

**Programme** : Diploma in MT  
**Programme Code** : 05/19  
**Name of Course** : Metallurgical Drawing and Design  
**Course Code** : MT581

**Teaching Scheme:**

	Hours /Week	Total Hours
Theory	04	64
Practical	03	48

**Evaluation Scheme:**

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term work
Duration	Three class tests, each of 60 minutes	3Hrs.	--	--	--
Marks	20	80	--	50	--

**Course Rationale:**

Engineering Drawing is a language of Engineers. Metallurgical Engineer should be in a position to read Engineering Drawing & details shown on the drawing. The students should know design aspect of various metallurgical topics.

**Course Objectives:**

After studying this course, the student will be able to

- Heat Treatment.
- Heat transfer and furnace design.
- Design aspects in foundry field.
- Design fundamentals in metal working processes such as rolling, forging and sheet metal working processes.

**Course Content:**

Chapter No.	Name of Topic/Sub topic	Hrs	Weight age
<b>SECTION I</b>			
<b>1</b>	<b>Designing of Heat Treatment components/Parts</b>		
	1.1 Design considerations for heat-treated parts.	<b>04</b>	<b>08</b>
	1.2 Design of fixtures for the mass heat treatment of metallic parts in salt bath.		
<b>2</b>	<b>Designing Of Heat Treatment Furnaces</b>		
	2.1 Conduction, convection, radiation.	<b>12</b>	<b>12</b>
	2.2 Selection & positioning of pyrometers in heating & melting furnaces.		
	2.3 Calculations for heating elements for electrical furnace, salt bath furnaces.		
	2.4 Calculations of fuels, calculations for the requirements of allied machinery for oil & ash furnaces.		
<b>3</b>	<b>Designing of Molding in Foundry</b>		
	3.1 Design of pattern, gating, risering etc. for industrial cast components.	<b>04</b>	<b>08</b>
	3.2 Die & mold design for special casting processes like die casting, centrifugal casting etc.		
	3.3 Mechanized foundry.		
<b>4</b>	<b>Designing of melting section in Foundry</b>		
	4.1 Design of cupola furnace from required melting rate.	<b>12</b>	<b>12</b>
	4.2 Non-ferrous jobbing foundry.		
<b>SECTION II</b>			
<b>5</b>	<b>Designing of Metal Working shop</b>		
	5.1 Design of forging die, forging shop layout.	<b>12</b>	<b>16</b>
	5.2 Simple design of rolling mill passes & sequences calculations.		
	5.3 Calculations of wire drawing passes, Power required etc.		
	5.4 Rolling Mill Layout.		
	5.5 Design of dies used for extrusion and Press Work.		
	5.6 Electroplating plant Layout.		
<b>6</b>	<b>Designing of Welding and Joining component</b>		
	6.1 Design of different types of weld joints.	<b>10</b>	<b>12</b>
<b>7</b>	<b>Designing of Powder Metallurgy plant</b>		

	7.1	Design of different dies and punches for compaction plant layout.	10	12
<b>Total</b>			<b>64</b>	<b>80</b>

### List of Practicals/Experiments/Assignments:

Sr. No.	Name of Practical/Experiment/Assignment	Hrs
1	Drawing at least one sheet on each topic.	28
2	Complete at least five design projects. The project report should include any drawing if necessary.	20
<b>Total</b>		<b>48</b>

### Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
<b>SECTION I</b>		
1	Designing of Heat Treatment component/Parts	Lecture method, Industrial visit, Practical
2	Designing Of Heat Treatment Furnaces	Lecture method, Industrial visit, Practical
3	Designing of Molding in Foundry	Lecture method, Industrial visit, Practical
4	Designing of melting section in Foundry	Lecture method, Industrial visit, Practical
<b>SECTION II</b>		
5	Designing of Metal Working shop	Lecture method, Industrial visit, Practical
6	Designing of Welding and Joining component	Lecture method, Industrial visit, Practical
7	Designing of Powder Metallurgy plant	Lecture method, Industrial visit, Practical



**Text Books:**

<b>Sr. No</b>	<b>Author</b>	<b>Title</b>	<b>Publication</b>
1	T.V.Ramana Rao	Metal Casting Principle and Practice	New Age International (P) Ltd., Publishers
2	P.L. Jain	Principles Of Foundry Technology.	Tata Macgraw Hill Publishing Company, New Delhi.
3	Richard W.Heine,Carl R.Loper,Philip C. Rosenthal	Principle Of Metal Casting.	Tata Macgraw Hill Publishing Company, New Delhi.

**Reference Books:**

<b>Sr. No</b>	<b>Author</b>	<b>Title</b>	<b>Publication</b>
1	--	Casting Design, AFS Hand Book	American Society Of Metals.

**Learning Resources: Books.**

### Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
<b>SECTION I</b>					
1	Designing of Heat Treatment component/Parts	04	02	02	08
2	Designing Of Heat Treatment Furnaces	08	02	02	12
3	Designing of Molding in Foundry	04	02	02	08
4	Designing of melting section in Foundry	08	02	02	12
<b>SECTION II</b>					
5	Designing of Metal Working shop	10	04	02	16
6	Designing of Welding and Joining component	08	02	02	12
7	Designing of Powder Metallurgy plant	08	02	02	12
<b>Total</b>		<b>50</b>	<b>16</b>	<b>14</b>	<b>80</b>

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**Programme** : Diploma in MT  
**Programme Code** : 05/19  
**Name of Course** : Selection of Materials and Failure analysis  
**Course Code** : MT582

**Teaching Scheme:**

	<b>Hours /Week</b>	<b>Total Hours</b>
<b>Theory</b>	<b>04</b>	<b>64</b>
<b>Practical</b>	<b>03</b>	<b>48</b>

**Evaluation Scheme:**

	<b>Progressive Assessment</b>	<b>Semester End Examination</b>			
		<b>Theory</b>	<b>Practical</b>	<b>Oral</b>	<b>Term work</b>
<b>Duration</b>	Three class tests, each of 60 minutes	3Hrs.	--	--	--
<b>Marks</b>	<b>20</b>	<b>80</b>	--	<b>50</b>	--

**Course Rationale:**

As the uses of metals are varied and innumerable the information on metal selection becomes very significant. The aim of the subject is to enable judicious selection of material based upon the relationship between technical and economic facts.

**Course Objectives:**

After studying this course, the student will be able to

- Select a proper material depending upon property requirement and application.
- Study the failure, which has taken place in the material during service.
- Enlist the causes of the failure.

**Course Content:**

Chapter No.	Name of Topic/Sub topic	Hrs	Weight age
<b>SECTION I</b>			
<b>1</b>	<b>Introduction</b>		
	1.1 Principles involved in the selection of materials.	<b>08</b>	<b>12</b>
	1.2 Selection process, determination of performance requirements, evaluation of alternatives, weighted properties, incremental return, limits on properties.		
	1.3 Factors affecting material prices, material substitution.		
	1.4 Computer's use for selection of material.		
<b>2</b>	<b>Functional Requirement of Engineering Materials</b>		
	2.1 Selections of material for strength, resistance to corrosion, temperature, wear with practical examples.	<b>12</b>	<b>14</b>
	2.2 Selection of non ferrous materials.		
<b>3</b>	<b>Steel Selection</b>		
	3.1 High strength, heat resistant alloys, corrosion resistant steels required for good weldability, formability, forgeability.	<b>12</b>	<b>14</b>
	3.2 Tool steels required for cutting, cold-working dies, hot working dies.		
	3.3 Selection of materials and processes for tools and a few components of automobile engines, machine tools, foundry metal-working equipment, testing machine, ore-dressing equipment.		
<b>SECTION II</b>			
<b>4</b>	<b>Fracture Toughness</b>		
	4.1 Use of fracture toughness to predict performance of components.	<b>16</b>	<b>20</b>
	4.2 Plain strain fracture, critical crack size, crack growth under cyclic loads. (No mathematical details)		
<b>5</b>	<b>Failure Analysis</b>		
	5.1 Failure- Definition, its causes, correlation of failure with microstructure.	<b>16</b>	<b>20</b>
	5.2 Categories of material stressors- Mechanical, chemical, electrochemical, thermal, radiation and electrical.		
	5.3 Modes of fracture.		



	5.4	Factors influencing brittle fracture.		
	5.5	Why failure investigation is performed?		
	5.6	Procedure of failure analysis.		
<b>Total</b>			<b>64</b>	<b>80</b>

### List of Practicals/Experiments/Assignments:

Sr. No.	Name of Practical/Experiment/Assignment	Hrs
1	Study of different types of failures; ductile, brittle, wear, fatigue, corrosion, stress corrosion.	16
2	Case studies of different types of fractures.	12
3	Case studies of selection of materials.	12
4	Presentation on case study on selection of material for any specific application.	08
<b>Total</b>		<b>48</b>

### Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
<b>SECTION I</b>		
1	Introduction	Lecture method.
2	Functional requirement of Engineering Materials	Lecture method.
3	Steel selection	Lecture method, Demonstration method.
<b>SECTION II</b>		
4	Fracture toughness	Lecture method.
5	Fracture analysis	Lecture method.

### Text Books:

Sr. No	Author	Title	Publication
1	Dieter	Mechanical Metallurgy	McGraw-Hill international
2	Reed-Hill	Physical Metallurgy Principles	East-West Press Pvt. Ltd., New Delhi.

### Learning Resources:

Transparency – O. H. P.



### Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
<b>SECTION I</b>					
1	Introduction	6	3	3	12
2	Functional Requirement Of Engg. Materials	6	4	4	14
3	Steel Selection	6	4	4	14
<b>SECTION II</b>					
4	Fracture Toughness	10	5	5	20
5	Failure Analysis	10	5	5	20
<b>Total</b>		<b>38</b>	<b>21</b>	<b>21</b>	<b>80</b>

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**Programme** : Diploma in MT  
**Programme Code** : 05/19  
**Name of Course** : Welding and Modern Forming Processes  
**Course Code** : MT583

**Teaching Scheme:**

	Hours /Week	Total Hours
Theory	04	64
Practical	03	48

**Evaluation Scheme:**

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term work
Duration	Three class tests, each of 60 minutes	3Hrs.	--	--	--
Marks	20	80	--	50	--

**Course Rationale:**

A Metallurgist is being continually controlled with complexities of modern industrial activities. The growing competition & developments in the production methods pose intricate problems as regards to maintenance & repairs. It is therefore, necessary to impart the basic knowledge of fabrication technology to the students of metallurgy.

**Course Objectives:**

After studying this course, the student will be able to

- Aware of the basic knowledge of fabrication technology.
- Know basic principles of various welding methods.
- Know about equipments required for fabrication Industries.
- Know Modern forming processes & equipments.

**Course Content:**

Chapter No.	Name of Topic/Sub topic	Hrs	Weight age
<b>SECTION I</b>			
<b>1</b>	<b>Introduction</b>		
	i.1 Various metal forming processes.	<b>04</b>	<b>05</b>
	1.2 Metal joining methods; welding, brazing, soldering.		
	1.3 Requirements and classification of Welding processes.		
	1.4 Metallurgical changes that occur in welding.		
<b>2</b>	<b>Gas Welding</b>		
	2.1 Materials and equipments.	<b>10</b>	<b>15</b>
	2.2 Fuel gases and their characteristics, availability, welding flame.		
	2.3 Welding torches, their classification, filler materials, fluxes.		
	2.4 Gas welding techniques, Oxy-acetylene welding, torch angle, heat input, nature of flame and its applications.		
	2.5 Welding electrode- coated, bare, function of these coating materials.		
<b>3</b>	<b>Arc Welding Process</b>		
	3.1 Electrode arc properties.	<b>08</b>	<b>10</b>
	3.2 Equipment for arc welding.		
	3.3 Requirement of welding generator and transformer.		
	3.4 Classification of arc welding process; shielded metal arc welding, submerge arc welding, inert gas, shielded arc welding. TIG, MIG.		
<b>4</b>	<b>Other Welding Processes</b>		
	4.1 Principle and fundamentals of; Resistance welding, Thermit welding, Cold welding, Electro-slag welding, Explosion welding, Friction welding.	<b>06</b>	<b>06</b>
<b>5</b>	<b>High Energy Beam Welding Processes</b>		
	5.1 Electron beam welding, Laser welding.	<b>04</b>	<b>04</b>



SECTION II				
<b>6</b>	<b>Metal Transformation in Welding</b>			
	6.1	Various types of weld joints, structure of weld joints.	<b>08</b>	<b>10</b>
	6.2	Heat affected zone.		
	6.3	Pre and post heat treatment of welding.		
	6.4	Application of various welding process.		
<b>7</b>	<b>Soldering and Brazing</b>			
	7.1	Difference between soldering and brazing, their characteristics, Soft solders.	<b>12</b>	<b>15</b>
	7.2	Requirement of soldering alloys.		
	7.3	Flux, types of fluxes and their functions.		
	7.4	Solder material composition.		
<b>8</b>	<b>Testing and Inspection of Weld</b>			
	8.1	Welding defects, their cause and remedies, inspection of defects.	<b>08</b>	<b>10</b>
	8.2	Testing of welds; destructive and non destructive.		
<b>9</b>	<b>Modern Forming Process</b>			
	9.1	Modern forging processes, types of processes.	<b>04</b>	<b>05</b>
	9.2	Powder forging; Description, process characteristics, advantages and disadvantages.		
	9.3	Cold Forging; Description, process characteristics, advantages and disadvantages.		
			<b>Total</b>	<b>80</b>

### List of Practicals/Experiments/Assignments:

Sr. No.	Name of Practical/Experiment/Assignment	Hrs
1	Study of welding of steel component by Oxy-Acetylene gas welding process.	08
2	Study of electric arc welding process.	08
3	Study of spot welding process.	08
4	Study of advanced energy beam welding process.	08
5	Study of structure of welding.	08
6	Study of Brazing and Soldering of alloys.	08
		<b>Total</b>
		<b>48</b>

**Instructional Strategy:**

Sr. No.	Topic	Instructional Strategy
<b>SECTION I</b>		
1	Introduction	Lecture method.
2	Gas Welding	Lecture method, practical, industrial visit.
3	Arc Welding	Lecture method, practical.
4	Other Welding Processes	Lecture method, transparencies-OHP.
5	High Energy Beam Welding Processes	Lecture method.
<b>SECTION II</b>		
6	Metal Transformation in Welding	Lecture method, practical.
7	Soldering and Brazing	Lecture method.
8	Testing and Inspection of Welds	Lecture method, practical.
9	Modern Forming Processes	Lecture method, demonstration.

**Text Books:**

Sr. No	Author	Title	Publication
1	P. N. Rao	Modern Manufacturing Process	Tata McGraw Hill Co.
2	Richard L. Little	Welding Technology	Tata McGraw Hill Co.

**Reference Books:**

Sr. No	Author	Title	Publication
1	Nil	Welding Hand book Vol. 2	ASM Handbook
2	Suresh Daleja	Manufacturing Science & Technology	Tata McGraw Hill Co.
3	B. Kumar	Manufacturing Technology	Khanna Publisher, N.Delhi

Learning Resources: OHP-Transparencies, charts.

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
<b>SECTION II</b>					
1	Introduction	3	2	--	5
2	Gas Welding	5	5	5	15
3	Arc Welding	4	3	3	10
4	Other Welding Processes	2	2	2	06
5	High Energy Beam Welding Processes	2	2	--	04
<b>SECTION II</b>					
6	Metal Transformation in Welding	2	6	2	10
7	Soldering and Brazing	5	5	5	15
8	Testing and Inspection of Welds	5	3	2	10
9	Modern Forming Processes	5	--	--	5
<b>Total</b>		<b>33</b>	<b>28</b>	<b>19</b>	<b>80</b>

  
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**Programme** : Diploma in MT  
**Programme Code** : 05/19  
**Name of Course** : Computer Applications in Metallurgy  
**Course Code** : MT584

**Teaching Scheme:**

	Hours /Week	Total Hours
Theory	04	64
Practical	03	48

**Evaluation Scheme:**

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term work
Duration	Three class tests, each of 60 minutes	3Hrs.	--	--	--
Marks	20	80	--	50	--

**Course Rationale:**

Everyday use of the computers is increasing in every walk of life. At present there are hardly any industries, which do not use computers for some work. It has become possible to achieve newer heights of excellence and efficiency due to computers. In future it is not possible to survive for any industry without extensive use of computers in various activities at all levels. It is necessary to expose our students to this new world of computing so that they can proceed with applications in their specific fields. In present times of high speed computing it is necessary to program computers with the help of structured and dynamic languages like 'C'. Study of 'C' is useful in solving problems / tasks related to various areas of applications. Now a day almost every setup in software engineering applications chooses 'C' as a basic tool to develop software.

**Course Objectives:**

After studying this course, the student will be able to

- Conversant with 'C' language.
- Write a program in 'C' language.
- Make use of various data types, structures, pointers in various applications.
- Learn to solve problems / tasks in a structured way.

**Course Content:**

Chapter No.	Name of Topic/Sub topic	Hrs	Weightage
<b>SECTION I</b>			
<b>1</b>	<b>Data Base Management System</b>		
	1.1 Creating data base.	<b>10</b>	<b>12</b>
	1.2 Classifying, sorting and indexing records of data base files.		
	1.3 Editing, appending database files.		
	1.4 Using various built in functions of data base management system.		
<b>2</b>	<b>DBMS and 'C' Programs</b>		
	2.1 Design of gating system for casting, material management, material selection, charge calculation.	<b>10</b>	<b>12</b>
	2.2 Calculation of hardness values for various harnesses.		
	2.3 Analysis of various types of data, monitoring performance of workers in foundry.		
	2.4 Various small programs based on 'C' language.		
<b>3</b>	<b>'C' Programming</b>		
	3.1 Calculations and graphical display of tension test results.	<b>12</b>	<b>16</b>
	3.2 Charge calculations, analysis and graphical display of data for calibration of thermo-couple.		
	3.3 Various other programs based on 'C' language.		
	3.4 Introduction to Visual C.		
<b>SECTION II</b>			
<b>4</b>	<b>Image Analyzer for Microstructure Examination</b>		
	4.1 Introduction.	<b>10</b>	<b>12</b>
	4.2 Nodule count, grain size measurement.		
	4.3 Phase analysis, percentage phase measurement.		
	4.4 Case depth and coating measurement.		
	4.5 Inclusion rating.		
	4.6 Graphite type.		
<b>5</b>	<b>Micro Hardness Tester</b>		
	5.1 Effective case depth measurement by Vickers hardness method.	<b>06</b>	<b>08</b>
	5.2 Coating hardness measurement.		
	5.3 Knoop hardness testing specially for nitrated case depth.		



	5.4	Single phase hardness measurement.		
<b>6</b>	<b>Use of Computer for Tensile Testing Machine</b>			
	6.1	On line stress strain curve, 0.2 % proof test.	<b>04</b>	<b>06</b>
	6.2	Elevated temperature testing.		
<b>7</b>	<b>Spectrometers, Cryogenic and Potanshostate machine</b>			
	7.1	Working principle, advantages and disadvantages of computerized cryogenic bath machine.	<b>12</b>	<b>14</b>
	7.2	Vacuum emission spectrometer.		
	7.3	Atomic absorption spectrometer.		
	7.4	Optical emission spectrometer.		
	7.5	Introduction to potanshostate machine used for corrosion rate measurement.		
<b>Total</b>			<b>64</b>	<b>80</b>

#### List of Practicals/Experiments/Assignments:

<b>Sr. No.</b>	<b>Name of Practical/Experiment/Assignment</b>	<b>Hrs</b>
1	Practicing creation of database, classifying, sorting and indexing records of database file.	04
2	Practicing at dot prompt, editing, appending database files.	04
3	Practicing use of various built in functions of database management systems.	04
4	Practicing various small programs in 'C' language.	04
5	Various programs using 'C' language about applications in Metallurgy.	08
6	Use of image analyzer for Nodule count, grain size measurement, phase analysis, percentage phase measurement, case depth and coating measurement, inclusion rating, graphite type.	08
7	Use of micro hardness tester for Effective case depth measurement by Vickers hardness method, coating hardness measurement.	04
8	Use of micro hardness tester for Knoop hardness testing specially for nitrided case depth, single phase hardness measurement.	04
9	Study of computerized on line stress strain curve, 0.2 % proof test, elevated temperature testing.	04
10	Study of Vacuum emission spectrometer, Atomic absorption spectrometer, Optical emission spectrometer.	04
<b>Total</b>		<b>48</b>



### Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
<b>SECTION I</b>		
1	Data Base Management System	Class room teaching and hands on training on computer.
2	DBMS and 'C' Programs	Class room teaching and hands on training on computer.
3	'C' Programming	Class room teaching and hands on training on computer.
<b>SECTION II</b>		
4	Image Analyzer for Microstructure Examination	Class room teaching and hands on training on computer.
5	Micro Hardness Tester	Class room teaching and hands on training on computer.
6	Use of Computer for Tensile Testing Machine	Class room teaching and hands on training on computer.
7	Spectrometers, Cryogenic and Potanshostate machine	Class room teaching and hands on training on computer.

### Text Books:

Sr. No	Author	Title	Publication
1	Yashawant Kanetkar	Let Us C	BPB Publications, New Delhi.

### Reference Books:

Sr. No	Author	Title	Publication
1	Henry Mulish & Herbert L. Cooper	The Spirit of 'C'	Jaico Publishing House, Mumbai.
2	E. Balaguruswami	Programming in ANSI 'C'	Tata-McGra Hill Publishing Company, New Delhi.

**Learning Resources:** Computer, Instruments, and books.

**Specification Table:**

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
<b>SECTION I</b>					
1	Data Base Management System	04	04	04	12
2	DBMS and 'C' Programs	04	04	04	12
3	'C' Programming	04	06	06	16
<b>SECTION II</b>					
4	Image Analyzer for Microstructure Examination	02	02	08	12
5	Micro Hardness Tester	02	02	04	08
6	Use of Computer for Tensile Testing Machine	02	02	02	06
7	Spectrometers, cryogenic and Potanshostate machine	02	04	08	14
<b>Total</b>		<b>20</b>	<b>24</b>	<b>36</b>	<b>80</b>

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