Syllabus for Blacksmith

Course Name	Blacksmith
Sector	Capital Goods
Course Code	CGM/2023/BLSM-RPL/260
Level	RPL LEVEL 3
Occupation	Blacksmith
Job Description	The job role is responsible for tasks involving knowing metal steel properties, scheduling rod reinforcement, handling rail specifications, cutting rails with tools, managing engineering tools, preparing rivets for bridge work, and contributing to railway-related blacksmithing.
Course Duration	Total Duration 80 Hrs. (T-25, P-55) RPL
Trainees' Entry Qualification	Grade 8 with more than 5 Year Experience in the relevant Field
Trainers Qualification	Degree or Diploma in Mechanical Engineering with 1 yr experience in relevant field OR ITI in relevant trade with 3 yr experience in relevant field

Structure of Course:

Module No.	Module name	Outcome	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
1.	Workplace Safety	Apply safe working practices in the industry	1	1	2
2.	Basic Engineering Drawing	Practice & interpret technical drawings	2	6	8
3	Introduction to Blacksmithing	Perform basic blacksmithing tasks with essential tools, and utilizing coals, blowers, and other equipment with an understanding of metal properties and safety protocols.	2	6	8
4	Properties of Metal Steel	Apply heat treatment techniques, identifying diverse types of steel and its properties	2	6	8
5	Reinforcement and Scheduling of Rods	Read and interpret reinforcement drawings, with hands-on experience in scheduling and bending steel rods	2	6	8
6	Rails: Sizes, Weight, and Cutting	Use hacksaw blades and drills for rail cutting, and handle	2	6	8

Module No.	Module name	Outcome	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
		various rail sizes and weights			
7	Tools of the Trade	Use blacksmithing tools hammers, tongs, chisels, and Jim-Crows for forging and shaping metal.	6	10	16
8	Bridge Riveting and Railway Applications	Explain role of blacksmiths in bridge construction and maintenance, in the preparation of rivets for bridge riveting works, and in the railway industry	6	10	16
9	Employability Skill		2	4	6
		TOTAL:	25	55	80

SYLLABUS:

Module No. 1: Workplace Safety

Outcome: Apply safe working practices in the industry

Theory Content:

1. Awareness of safety norms.
2. Safety-PPE usage and its benefits
3. Fire prevention and personal safety.
4. Ergonomic safety and health principles.
5. Use various PPE while working.
6. Safety during machine / material handling

Practical Content:

1. Accident prevention and safety regulations while material handling, eliminating unsafe conditions, unsafe actions, discovering causes of accidents.
2. Fire prevention and personal safety.
3. Safety during machine handling.
4. Emergencies, rescue and first aid procedures.
5. Familiar with Personal protective Equipment's and clothes Different Type of Safety Sign, First Aid Box, Safety instrument and clothing

Tools & Equipment needed:

Protective clothing (aprons, gloves), eye and hearing protection, respiratory gear, steel-toed boots, hard hats, welding helmets, ventilation systems, first aid kits, PPE, fire safety equipment, and organizational tools like anvil stands.

Module No. 2: Basic Engineering Drawing

Outcome: Practice & interpret technical drawings

Theory Content:

- Introduction of technical drawing and lettering
- Use and care drawing boards and different drawing instruments, Drawing sheets and their sizes.
- Explain Types of Lines: Horizontal, Vertical, Inclined, parallel lines.
- Concept of using Scales in Drawing – Enlarging, Full Size & Reducing Scale.

Practical Content:

Introduction of technical drawing and lettering

- How to begin a drawing – Layout of drawing sheet.
- Drawing of — i) Horizontal lines, ii) Vertical lines, iii) Inclined lines, iv) Parallel lines,
- Single stroke Lettering by conventional method.
- Dimensioning—System of Dimensioning

Geometrical Construction

- Geometrical construction of Polygons (Pentagon, Hexagon & Octagon) by general method.

Orthographic Projection of Line & Lamina

- Projector; Plane of projection – Vertical Plane, Horizontal Plane & Profile Plane. Concept of 1st angle
- Projection; 3rd angle Projection. Reference Line – Symbol of methods of projection. (Demonstration with models).
- Projection of Points, Lines & Lamina (Square, rectangular, triangular, hexagonal, pentagonal and circular) parallel to VP and angle with HP & vice versa.

Freehand Sketch

Introduction – Necessity.

b) Free hand sketches of rolled steel sections – i) T-section, ii) I-section, iii) Angle section, iv) Channel section, v) Circular section, vi) Rectangular Section, vii) Steel flat, viii) Double ended wrench, ix) Screw driver, x) Nail puller

Tools & Equipment needed: Drawing instrument box, Drawing instrument box, Set square celluloid 30°-60°, French-curves (set of 12 celluloid), T-Square or Mini drafter, Drawing board.

Module No. 3: Introduction to Blacksmithing

Outcome: Perform basic blacksmithing tasks with essential tools, and utilizing coals, blowers, and other equipment with an understanding of metal properties and safety protocols.

Theory:

- History and evolution of blacksmithing
- Importance of blacksmithing in various industries

- Overview of different types of metals and their properties
- Safety precautions in a blacksmithing workshop
- Overview of different types of coals used in blacksmithing
- Properties and characteristics of bituminous, anthracite, and coke coals
- Suitability of coals for various blacksmithing processes
- Role of blowers in the blacksmithing process
- Different types of blowers: hand-cranked, electric, and pneumatic
- Selection criteria for blowers based on workshop needs

Practical:

- Familiarization with the blacksmithing workshop
- Introduction to basic tools: hammer, anvil, tongs, etc.
- Demonstrations on the proper use of safety equipment
- Examination and comparison of different coals
- Demonstrations on the proper use of each type of coal
- Hands-on experience with various blowers
- Setting up and operating blowers for different blacksmithing task

Tools and equipment:

Safety Equipment: Safety Glasses, Ear Protection, Heat-Resistant Gloves, Dust Masks/Respirators, First Aid Kit

Workshop Tools: Hammers (various weights and types), Anvils (various sizes), Tongs (various types), Chisels (assorted sizes), Files (assorted types and sizes), Vises (large enough for various projects), Punches (assorted sizes), Swage Blocks (various shapes), Fullers (assorted sizes), Rivet Sets, Blacksmithing Rulers and Measuring Tools,

Power Tools: Angle Grinders (with cutting and grinding discs), Belt Sanders, Drill Press (with assorted drill bits), Welding Machines (for basic metal joining tasks),

Forging Equipment: Coal Forges, Propane Forges, Fire Tools (rakes, shovels, etc.), Quenching Tubs,

Consumables: Bituminous Coal, Anthracite Coal, Coke, Propane Gas Cylinders, Grinding Discs, Welding Rods - Assorted types,

Blowers: Hand-Cranked Blowers, Electric Blowers, Pneumatic Blowers.

Module No. 4: Properties of Metal Steel

Outcome: Apply heat treatment techniques, identifying diverse types of steel and its properties.

Theory:

- Composition and properties of steel

- Heat treatment and its effects on steel
- Understanding the importance of annealing, quenching, and tempering

Practical:

- Hands-on experience with heat treatment techniques
- Identifying different types of steel and their applications

Tools and Equipment:

Projector and Screen, Whiteboard, Laptop or Computer.
Steel Samples: Assorted steel samples for hands-on examination.
Heat Treatment Furnaces: Electric or gas furnaces for heat treatment exercises.
Quenching Tanks: Containers filled with various quenching mediums (oil, water, etc.).
Tempering Ovens: Ovens for tempering steel samples at different temperatures.
Safety Gear: Safety glasses, heat-resistant gloves, and aprons for all participants.
Callipers and Measuring Tools: Tools for measuring and analysing steel dimensions.
Identification Charts: Charts displaying the composition and properties of different types of steel.
Steel Marking Tools: Chalk, soapstone, or other marking tools for labelling steel samples.

Module No. 5: Reinforcement and Scheduling of Rods

Outcome: Read and interpret reinforcement drawings, with hands-on experience in scheduling and bending steel rods

Theory:

- Basics of reinforcement in construction
- Understanding the role of steel rods in reinforcement
- Scheduling and planning of reinforcement activities

Practical:

- Reading and interpreting reinforcement drawings
- Hands-on practice in scheduling and bending steel rods

Tools and Equipment:

Projector and Screen, Whiteboard, Laptop or Computer.
Printed or digital copies of various reinforcement drawings for hands-on interpretation.
Steel Rods: Assorted steel rods of different sizes and lengths for practical exercises.
Cutting Tools: Hacksaws, portable band saws, or rebar cutters for cutting steel rods.
Bending Tools: Rod bending machines or manual bending tools for hands-on practice.
Measuring Tools: Tape measures, rulers, and callipers for accurate measurements.

Module No. 6: Rails: Sizes, Weight, and Cutting

Outcome: Use hacksaw blades and drills for rail cutting, and handle various rail sizes and weights

Theory:

- Overview of railway tracks and their components
- Understanding rail sizes and weight specifications

- Techniques for rail cutting and its importance

Practical:

- Using hacksaw blades and drills for rail cutting
- Practical sessions on handling different rail sizes and weights

Tools & Equipment List:

Projector and Screen, Whiteboard, Laptop or Computer
Hacksaws, Drills, Electric or manual drills with assorted drill bits for rail cutting exercises,
Rail Samples: Assorted rail samples of different sizes and weights for hands-on practice.

Module No. 7: Tools of the Trade

Outcome: Use blacksmithing tools hammers, tongs, chisels, and Jim-Crows for forging and shaping metal.

Theory:

- Introduction to tools used in blacksmithing like hammers, tongs, chisels
- Understanding the purpose and application of each tool
- Maintenance and care of blacksmithing tools
- Different types and designs of Jim-Crows
- Applications and uses of Jim-Crows in forging and shaping metal

Practical:

- Hands-on experience with various tools used in blacksmithing like hammers, tongs, chisels
- Demonstrations on tool maintenance and repair
- Identify different types and designs of Jim-Crows
- Applications and uses of Jim-Crows in forging and shaping metal

Tools & Equipment:

Hammers, Tongs, Chisels, Anvils, Jim-Crows, Vises.

Module No. 8: Bridge Riveting and Railway Applications

Outcome: Explain role of blacksmiths in bridge construction and maintenance, in the preparation of rivets for bridge riveting works, and in the railway industry

Theory:

- Role of blacksmiths in bridge construction and maintenance
- Preparation of rivets for bridge riveting works
- Overview of blacksmith's role in the railway industry

Practical:

- Hands-on riveting exercises
- Case studies on the historical and contemporary role of blacksmiths in railways

Tools & Equipment:

Riveting Tools: Assorted riveting tools, including hammers, rivet sets, and bucking bars for hands-on riveting exercises.

Metal Pieces for Riveting: Steel or iron pieces for use in practical riveting exercises.

Safety Gear: Safety glasses, gloves, and aprons for all participants.

Consumables: Rivets: Assorted rivets for use in practical exercises

Module No. 9: Employability Skills

Detail Content

- **Basic English Skills**

1. Converse using basic English sentences.
2. How to Greet others
3. Read and interpret text written in basic English
4. Write a short note/paragraph / letter using basic English

- **Communication Skills**

1. Demonstrate how to communicate effectively using verbal and nonverbal communication Etiquette.
2. Discuss the significance of working collaboratively with others in a team

- **Financial Skills**

1. Outline the importance of selecting the right financial institution, product and service
2. Demonstrate how to carry out offline and online financial transactions, safely and securely like net banking, wallet payment, UPI.
3. List the common components of salary and compute income, expenditure, taxes, investments etc.

- **Essential Digital Skills**

1. Familiarization of working with computer
2. Discuss the significance of displaying responsible online behavior while browsing using various social media platforms, e-mails, etc., safely and securely
3. Send email with attachment. Receive email and download attachment

- **Customer Service Skills**

1. Explain the significance of identifying customer needs and responding to them in a professional manner.
2. Discuss the significance of maintaining hygiene and dressing appropriately

Learning Outcome – Assessment Criteria

Module No.	Outcome	Assessment Criteria
1	Apply safe working practices in the industry	**After completion of this module students will be able to:** 1.1 Follow and maintain procedures to achieve a safe working environment in line with occupational health and safety regulations and requirements. 1.2 Identify basic first aid and use them under different circumstances. 1.3 Identify different fire extinguisher and use the same as per requirement. 1.4 Identify safety alarms accurately 1.5 Follow about General safety precaution in industry with Blacksmithing Work
2	Practice & interpret technical drawings	**After completion of this module students will be able to:** 2.1 Draw plane figures applying drawing instruments with proper layout and folding of drawing sheets. 2.2 Construct Line, Lettering, Dimensioning, and Scale – Plain, Diagonal 2.3 Draw plan, elevation, side view of different objects with appropriate type of lines and dimensions as per standard convention. 2.4 Draw simple geometrical figure like square, rectangle, circle using CAD.
3	Perform basic blacksmithing tasks with essential tools, and utilizing coals, blowers, and other equipment with an understanding of metal properties and safety protocols	**After completion of this module students will be able to:** 3.1 Identify and explain the properties of different metals relevant to blacksmithing. 3.2 Describe the properties and characteristics of bituminous, anthracite, and coke coals. 3.3 Demonstrate the proper use of each type of coal 3.4 Evaluate and select the appropriate blower based on workshop needs. 3.5 Identify and use basic tools such as hammers, anvils, and tongs. 3.6 Set up and operate blowers like hand-cranked, electric, and pneumatic blowers for different blacksmithing tasks.
4	Apply heat treatment techniques, identifying diverse types of steel and its properties.	**After completion of this module students will be able to:** 4.1 Comprehend the composition of steel, including its elemental components and their

Module No.	Outcome	Assessment Criteria
		influence on material properties. 4.2 Explain the various mechanical and thermal properties of steel and their significance in practical applications. 4.3 Demonstrate heat treatment principles, including annealing, quenching, and tempering, and their effects on steel properties. 4.4 Identify different types of steel through visual inspection and measurements.
5.	Read and interpret reinforcement drawings, with hands-on experience in scheduling and bending steel rods	**After completion of this module students will be able to:** 5.1 Comprehend concepts related to reinforcement in construction. Explain the crucial role of steel rods in reinforcement structures. 5.2 Demonstrate reinforcement scheduling and planning principles. 5.3 Execute hands-on reinforcement scheduling exercises, including accurate placement and organization of steel rods. 5.4 Demonstrate bending of steel rods to specified shapes and dimensions. 5.5 Use measuring tools to ensure accurate dimensions of steel rods.
6	Use hacksaw blades and drills for rail cutting, and handle various rail sizes and weights	**After completion of this module students will be able to:** 6.1 Comprehend overview of railway tracks and their components. 6.2 Explain rail sizes and weight specifications, considering their implications in rail infrastructure. 6.3 Demonstrate techniques for rail cutting and the importance of these techniques in railway maintenance and construction. 6.4 Use hacksaw blades and drills for rail cutting exercises, ensuring accuracy and safety. 6.5 Execute rail cutting tasks, considering specified dimensions and guidelines.

Module No.	Outcome	Assessment Criteria
7	Use blacksmithing tools hammers, tongs, chisels, and Jim-Crows for forging and shaping metal.	**After completion of this module students will be able to:** 7.1 Use blacksmithing tools, including hammers, tongs, chisels, and Jim-Crows. 7.2 Explain application of each blacksmithing tool in different forging and shaping scenarios. 7.3 Explain different types and designs of Jim-Crows and their applications in forging and shaping metal. 7.4 Perform basic maintenance and repair tasks for blacksmithing tools. 7.5 Demonstrate ability to effectively apply Jim-Crows in forging and shaping metal during practical sessions
8	Explain role of blacksmiths in bridge construction and maintenance, in the preparation of rivets for bridge riveting works, and in the railway industry	**After completion of this module students will be able to:** 8.1 Demonstrate techniques and processes involved in the preparation of rivets for bridge riveting works. 8.2 Explain broader role of blacksmiths in the railway industry, including their contributions and responsibilities 8.3 Apply riveting skills in practical scenarios, ensuring accuracy and effectiveness in the riveting process 8.4 Explain historical and contemporary role of blacksmiths in the construction and maintenance of bridges.
9	Employability Skill	As per guided curriculum

List of Tools, Equipment & materials needed for 30 Trainees (Practical)

Sl No	Items Name	Specification	Qty
1	Anvil		30 Nos.
2	Steel Rule		30 Nos.
3	Blacksmith Hammers (Ball Peen)		30 Nos.
4	Blacksmith Hammers (Cross Peen)		30 Nos.
5	Blacksmith Hammers (Straight Peen)		30 Nos.
6	Tong bolt 300, 500, 1000, 1500 mm		6 each

Sl No	Items Name	Specification	Qty
7	Tong hollow bit 300, 500, 1000, 1500 mm		6 each
8	Tong side 300, 500, 1000, 1500 mm		6 each
9	Tong flat 300, 500, 1000, 1500 mm		6 each
10	Blacksmith's leveling block with holes and accessories for bending		1 nos.
11	Drifts		30 Nos.
12	Slitters		30 Nos.
13	Center punches		30 Nos.
14	Twisting tools		30 Nos.
15	Chisels		30 Nos.
16	Files (assorted types and sizes)		15 Nos
17	Vises		As required
18	Punches		As required
19	Swage Blocks		As required
20	Fullers		As required
21	Rivet Sets		As required
22	Blacksmithing Rulers and Measuring Tools		3**0**
23	Coal Forges, Propane Forges		2 each
24	Fire Tools (rakes, shovels, etc)		15 each
25	Quenching Tubs		15 nos
26	Propane Gas Cylinders		As required
27	Bituminous Coal, Anthracite Coal		As required
28	Welding Rods - Assorted types		As required
29	Blowers: Hand-Cranked Blowers, Electric Blowers, Pneumatic Blowers.		As required
30	Assorted steel samples		As required
31	Electric or gas furnaces		2 no
32	Tempering Ovens		2 no
33	Callipers and Measuring Tools		20 nos
34	Hacksaws		30 nos
35	portable band saws		10 nos
36	Rod bending machines		1 no
37	Electric or manual drills with assorted drill bits for rail cutting exercises		2 no
38	Assorted rail samples of different sizes and weights		As required
39	Jim-Crows		2 nos