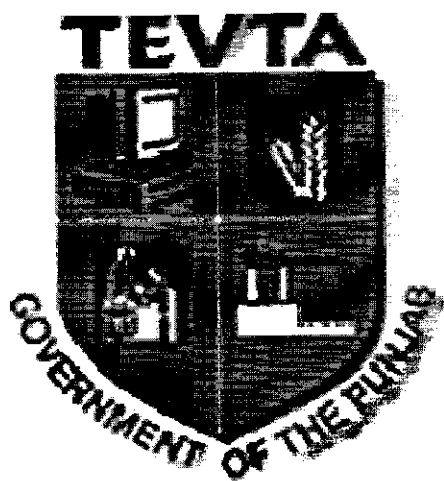


**GOVERNMENT OF THE PUNJAB**  
**TECHNICAL EDUCATION & VOCATIONAL TRAINING AUTHORITY**



**CURRICULUM FOR**  
**Molding & Casting Technology**  
**(03 – Months Course)**

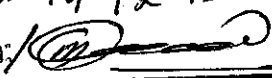
**Evaluated, December 2015**

**CURRICULUM SECTION**  
**ACADEMICS DEPARTMENT**

**96-H, GULBERG-II, LAHORE**

**Ph # 042-99263055-9, 99263064**

**gm.acad@tevta.gop.pk, manager.cur@tevta.gop.pk**

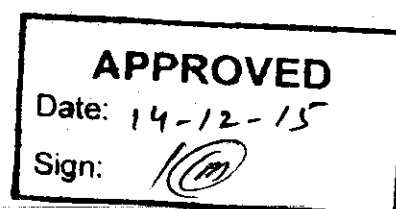
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**Date: -14-12-15**  
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**TRAINING OBJECTIVES:**

- To understand the basic concept molding and casting of metals and alloys. of material.
- To Train about knowledge and skills by using state of the art technology in respect of molding and casting techniques, manufacturing techniques & quality control.
- To Train about the need based skilled manpower, equipped with latest techniques and advanced technical know-how in molding and casting technology.
- To Train and fulfill the vacuum that already exists in this specialized field of study.

**CURRICULUM SALIENT:**

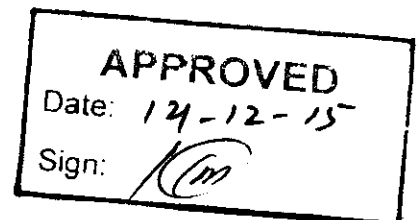
Name of the Course	:	"Molding and Casting Technology"
Entry level	:	Matric and above.
Duration of course	:	3-Months.
Total training hours	:	400 hours.
Training hours per week	:	40 hours
	:	7 Hours per day except
	:	5 Hours on Friday
Training Methodology	:	Practical 90 %
		Theory 10 %



**SKILL COMPETENCY DETAILS: -**

On the successful completion of this course the trainees should be able to:

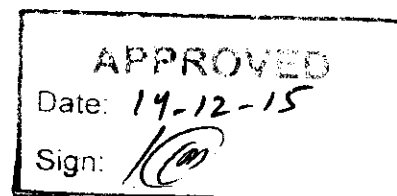
- To operate different types of furnaces, equipments & temperature controlling devices etc.
- Apply molding and casting techniques of metals and alloys (Ferrous & Non-ferrous).
- Run and execute molding machines, core making machines and sand testers etc.
- Making molds, cores, melting of metals, handling of ladles etc.



**KNOWLEDGE PROFICIENCY DETAILS: -**


On the successful completion of this course the trainees should be able to:

- Understand standard methods for molding and casting process.
- Describe standards for implementation of quality testing methods & practices at organization level.
- Identify the critical aspects needed for success in the job and organization. etc
- Basic concept of molding and casting techniques of metals and alloys (Ferrous & Non-ferrous).
- Have the basic knowledge of making molds, cores, melting of metals, handling of ladles etc.




**CURRICULUM DELIVERY STRUCTURE**

Area	Curriculum Delivery	Make up Session	Revision	Final Test	Total
W E E K	1 – 10	11	12	13	13
	10	1	1	1	13

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**SCHEME OF STUDIES****Molding & Casting Technology  
(3 – Months Course)**

Sr. No	Main Topic	Theory Hours	Practical Hours	Total Hours
1.	Introduction	02	0	02
2.	Patterns, Cores & Molds	03	42	45
3.	Gating & Rising	02	47	49
4.	Molding Processes and Equipments	03	55	58
5.	Casting Processes	04	45	49
6.	Melting Practice	04	50	54
7.	Fettling and cleaning	02	40	42
8.	Defects, Inspection and testing of casting.	03	38	41
9.	Heat Treatment	03	40	43
10.	Health, Safety & Environment	02	03	05
11.	Work Ethics	12	0	12
<b>Total</b>		<b>40</b>	<b>360</b>	<b>400</b>

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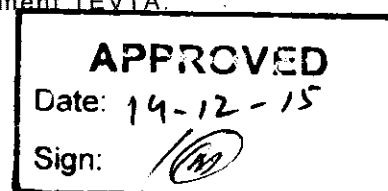
**DETAIL OF COURSE CONTENTS**Molding & Casting Technology  
(3– Months Course)

Sr. No.	Detail of Topics	Theory Hours	Practical Hours
1.	<b>Introduction</b> 1.1 Importance of casting processes 1.2 Types of casting processes 1.3 Advantages and disadvantages of casting processes 1.4 Classification of foundries 1.5 Flow chart/layout of basic steps & major foundry activities 1.6 Types of various ferrous & non ferrous cast alloys and its applications etc.	02	0
2.	<b>Patterns, Cores &amp; Molds</b> 2.1 Types of patterns 2.2 Material used for pattern making 2.3 Criteria for selection of pattern material 2.4 Functions of patterns 2.5 Design and lay out of patterns 2.6 Core boxes & Molds 2.7 Types of core boxes and molds 2.8 Types of Allowances etc.	03	42
3.	<b>Gating &amp; Rising</b> 3.1 Introduction 3.2 Importance of gating system 3.3 Types/Components of gating system 3.4 Functions of gating systems	02	47

	3.5 Design parameters 3.6 Gating ratio 3.7 Risers, types and functions 3.8 Design of risers 3.9 Directional solidification 3.10 Use/ importance of chills and ceramics bricks etc.		
4.	<b>Molding processes and Equipment</b> 4.1 Introduction 4.2 Types of molding processes 4.3 Expendable molding processes 4.4 Permanent molding processes 4.5 Molding machines 4.6 Types of core making machines 4.6.1 Shell Molding (Hot box) 4.6.2 Core Shooter (Cold box) 4.7 Sand mullers and mixers etc.	03	55
5.	<b>Casting Processes</b> 5.1 Sand casting processes 5.2 Types of sand casting 5.3 Investment casting 5.4 Ceramic casting 5.5 Shell casting 5.6 Plaster molding 5.7 Centrifugal casting 5.8 Die casting process , types and applications	04	45
6.	<b>Melting Practice</b> 6.1 Types of melting furnaces 6.2 Cupola ( operation, lining, raw material, charge calculation)	04	50



	6.3 Rotary furnace 6.4 Oil fired furnaces 6.5 Electric furnaces ( induction and arc furnaces) 6.6 Composition, physical properties and applications of ferrous and non ferrous castings 6.7 Importance and methods of inoculation in cast iron and DE oxidation practice in steel casting. 6.8 Degassing process 6.9 Types of Ladles 6.10 Heat controlling devices etc.		
7.	<b>Fettling and Cleaning</b> 7.1 Knock out 7.2 Cutting of in-gate risers 7.3 Short blasting 7.4 Finishing by using pneumatic chippers and grinders etc.	02	40
8.	<b>Defects, Inspection and testing of casting</b> 8.1 Casting defects, analysis and its remedies 8.2 Visual and dimensional inspection 8.3 Mechanical testing 8.4 Non destructive testing (optional)	03	38
9.	<b>Heat Treatment</b> 9.1 Introduction 9.2 Purpose and objectives 9.3 Allotropy of iron 9.4 Cooling curves 9.5 Iron- iron carbon diagram 9.6 Phase transformation	03	40



	9.7 Types of heat treatment 9.8 Heat treatment of heat treatment of steel and aluminum		
10	<b>Health, Safety &amp; Environment</b> 10.1 Introduction 10.2 Possible hazards in foundries 10.3 Safety equipment 10.4 Safety measures and techniques etc.	02	03
11	<b>Work Ethics</b>	12	0
<b>Total</b>		<b>40</b>	<b>360</b>

**LIST OF PRACTICAL:**

**1. Patterns, Cores & Molds**

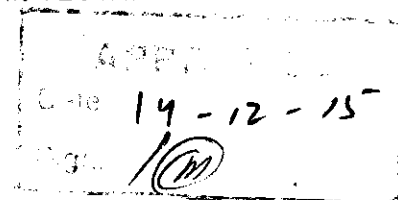
- 1.1 Making design and layout of patterns
- 1.2 Allowances calculation
- 1.3 Making of solid pattern
- 1.4 Making of split pattern
- 1.5 Making of loose piece pattern
- 1.6 Making of self core pattern
- 1.7 Preparation of core sand
- 1.8 Making of core boxes
- 1.9 Preparation of different types of cores
- 1.10 Preparations of different types of molds etc.

**2. Gating & Rising**

- 2.1 Design and placement of different types of gates
- 2.2 Design and placement of different types of risers

**3. Molding processes and Equipments**

- 3.1 Preparations of molds by expendable molding techniques
- 3.2 Preparations of molds by permanent molding techniques
- 3.3 Prepare molds by using jolt squeeze machine
- 3.4 How to use core shooter machine
- 3.5 How to use shell molding machine
- 3.6 How to use die casting machine
- 3.7 Preparation of sand mixture for ferrous castings
- 3.8 Preparation of sand mixture for non ferrous casings
- 3.9 Making a mold of solid pattern
- 3.10 Making a mold having core
- 3.11 Making a mold of self core pattern
- 3.12 Making a mold of parting off pattern



- 3.13 Making a mold of split pattern
- 3.14 Making a mold of loose pattern
- 3.15 Prepare molds by using jolt squeeze machine
- 3.16 Venting practice
- 3.17 How to place a core in mold
- 3.18 Assembling of cope and drag parts etc.

#### **4. Casting Processes**

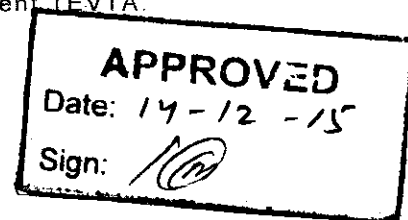
- 4.1 Preparation of casting by using sand molds
- 4.2 Preparation of casting by using plaster of Paris (PoP) molds
- 4.3 Preparation of casting by using wax molds
- 4.4 Preparation of casting by using ceramics molds
- 4.5 Preparations of casting by using shell molds etc.

#### **5. Melting Practice**

- 5.1 Charge calculation for different furnaces (cupola, induction, pit etc.)
- 5.2 Production of grey cast iron
- 5.3 Melting of aluminum by using pit furnace
- 5.4 Melting of steel by using induction furnace
- 5.5 Use of ladles
- 5.6 Temperature control during melting
- 5.7 How to make a furnace refractory lining
- 5.8 Use of degassers/Fluxes etc.

#### **6. Fettling and Cleaning**

- 6.1 Removal of risers, gates
- 6.2 Removal of fins
- 6.3 Knocking out for the removal of cores
- 6.4 Shot blasting operation etc.



**7. Defects, Inspection and Testing of Casting**

- 7.1 Visual inspection
- 7.2 Dimension inspection
- 7.3 Destructive testing
- 7.4 Non destructive testing (optional)

**8. Heat Treatment**

- 8.1 Annealing process & practice
- 8.2 Normalizing process & practice
- 8.3 Quenching process & practice
- 8.4 Tempering process & practice
- 8.5 Use of temperature control devices

**9. Health, Safety & Environment**

- 9.1 Use of protective clothing (fire resistant)
- 9.2 Use of safety shoes (fire resistant)
- 9.3 Use of safety goggles/gloves
- 9.4 Use of safety helmets etc

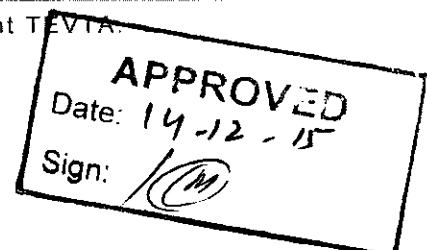
**LIST OF LABS:**

Following labs are Utilized/Engaged during this course:

- Pattern making work shop.
- Machine work shop
- Core making work shop.
- Casting and melting work shop.
- Fettling and Cleaning work shop.
- Heat treatment work Shop.
- Material & certification Lab.
- Mechanical testing Lab.
- Sand testing Lab etc.

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**LIST OF TOOLS AND EQUIPMENT**

(For class of 25 students)

Sr. No	Tools/Equipment	Quantity
1	Measuring Tools (different types)	25 Set
2	Layout Tools (different types)	25 Set
3	Holding Tools (different types)	25 Set
4	Cutting Tools (different types)	25 Set
5	Chisels (different types)	25 Set
6	Files (different types)	25 Set
7	Hack Saw(different types)	25 Set
8	Drilling Machines	05 No
9	Molding Tools (different types)	25 Set
10	Molding flasks	50 No
11	Sand Mixers	02 No
12	Cupola furnace	01 No
13	Rotary furnace	01 No
14	Induction furnace	01 No
15	Pit furnace	01 No
16	Ladles	05 No
17	Shot blasting machine	01 No
18	Lath machine	05 No
19	Milling machine	05 No
20	Sand testing equipment	01 No
21	Emission Spectrometer	01 No
22	Mechanical testing Equipment	01 No
23	Core shooter machine	01 No
24	Shell moldig machine	01 No
25	Investment casting machine	01 No
26	Die casting machine	01 No
27	Jolt squeeze machines	02 No

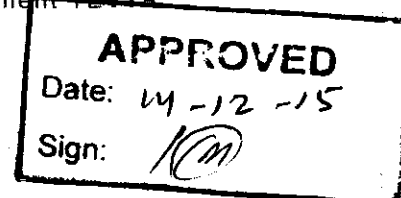
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**LIST OF CONSUMABLE MATERIAL**

(For class of 25 students)

Sr.	Material	Quantity
1.	Wood for patterns	50 kg
2.	Metal for patterns	10 kg
3.	Silica sand	10 bags
4.	Clay	10 bags
5.	Parting powder	02 packets
6.	Organic oil for cores	10 liters
7.	Resins	15 liters
8.	Glue	10 packets
9.	Plaster of Paris	10 bags
10.	Coal dust	01 packet
11.	Paints	03 liters
12.	Fluxes	10 bags
13.	Aluminum scrap	500 kg
14.	Pig iron	500 kg
15.	Coke	200 kg
16.	Shots for shot blasting etc.	01 bag
17.	Wax for investment casting	20 kg
18.	Refractory material for investment casting	10 kg





**MINIMUM QUALIFICATION OF INSTRUCTOR**

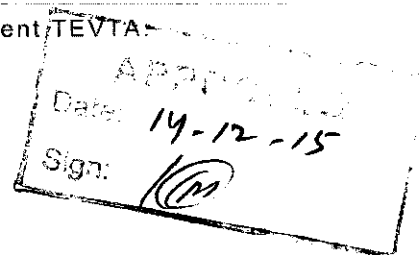
1. B.Sc. Engineering in Metallurgy and Material Sciences/Mechanical.

OR

2. B.Tech / BS-Tech in Mechanical Technology with hands on experience.

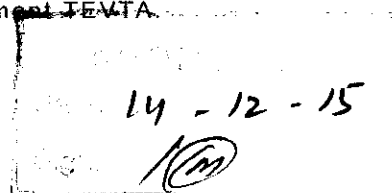
OR

3. DAE in Mechanical/ Cast Metals and Foundry Technology with three (03) years' experience.



**REFERENCE BOOKS**

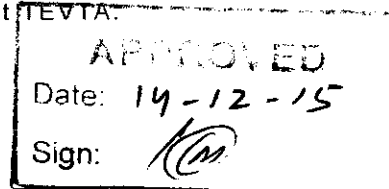
1. Principle of Metal casting by Heine, Loper, Rosenthal
2. “Foundry Engineering by Taylor, Flaming, Wulff (Wiley Eastern Ltd.)
3. “Foundry Practice by N. D.Titor (MIR)
4. Principle of foundry Technology by P.L Jain
5. The foseco foundry foundry man hand book by R. Brown
6. ASM hand book “Casting” vol. 15
7. ASM hand book “Heat treatment” vol. 4
8. Advances in material manufacturing science and technology by xing Ai, jianfeng
9. Liand chuanzhen huang
10. AFS “introduction to the cast metal industry”
11. AFS “ Pattern making”
12. AFS “ Fundamental core technology”
13. AFS” Cupola melting, operation and maintenance
14. Principle of manufacturing materials and process by Compbell.
15. AFS “Principle of production metallurgy for ferrous castings



### **EMPLOYABILITY OF PASS-OUTS**

The pass outs of this course may find job / employment opportunities in the following areas / sectors: -

- Agriculture Industry
- Automobile Industry
- Cast Metals & Foundry Industry
- Sanitary Fittings Industry
- Cutlery Industry
- Cement/Sugar Plant Making Industry
- Textile Industry
- Surgical Instrument Industry
- Oil & Gas sector
- Petrochemical Industry
- Manufacturing Industry
- Aerospace Industry etc.



**CURRICULUM EVALUATION COMMITTEE**

**Mr. Muhammad Aqeel**

Chief Instructor Mechanical

GCT Railway Road Lahore.

(Convener)

**Engr. M. Akram Sarfraz**

Instructor Mechanical

GCT Railway Road Lahore

(Member)

Developed by Curriculum Section, Academics Department TEVTA.

