position.
- 3.13 Open Butt weld practice on M.S. sheet in flat position.
- 3.14 Setting of Gas cutting equipment practice.
- 3.15 Gas cutting practice on Mild steel plate.
- 3.16 Brazing practice on different metal pieces.

WELDING (ARC & GAS)
LIST OF TOOLS, EQUIPMENT & CONSUMABLE MATERIAL
(FOR 30 STUDENTS)

LIST OF TOOLS

1.	COMMON HAND TOOLS	QTY.
3.1	Work Benches	5 Nos.
3.2	Bench vices	20 Nos.
3.3	Hammer all types and shapes	12 Nos (each type)
3.4	Chisels (all types and shapes)	24 Nos (each type)
3.5	Hacksaw (Adjustable Frames)	24 Nos.
3.6	Fitted with 12" double side cutting blade.	
	Outside calipers	12 Nos.
3.7	Inside Calipers	12 Nos.
3.8	Files all types, shape and sizes with handles.	24 No (each type)
3.9	Tongs small and large	12 Nos.
3.10	Try Square small and large	24 Nos. (each)
3.11	Combination Pliers insulated, 8" long.	12 Nos.
3.12	Open end spanner set (double end)	2 set
3.13	Screw Driver set straight and Phillips type	4 sets (each type)
3.14	Spanner adjustable 12", 10", 8"	6 Nos. (each type)
3.15	Anvil with stand	2 Nos.
3.16	Box spanner sets	2 sets.
3.17	Allen key set	2 sets.
3.18	Tin snip/sheet cutter	06 Nos.(each type)
3.19	Blow lamp	2 Nos.
3.20	Soldering Iron (Manual)	06 Nos.

MEASURING TOOLS:

3.21	Steel rule 30 and 15 cm	24 Nos.
3.22	Steel Tape 3 mtrs. & 5 mtrs.	24 Nos.
3.23	Sprit level	6 Nos.

LIST OF EQUIPMENT/MACHINES:

2.1	Pedestal grinder	1 No.
2.2	Disc Grinder 4"	6 Nos.
2.3	Disc grinder 7"	6 Nos.
2.4	Power saw	1 No.
2.5	Bench Shear	1 No.
2.6	Soldering Iron electric	6 Nos.
2.7	Hand Drill Machine	1 No.

Gas Welding Tools and Accessories:

1.	Cylinder trolley	6 Nos.
2.	Oxygen cylinder	6 Nos.
3.	Acetylene cylinder	6 Nos.
4.	Oxygen Regulator	6 Nos.
5.	Acetylene Regulator	6 Nos.

6.	Flash Back Arrestor Oxygen	6 Nos.
7.	Flash Back Arrestor DA	6 Nos.
8.	Rubber Hose Oxygen	100 meters.
9.	Rubber Hose Acetylene	100 meters.
10.	Hose clamps	24 Nos.
11.	Blow pipe complete kit box including blow pipe, Cutting torch set of welding and cutting nozzles and tip cleaner etc.	4 kits
12.	Spark lighter.	12 Nos.
13.	Welding table with five bricks top.	4 Nos.
14.	Welding goggle.	24 Nos.
15.	Low pressure injector type torch set with nozzle.	4 Nos.
16.	Low pressure Acetylene generator.	2 Nos.
17.	Cylinder valve opening key.	6 Nos.

ARC Welding Equipment :

18.	AC Welding transformer 50-250 Amp.	6 Nos.
19.	DC Welding Generator 50-350 Amp.	1 No.
20.	AC/DC Arc Welder (Rectifier type).	1 No.
21.	Welding Cable.	200 mtrs.
22.	Electrode holder 500 Amps.	12 Nos.
23.	Earth clamps with work return lead.	12 Nos.
24.	Welding Helmet and hand screens.	12 Nos. each
25.	Chipping hammer.	12 Nos.
26.	Steel wire Brush.	48 Nos.
27.	Welding Booth	8 Nos.
28.	Hot box / Electrode heating box.	1No.

3 CONSUMABLES (MINIMUM MATERIAL REQUIRED FOR ONE YEAR)

3.1	M.S. Gas Welding Filler wire, 1.5mm dia.	10 KG
3.2	M.S. Gas Welding Filler wire, 2 mm dia.	10 KG
3.3	Brass Filler wire, 2.4 mm dia.	3 KG
3.4	Brazing Flux.	2 tins
3.5	Welding Flux.	2 tins
3.6	Arc Welding M.S Electrodes E-6013, 2.4 mm Dia.	250 KG
3.7	Arc Welding M.S Electrodes E-6013, 3.2 mm Dia.	300 KG
3.8	Arc Welding M.S Electrodes E-6013, 4 mm Dia.	100 KG
3.9	Arc Welding Electrodes E-7018, 2.4 mm Dia.	50 KG
3.10	Arc Welding Electrodes E-7018, 3.2 mm Dia.	50 KG
3.11	Mild Steel Strip Size 150x50x1.6 mm.	800 pcs.
3.12	Mild Steel Strip Size 150x50x2 mm.	800 pcs.
3.13	Mild Steel Strip Size 150x50x3.2 mm.	1000 pcs.
3.14	Mild Steel Strip Size 150x50x6 mm.	600 pcs.
3.15	Silver Solder 50:50	4KG
3.16	Calcium Carbide.	10 KG
3.17	Filter Glasses 11 No. & 12 No. for Arc Welding Screen.	100 Nos.
3.18	Clear glasses for protection of filter glasses.	300 Nos.

REFERENCE BOOKS FOR TEACHERS

1. "Modern Welding"
by A.D ALT House / Turnguist / Bow Ditch USA
2. Welders Trade Theory (GTZ)
3. "Welding Skills" an apt publication, Giachino Weeks. USA
4. "New Lesson in ARC Welding"
Lincoln Electric Company, USA.
5. "Arc Welding projects for the school shops"
By Lincoln Electric Company.
6. "Procedure handbook of Arc Welding Design and practice"
By Lincoln Electric Company. USA

GENERAL RECOMMENDATIONS

Text Book

1. The textbook should be fully illustrated based on approved national curriculum.
2. The language used should be Urdu/English. Script should be simple and easy. Examples should be chosen from every day life wherever possible.
3. There should be uniformity in terminology in textbooks. For this purpose a glossary of uniform terminology based upon S.I. Units should be prepared and provided.
4. The Technical Terms/Terminology should not be translated as such and these should be directly written in Urdu.
5. Objective type as well as descriptive test items should be provided at the end of each chapter, which should serve as guideline for students and teachers.
6. The experiments suggested in the curriculum should be dealt with in detail in a separate Practicals' Manual. The experiments should be prescribed in an open-ended manner.
7. Since curriculum development is a continuous process, a follow-up committee should be formed to check its proper implementation and evaluation.

Practical Manual

In order to maintain a uniform standard of practical activities throughout the country, Practical Manual should be prepared for the purpose. This manual should cover all the practicals in the trade indicating Title of practical, material, Tools & Instruments, Procedure, figure(s), Readings/ output data/result/conclusions and safety precautions etc. The final practical examination should be based on the activities prescribed in the curriculum.

Teacher's Guide

In order to provide direction in the planning of academic activities, the Trade teacher needs some resource material to bank upon. A teacher's guide giving essential background information, knowledge, lesson schemes, objectives, teaching methodologies, motivation, conducting practical, assessment procedures etc. be prepared for the purpose and provided to the Trade teachers.

Workshop

1. In order to facilitate the students to develop desired skills and competencies, it is recommended that practical activities should be carried out individually, where possible.
2. The workshop should be fully equipped as stipulated in the Curriculum. Provision should be made in school budget to purchase/replace latest tools and equipments to update the workshop.
3. Recommended consumables should be provided for practicals in reasonable quantity.

Evaluation of Curriculum

It is recommended that provincial curriculum evaluation committees should be formulated on permanent basis comprising curriculum experts, teacher trainers, working technical teachers, experts, subject specialists and educationists to evaluate the shortcomings and achievements of the curriculum. The committees will be expected to remain in contact with the teachers to obtain feedback for decision making.

Methodology of Instruction

Following methods of teaching may be used in technical education as considered appropriate by the teacher:

1. Project Method
2. Illustration Method
3. Investigation Method
4. Demonstration Method
5. Practice/Drill Method
6. Lecture Method
7. Assignment Method
8. Discussion (Questions & Answers) Method
9. Visit to industry
10. Tutorial

Characteristics of Technical Teachers

For effective instruction, the desirable qualities of competent technical teachers should be:-

- a) Good manager, facilitator, and counsellor
- b) Educational background and industrial experience
- c) Mastery of instructional techniques
- d) Competence in the subject
- e) Resourcefulness and creativeness
- f) Ability to develop good personal relationship with students
- g) Knowledge of performance evaluation procedures

Promotional Activities

During education various co-curricula activities develop and promote interest, positive attitudes and commitment. Following activities may be utilized to promote Vocational and Technical Education:

1. Technical club
2. Bulletin Board
3. Exhibition corner
4. Display of Projects
5. Quiz Contests
6. Technical & Science exhibition
7. Technical & Science Fair
8. Technical & Science Olympiad etc.

Assessment of Student Achievement

The procedure in vogue for evaluation is the examination. It is however, suggested that in addition to annual examination, the teachers should also evaluate class work on completion of each lesson/unit followed by periodic tests in the subject. Besides periodic and annual tests, skill standards prepared by National Training Bureau should be used at the end of the year.

For the purpose of class-room appraisal, individual as well as group technique may be used. The tests should comprise both short answer and objective type questions. Assessment should focus knowledge, skills, competencies, and application of concepts and ability to use the techniques and tools. It is therefore, suggested that a comprehensive scheme of knowledge, skills, competencies etc. be prepared to assess students' achievements. Rigorous efforts are needed to prepare such items. Standardized test items, be prepared for the use of the examining Boards and also for the classroom teachers.

It is to be kept in mind that students study habits are influenced by the teacher's method of testing. It is therefore, suggest that examination should be a meaningful activity.

Recommended Scheme of Studies

Each vocational subject is being divided into two parts – theory and practical, of 50 marks each. Geometrical and Technical Drawing is included as an essential part of the engineering trades. Questions of 20 % marks will be from Geometrical and Technical Drawing and the rest of the examination will be of 80% marks covering the whole theory and practical course of the respective trade.

Relative Marks distribution in Examination is as under:

Theory Paper: 50	(i)	Trade	40 Marks
	(ii)	Geometrical & Technical Drawing	10 Marks
Practical Paper: 50	(i)	Trade	40 Marks
	(ii)	Geometrical & Technical Drawing	10 Marks
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Total:100			
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In the examination, the level of learning abilities to be tested may be taken as:

Knowledge – The ability to recall facts, nomenclature, classifications, practical techniques, laws and theories, straight-forward calculation and computation.

Comprehension – The ability to translate data from one form to another (verbal into mathematical, tabular or graphical and vice versa) to interpret or deduct the significance of data, and to solve problems.

Application – The ability to apply knowledge, experience and skill to new situations presented in a novel manner.

In the theory examination paper such questions may be set which facilitate to test learning abilities related to *Knowledge, Comprehension and Application*.

The questions asked may provide the students an opportunity to give reasoned arguments, to apply his knowledge to the theoretical and practical problems, or to interpret given data and apply in the situation described thereby.

In the practical examination, the student will be required to perform a practical, to use tools and equipment, to observe and tabulate data, perform calculations and draw graphs, to locate fault, to make physically required circuits, to troubleshoot and repair desired circuit/unit etc.

In the practical examination, the level of competencies and skill to be tested may be taken into five categories as:

Imitation - The ability to observe skill and attempt to repeat it.

Manipulation - The ability to perform skill according to instruction rather than observation.

Precision - The ability to reproduce a skill with accuracy, proportion, and exactness.

Articulation- The ability to combine more than one skill in sequence with harmony and consistency.

Naturalisation – The ability to comprehend one or more skills with ease and adapt automatically with limited physical or mental exertion.

Use of Tools - The skills and competencies to use tools and equipment.

Approximate percentage of marks allotted to each of the above abilities may be:-

<i>Knowledge</i>	20 %
<i>Comprehension</i>	25 %
<i>Application</i>	15 %
<i>Skills and competencies</i>	40 %