Programme : **Diploma in MT**
Programme Code : **05/19**
Name of Course : **Metallurgical Drawing and Design**
Course Code : **MT761**

Teaching Scheme:

	Hours /Week	Total Hours
Theory	02	32
Practical	03	48

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term work
Duration	Two 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	Weightage
	SECTION I			
1	**Designing of Heat Treatment components/Parts**			
	1.1	Design considerations for heat-treated parts.	02	08
	1.2	Design of fixtures for the mass heat treatment of metallic parts in salt bath.		
2	**Designing Of Heat Treatment Furnaces**			
	2.1	Conduction, convection, radiation.	06	12
	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.		
3	**Designing of Molding in Foundry**			
	3.1	Design of pattern, gating, risering etc. for industrial cast components.	02	08
	3.2	Die & mold design for special casting processes like die casting, centrifugal casting etc.		
	3.3	Mechanized foundry.		
4	**Designing of melting section in Foundry**			
	4.1	Design of cupola furnace from required melting rate.	06	12
	4.2	Non-ferrous jobbing foundry.		
	SECTION II			
5	**Designing of Metal Working shop**			
	5.1	Design of forging die, forging shop layout.	08	16
	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.		
6	**Designing of Welding and Joining component**			
	6.1	Design of different types of weld joints.	**04**	**12**
7	**Designing of Powder Metallurgy plant**			
	7.1	Design of different dies and punches for compaction plant layout.	**04**	**12**
		Total	**32**	**80**

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
	Total	**48**

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
	SECTION I	
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
	SECTION II	
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:

Sr. No	Author	Title	Publication
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:

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

Learning Resources: Books.

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
	SECTION I				
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
	SECTION II				
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
	Total	**50**	**16**	**14**	**80**

(Prof.P.B.Kamble)
Prepared By

(Prof.S.B.Kulkarni)
Secretary, PBOS

(Prof.P.B.Kamble)
Chairman, PBOS

Programme : **Diploma in MT**
Programme Code : **05/19**
Name of Course : **Selection of Materials and Failure analysis**
Course Code : **MT762**

Teaching Scheme:

	Hours /Week	Total Hours
Theory	**03**	**48**
Practical	**02**	**32**

Evaluation Scheme:

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

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	Weightage
	SECTION I			
1	**Introduction**			
	1.1	Principles involved in the selection of materials.	08	12
	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.		
2	**Functional Requirement of Engineering Materials**			
	2.1	Selections of material for strength, resistance to corrosion, temperature, wear with practical examples.	08	14
	2.2	Selection of non ferrous materials.		
3	**Steel Selection**			
	3.1	High strength, heat resistant alloys, corrosion resistant steels required for good weldability, formability, forgeability.	08	14
	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.		
	SECTION II			
4	**Fracture Toughness**			
	4.1	Use of fracture toughness to predict performance of components.	12	20
	4.2	Plain strain fracture, critical crack size, crack growth under cyclic loads. (No mathematical details)		
5	**Failure Analysis**			
	5.1	Modes of fracture.	12	20
	5.2	Factors influencing brittle fracture.		
	5.3	Causes of failure of engineering components.		
		Total	**48**	**80**

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.	12
2	Case studies of different types of fractures.	08
3	Case studies of selection of materials.	08
4	Presentation on case study on selection of material for any specific application.	04
	Total	**32**

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
	SECTION I	
1	Introduction	Lecture method.
2	Functional requirement of Engineering Materials	Lecture method.
3	Steel selection	Lecture method, Demonstration method.
	SECTION II	
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	
	SECTION I				
1	Introduction	06	03	03	12
2	Functional Requirement Of Engg. Materials	06	04	04	14
3	Steel Selection	06	04	04	14
	SECTION II				
4	Fracture Toughness	10	05	05	20
5	Failure Analysis	10	05	05	20
	Total	**38**	**21**	**21**	**80**

(Prof.N.S.Kadam)
Prepared By

(Prof.S.B.Kulkarni)
Secretary, PBOS

(Prof.P.B.Kamble)
Chairman, PBOS

Programme : **Diploma in MT**
Programme Code : **05/19**
Name of Course : **Welding and Modern Forming Processes**
Course Code : **MT763**

Teaching Scheme:

	Hours /Week	Total Hours
Theory	03	48
Practical	02	32

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term work
Duration	Two 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	Weightage
	SECTION I			
1	**Introduction**			
	1.1	Various metal forming processes.	03	05
	1.2	Metal joining methods; welding, brazing, soldering.		
	1.3	Requirements and classification of Welding processes.		
	1.4	Metallurgical changes that occur in welding.		
2	**Gas Welding**			
	2.1	Materials and equipments.	08	15
	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.		
3	**Arc Welding Process**			
	3.1	Electrode arc properties.	06	10
	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.		
4	**Other Welding Processes**			
	4.1	Principle and fundamentals of; Resistance welding, Thermit welding, Cold welding, Electro-slag welding, Explosion welding, Friction welding.	05	06
5	**High Energy Beam Welding Processes**			
	5.1	Electron beam welding, Laser welding.	02	04

SECTION II				
6	**Metal Transformation in Welding**			
	6.1	Various types of weld joints, structure of weld joints.	06	10
	6.2	Heat affected zone.		
	6.3	Pre and post heat treatment of welding.		
	6.4	Application of various welding process.		
7	**Soldering and Brazing**			
	7.1	Difference between soldering and brazing, their characteristics, Soft solders.	09	15
	7.2	Requirement of soldering alloys.		
	7.3	Flux, types of fluxes and their functions.		
	7.4	Solder material composition.		
8	**Testing and Inspection of Weld**			
	8.1	Welding defects, their cause and remedies, inspection of defects.	05	10
	8.2	Testing of welds; destructive and non destructive.		
9	**Modern Forming Process**			
	9.1	Modern forging processes, types of processes.	04	05
	9.2	Powder forging; Description, process characteristics, advantages and disadvantages.		
	9.3	Cold Forging; Description, process characteristics, advantages and disadvantages.		
		Total	48	80

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.	06
2	Study of electric arc welding process.	06
3	Study of spot welding process.	04
4	Study of advanced energy beam welding process.	04
5	Study of structure of welding.	06
6	Study of Brazing and Soldering of alloys.	06
	Total	32

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
	SECTION I	
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.
	SECTION II	
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	
	SECTION II				
1	Introduction	03	02	--	05
2	Gas Welding	05	05	05	15
3	Arc Welding	04	03	03	10
4	Other Welding Processes	02	02	02	06
5	High Energy Beam Welding Processes	02	02	--	04
	SECTION II				
6	Metal Transformation in Welding	02	06	02	10
7	Soldering and Brazing	05	05	05	15
8	Testing and Inspection of Welds	05	03	02	10
9	Modern Forming Processes	05	--	--	05
	Total	**33**	**28**	**19**	**80**

Kamble
(Prof.P.B.Kamble)
Prepared By

(Prof.S.B.Kulkarni)
Secretary, PBOS

Kamble
(Prof.P.B.Kamble)
Chairman, PBOS

Programme : **Diploma in MT**
Programme Code : **05/19**
Name of Course : **Computer Applications in Metallurgy**
Course Code : **MT764**

Teaching Scheme:

	Hours /Week	Total Hours
Theory	02	32
Practical	03	48

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term work
Duration	Two 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	Weigh tage
	SECTION I			
1	**Data Base Management System**			
	1.1	Creating data base.	05	12
	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.		
2	**DBMS and 'C' Programs**			
	2.1	Design of gating system for casting, material management, material selection, charge calculation.	05	12
	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.		
3	**'C' Programming**			
	3.1	Calculations and graphical display of tension test results.	06	16
	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.		
	SECTION II			
4	**Image Analyzer for Microstructure Examination**			
	4.1	Introduction.	05	12
	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.		

5	**Micro Hardness Tester**			
	5.1	Effective case depth measurement by Vickers hardness method.	03	08
	5.2	Coating hardness measurement.		
	5.3	Knoop hardness testing specially for nitrided case depth.		
	5.4	Single phase hardness measurement.		
6	**Use of Computer for Tensile Testing Machine**			
	6.1	On line stress strain curve, 0.2 % proof test.	02	06
	6.2	Elevated temperature testing.		
7	**Spectrometers, Cryogenic and Potanshostate machine.**			
	7.1	Working principle, advantages and disadvantages of computerized cryogenic bath machine.	06	14
	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.		
		Total	**32**	**80**

List of Practicals/Experiments/Assignments:

Sr. No.	Name of Practical/Experiment/Assignment	Hrs
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	04

	by Vickers hardness method, coating hardness measurement.	
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
	Total	**48**

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
	SECTION I	
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.
	SECTION II	
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	
	SECTION I				
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
	SECTION II				
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
	Total	**20**	**24**	**36**	**80**

(Prof.N.T.Vitekar)
Prepared By

(Prof.S.B.Kulkarni)
Secretary, PBOS

(Prof.P.B.Kamble)
Chairman, PBOS

Programme : **Diploma in MT**
Programme Code : **05/19**
Name of Course : **Advanced Physical Metallurgy**
Course Code : **MT765**

Teaching Scheme:

	Hours /Week	Total Hours
Theory	**03**	**48**
Practical	**02**	**32**

Evaluation Scheme:

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

Course Rationale:

Metallurgical engineers often have to work in heat treatment shops or in design department to select a suitable material for required working condition. This subject deals with relationship between properties and selection of materials for such properties. This requires further detailed knowledge of physical metallurgy, so this course will be suitable to specialize in material selection.

Course Objectives:

After studying this course, the student will be able to

- Familiar with modern techniques to study crystal structure by X-rays and electron microscope.
- Have fundamental knowledge of physical properties of materials.
- Know theory of diffusion, which is required for understanding heat-treating processes like Carburising, Nitriding and various diffusion metalising processes.
- Study phase tranformation, which is important to understand various transformations.

Course Content:

Chapter No.	Name of Topic/Sub topic		Hrs	Weightage
	SECTION I			
1	**X-Ray Diffraction**			
	1.1	X-ray technique, Bragg's law.	04	08
	1.2	Diffraction methods; Lauve method, rotating crystal method, powder method, calculation of lattice parameter.		
	1.3	Electron microscope.		
2	**Alloy Steels**			
	2.1	Classification of alloying elements.	10	16
	2.2	Effect of alloying elements on Iron-Carbon equilibrium diagram.		
	2.3	Effect of alloying elements on the shape of T.T.T. diagram of steels.		
	2.4	Effect on the properties of steels.		
	2.5	Classification of low alloy steels, high alloy steels.		
	2.6	Introduction to micro alloyed steels.		
3	**Physical Properties & Selection of Materials for Various Applications**			
	3.1	Magnetic properties, electrical properties, selection of materials for electrical application.	10	16
	3.2	Machinability– concept of machinability, measurement of machinability, machinability index of various metals and alloys.		
	3.3	Wear resistance, types of wear; metal to metal (lubricated and non lubricated), metal to non metal, dry friction– metal to non metal, particle impact, metal to fluid. Selection of materials for higher wear resistance.		

SECTION II				
4	**High Temperature Properties, Corrosion Resistance & Stainless Steels**			
	4.1	High temperature properties, selection of materials for use at elevated temperatures, super alloys.	08	16
	4.2	Chromium steels, role of chromium in stainless steels.		
	4.3	Classification of stainless steels, AISI specifications.		
	4.4	Applications of different types of stainless steels.		
	4.5	Carbide precipitation in stainless steels, stabilization treatment.		
5	**Tools Steels**			
	5.1	Tools steels, classification of tool steels on the basis of application.	08	12
	5.2	Properties required for different types of tool steels.		
	5.3	Heat treatment of HSS cutting tools, heat treatment of measuring instruments, heat treatment of dies and die moulds, heat treatment of machine parts, springs.		
	5.4	PVD, CVD.		
	5.5	Introduction to failure due to process deficiency and wrong selection of material.		
6	**Diffusion in Metals**			
	6.1	Fick's first law, mechanism of diffusion, diffusion in alloys, illustrative examples.	04	08
	6.2	Growth of oxide layer.		
	6.3	Carburizing- variables that influence diffusion; temperature, concentration, crystal structure, impurities, grain size.		
7	**Study Of Phase Transformation**			
	7.1	Nucleation and growth consideration, order-disorder changes.	04	04
	7.2	Precipitation hardening solution treatment, aging treatment.		
		Total	**48**	**80**

List of Practicals/Experiments/Assignments:

Sr. No.	Name of Practical/Experiment/Assignment	Hrs
1	Study of electron microscope.	04
2	Study of X-ray diffraction and Bragg's law.	04
3	Study the effect of alloying elements on Iron – Carbon equilibrium diagram.	04
4	Study of machinability.	02
5	Study of wear-resistance.	02
6	Metallography of stainless steels.	04
7	Study of Tool steels.	04
8	Study of Fick's law i) Chromizing ii) Aluminizing	04
9	Study of nucleation and growth process.	04
	Total	**32**

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
	SECTION I	
1	X-Ray Diffraction	Class room teaching, visit.
2	Alloy Steels	Class room teaching, group discussion.
3	Physical Properties & Selection of Materials for Various Applications	Class room teaching, expert lecture.
	SECTION II	
4	High Temperature Properties, Corrosion Resistance & Stainless Steels	Class room teaching.
5	Tools Steels	Class room teaching.
6	Diffusion in Metals	Class room teaching, group discussion.
7	Study Of Phase Transformation	Class room teaching.

Text Books:

Sr. No	Author	Title	Publication
1	Avner	Introduction To Physical Metallurgy	McGraw-Hill International
2	Clark and Varney	Metallurgy For Engineers	CBS publishers and distributors

Reference Books:

Sr. No	Author	Title	Publication
1	Guy	Elements of physical metallurgy	Oxford Book Company
2	Zakharao	Heat treatment of metals and alloys	Foreign Language Publishing House, Moscow.
3	Robert E. Red-Hill	Physical Metallurgy Principles	Affiliated East-west Press Pvt. Ltd., New Delhi.

Learning Resources: Transparency – O. H. P.

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
	SECTION I				
1	X-Ray Diffraction	04	04	--	08
2	Alloy Steels	08	04	04	16
3	Physical Properties & Selection of Materials for Various Applications	08	04	04	16
	SECTION II				
4	High Temperature Properties, Corrosion Resistance & Stainless Steels	08	04	04	16
5	Tools Steels	08	02	02	12
6	Diffusion in Metals	04	04	--	08
7	Study of Phase transformation	02	02	--	04
	Total	**42**	**24**	**14**	**80**

(Prof.N.S.Kadam)
Prepared By

(Prof.S.B.Kulkarni)
Secretary, PBOS

(Prof.P.B.Kamble)
Chairman, PBOS

Programme : **Diploma in MT**
Programme Code : **05/19**
Name of Course : **Modern Foundry Engineering**
Course Code : **MT766**

Teaching Scheme:

	Hours /Week	Total Hours
Theory	02	32
Practical	03	48

Evaluation Scheme:

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

Course Rationale:

To enable the Metallurgy engineer with various foundry practices such as ferrous and non-ferrous alloys, which are popularly cast. He should also understand the other important aspects of foundry apart from only the production processes.

Course Objectives:

After studying this course, the student will be able to be

- Specialized in the foundry engineering.
- Confident in entering foundry industry and career.

Course Content:

Chapter No.	Name of Topic/Sub topic		Hrs	Weightage
	SECTION I			
1	**Flow of Metals and Gating system**			
	1.1	Laws of fluid dynamics governing the design of gating system. Equation of Continuity Bernoulli's theorem.	03	12
	1.2	Calculation of pouring time for Ferrous and Non Ferrous alloys.		
	1.3	Importance and determination of dimensions of passages i.e. gating ratio.		
2	**Risering of Casting**			
	2.1	Directional solidification, riser shape, size and location.	03	07
	2.2	Chvorinov's rule, Cain's method.		
	2.3	Use of padding, exothermic material, chills.		
3	**Fettling, Cleaning and H.T. of Castings**			
	3.1	Fettling, cleaning and H.T. of castings.	02	04
4	**Casting Inspection**			
	4.1	Specifications, ISO, quality aspect, inspection procedure, destructive and non-destructive testing of casting.	04	06
	4.2	Methods of surface finish measurements.		
5	**Casting Defect Analysis**			
	5.1	Faults arising in pouring, inclusion and sand defects, gas defect, shrinkage defect and contraction defect.	04	11
	5.2	Dimensional errors, Compositional errors and segregation.		

SECTION II				
6	**Melting Practice and Metallurgy of Cast Iron**			
	6.1	Classification of C.I., chemical composition, effect on structure and properties.	02	04
	6.2	Molding practice for Grey C.I.		
7	**S.G.Iron**			
	7.1	Chemical composition, various techniques of S.G. iron production, Mg recovery.	03	08
	7.2	Molding practice for S.G. iron.		
	7.3	Austempered Ductile Iron.		
8	**Production of Steel Casting**			
	8.1	Specific characteristic of steel castings, melting practice, molding practice.	02	06
	8.2	Alloying practice for steel casting.		
9	**Foundry Practice for Non Ferrous Alloys**			
		Production of Al and Al alloys, Al casting alloys.	02	08
		Modification of Al-Si alloys.		
10	**Metal Treatment**			
	10.1	Degassing, fluxing, vacuum degassing.	02	04
		Ultrasonic treatment.		
11	**Production of Cu and Cu alloy Castings**			
	11.1	Metallurgical factors affecting foundry practice for Cu and Cu base casting alloys, melting furnaces, casting processes.	01	02
12	**Production of Mg base Casting Alloys**			
	12.1	Foundry techniques, melting of Mg-alloys, production of Zn and Zn alloy castings.	01	02
13	**Foundry Modernization, Mechanization and Lay out of Foundry**			
	13.1	Foundry modernization, mechanization and lay out of foundry.	01	04
14	**Foundry Planning**			
	14.1	Introduction to foundry planning.	01	02
		Total	32	80

List of Practicals/Experiments/Assignments:

Sr. No.	Name of Practical/Experiment/Assignment	Hrs
1	Study of various types of gates.	08
2	Study of various types of risers.	08
3	Case study of design of gating system and riser.	08
4	Study of various casting defects.	08
5	Crucible Melting of Al.	08
6	Drawing a layout for Ferrous and Non-Ferrous Foundry.	08
	Total	**48**

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
	SECTION I	
1	Flow of Metals and Gating system	Lecture method, practical.
2	Risering of Casting	Lecture method, Practical.
3	Fettling, Cleaning and H.T. of Castings	Lecture method, industrial visit.
4	Casting Inspection	Lecture method.
5	Casting Defect Analysis	Lecture method, Video Cassettes.
	SECTION II	
6	Melting Practice and Metallurgy of C.I.	Lecture method, industrial Visit.
7	S.G.Iron	Lecture method, industrial visit.
8	Production of Steel Casting	Lecture method, industrial visit.
9	Foundry Practice for Non Ferrous Alloys	Lecture method, industrial Visit, practical.
10	Metal Treatment	Lecture method.
11	Production of Cu and Cu alloy Castings	Lecture method, industrial visit.
12	Production of Mg base Casting Alloys	Lecture method, industrial visit.
13	Foundry Modernization, Mechanization and Lay out of Foundry	Lecture method, industrial Visit.
14	Foundry Planning	Lecture method.

Text Books:

Sr. No	Author	Title	Publication
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 McGraw Hill Publishing Company
3	Richard W.Heine, Carl R.Loper, Philip C. Rosenthal	Principle Of Metal Casting.	Tata McGraw Hill Publishing Company

Reference Books:

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

Learning Resources: OHP-Transparencies, charts, video cassettes.

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
	SECTION I				
1	Flow of Metals and Gating system	04	03	05	12
2	Risering of Casting	02	02	03	07
3	Fettling, Cleaning and H.T. of Castings	02	02	02	06
4	Casting Inspection	02	01	01	04
5	Casting Defect Analysis	05	02	04	11

SECTION II					
6	Melting Practice and Metallurgy of Cast Iron	02	--	02	04
7	S.G.Iron	03	02	03	08
8	Production of Steel Casting	02	02	02	06
9	Foundry Practice for Non Ferrous Alloys	03	02	03	08
10	Metal Treatment	02	01	01	04
11	Production of Cu and Cu alloy Castings	02	--	--	02
12	Production of Mg base Casting Alloys	02	--	--	02
13	Foundry Modernization, Mechanization and Lay out of Foundry	02	01	01	04
14	Foundry Planning	02	--	--	02
	Total	**35**	**18**	**27**	**80**

(Prof.P.B.Kamble)
Prepared By

(Prof.S.B.Kulkarni)
Secretary, PBOS

(Prof.P.B.Kamble)
Chairman, PBOS

Programme : **Diploma in MT**
Programme Code : **05/19**
Name of Course : **Surface Protection Methods**
Course Code : **MT767**

Teaching Scheme:

	Hours /Week	Total Hours
Theory	03	48
Practical	02	32

Evaluation Scheme:

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

Course Rationale:

Corrosion is one of the important phenomenons occurring in nature. Corrosion leads to loss of metals & its surface properties. If due care is not taken to prevent corrosion, it lead to failure of components. Therefore it is necessary to minimize the process of corrosion if not completely prevented. It is therefore necessary to know about the surface protection methods.

Course Objectives:

After studying this course, the student will be able to

- Know the importance of surface protection.
- Know various surface protection techniques & select a particular protection method under given conditions.
- Learn various testing and quality control methods involved in surface protection process.

Course Content:

Chapter No.	Name of Topic/Sub topic		Hrs	Weightage
		SECTION I		
1	Introduction			
	1.1	Corrosion, nature of corrosion, preventive methods for corrosion.	05	10
	1.2	Importance of surface protection, various methods.		
	1.3	Classification & advantage of various methods of surface protection.		
2	Surface Preparation			
	2.1	Necessity of surface preparation.	06	10
	2.2	Types of surface preparation methods; mechanical, chemical & electrochemical methods.		
	2.3	Mechanical methods such as grinding, polishing, brushing, buffing etc.		
	2.4	Chemical methods, degreasing of metal surface, detergent cleaning, acid & alkali cleaning.		
	2.5	Electrolytic cleaning & ultrasonic cleaning.		
	2.6	Factors for selection of proper cleaning methods.		
3	Electroplating			
	3.1	Principles of electrodeposition.	13	20
	3.2	Process of electrolysis, Faraday's law of electrolysis, examples of faraday's law, degree of dissociation, rate of deposition, current efficiency, thickness of deposition, plating time determination.		
	3.3	Plating procedure for- Chromium plating, Copper plating, Nickel Plating, Gold Plating, Bath composition, Controls, application of platings.		
	3.4	Quality control in plating- chemical analysis & pH control of plating solution, testing for porosity, Hydrogen embrittlment, adhesion, hardness, thickness related tests, salt spray test.		
	3.5	Special Plating Processes- electroforming, immersion plating, anodizing of Aluminum, etc.		
	3.6	Plant layout of Electroplating.		

SECTION II				
4	**Non-Metallic Coating**			
	4.1	Painting, surface preparation for painting.	12	15
	4.2	Primers.		
	4.3	Phosphate coatings, treatment before phosphating, mechanism of phosphate coating, formation methods of phosphate coating, advantage & application.		
	4.4	Vacuums metallizing.		
	4.5	Coloring of metals.		
5	**Allied Metallic Coating**			
	5.1	Galvanizing- surface cleaning, fluxing, molten metal bath temperature controls.	10	15
	5.2	Defect in galvanized coating.		
	5.3	Tinning- Terne Plating Commutation process -such as chromising , colorizing etc.		
	5.4	Metal spraying- surface preparation, spraying methods, applications.		
6	**Alloy Deposition**			
	6.1	General principles of alloy deposition, brass & bronze plating.	02	10
		Total	**48**	**80**

List of Practicals/Experiments/Assignments:

Sr. No.	Name of Practical/Experiment/Assignment	Hrs
1	Preparation of surface for Electroplating.	06
2	Principles of Electroplating.	04
3	Copper plating on M.S. Component.	06
4	Nickel Plating on M.S. Surface.	06
5	Chromium Plating on M.S. Surface.	06
6	Study & testing of Phosphate coating on M.S.	04
	Total	**32**

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
	SECTION I	
1	Introduction	Lecture method.
2	Surface Preparation	Lecture method, practical, industrial visit.
3	Electroplating	Lecture method, practical.
	SECTION II	
4	Nonmetallic Coating	Lecture method, Transparencies-OHP.
5	Allied Metallic Coatings	Lecture method, demonstration.
6	Alloy Deposition	Lecture method.

Text Books:

Sr. No	Author	Title	Publication
1	Cartwrite	Hand book Of Electroplating	Blackie & Sons Ltd. London & Glasgow

Reference Books:

Sr. No	Author	Title	Publication
1	William Blaume	Electroplating & Electroforming	McGraw Hill Book Comp.
2	Lainer	Modern Electroplating	Israel Program For SC Franc. Jerusalem
3	Eric N. Simons	Surface treatment of Steel	Sir Isaac Pitman & Sons Ltd. London
4	Society For Manufacturing Engg.	Surface Preparation & Finish	MIR Publisher
5	A. Kenneth Graham	Electroplating Engineering Handbook	Van Nostrand Reinhold Co. New York.

Learning Resources: Books, Transparencies.

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
	SECTION I				
1	Introduction	05	05	--	10
2	Surface Preparation	05	--	05	10
3	Electroplating	10	05	05	20
	SECTION II				
4	Non- Metallic Coating	10	--	05	15
5	Allied Metallic Coating	10	--	05	15
6	Alloy Deposition	05	--	05	10
	Total	**45**	**10**	**25**	**80**

(Prof.P.B.Kamble)
Prepared By

(Prof.S.B.Kulkarni)
Secretary, PBOS

(Prof.P.B.Kamble)
Chairman, PBOS

Programme	:	**Diploma in MT**
Programme Code	:	**05/19**
Name of Course	:	**Non-metallic Materials**
Course Code	:	**MT768**

Teaching Scheme:

	Hours /Week	Total Hours
Theory	03	48
Practical	02	32

Evaluation Scheme:

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

Course Rationale:

The total developments in science and technology depend to a considerable extent on materials technology. The properties and applications of non-metallic materials has been a very important topic in engineering and technology. It is often said that the rate of growth of technology is hindered by the limited availability of materials with the derived properties. The field of non-metallic materials has assured for itself the responsibility to discover and control properties of materials for fundamental research and applications.

Course Objectives:

After studying this course, the student will

- Be aware about the various non-metallic materials used in engineering applications.
- Know the basic principles necessary for understanding nature and properties of materials.
- Understand the relation between structure and properties of materials.

Course Content:

Chapter No.	Name of Topic/Sub topic		Hrs	Weightage
	SECTION I			
1	**Structure of Solids**			
	1.1	Crystalline nature, types of structures, carbon, silica, silicate, glasses etc.	03	05
2	**Colloids and Polymers**			
	2.1	Classification of colloids, intermediate systems, gels and pastes, clay-water dispersions emulsions.	08	20
	2.2	Polymers- Introduction, polymerization and its mechanisms, formations of polymers, structure, physical properties and chemical resistance.		
	2.3	Specific polymeric materials, poly-ethylene, resins, foamed plastics, wood, natural resins, PVC, acrylic polymers.		
3	**Rubbers**			
	3.1	Occurrence, structure & properties of rubbers, important applications in engineering industry.	05	05
	3.2	Natural rubber, styrene, butadiene, bectyl rubber, nitrite rubber etc.		
	3.3	Vulcanization of rubber, forming & fabrication techniques for rubber.		
4	**Glasses**			
	4.1	Structure of glasses, silicate structure, composition, properties, glass production and processing.	04	05
	4.2	Important types- Vitreous fused silica-polycrystaline glass, soda lime, lead glass, borosllicate glass, glass ceramics.		
5	**Ceramics**			
	5.1	Nature & types of ceramics, general characteristics.	04	05
	5.2	Common oxides, clays, porcelain, insulating materials, abrasives carbides, enamels, ceramic lubricants, steatites etc.		

SECTION II				
6	**Adhesives**			
	6.1	Characteristics of adhesives, adhesive bonding, mechanism and applications of adhesives.	05	08
	6.2	Types of adhesives, use of adhesives, adhesive joints.		
	6.3	Advantages and disadvantages of adhesive bonding.		
7	**Lubricants**			
	7.1	Function and characteristics of lubricating oils.	05	08
	7.2	Theory of lubrication.		
	7.3	Organic liquids, synthetic lubricating oils– cutting fluids, lubricating greases, solid lubricants.		
8	**Composite Materials**			
	8.1	Introduction, classification of composites, manufacturing processes.	05	08
	8.2	FRP composite, protective coating on composites.		
	8.3	Concrete, prestressed concrete.		
9	**Insulating Materials**			
	9.1	Types of insulating materials.	05	08
	9.2	Properties and requirements of insulating materials.		
	9.3	Thermal, electrical and sound insulating materials.		
10	**Magnetic Materials**			
	10.1	Magnetism in solids.	04	08
	10.2	Magnetic properties, concepts of ferromagnetic, paramagnetic, diamagnetic properties and materials.		
	10.3	Ferrites, soft magnetic materials and hard magnetic materials.		
		Total	**48**	**80**

List of Practicals/Experiments/Assignments:

Sr. No.	Name of Practical/Experiment/Assignment	Hrs
1	Study of silicate structure.	02
2	Hardness of plastic.	04
3	T.S. of plastic.	04
4	Tensile curve for rubber.	02
5	Hardness of rubber.	04
6	Impact property of ceramics.	04
7	Strength of an adhesive bond- tension & shear.	04
8	Study of lubricants.	04
9	Preparation of composites.	04
	Total	**32**

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
	SECTION I	
1	Structure of Solids	Lecture method.
2	Colloids &Polymers	Lecture method.
3	Rubbers	Lecture method.
4	Glasses	Lecture method.
5	Ceramics	Lecture method.
	SECTION II	
6	Adhesives	Lecture method.
7	Lubricants	Lecture method.
8	Composites	Lecture method.
9	Insulating Materials	Lecture method.
10	Magnetic Materials	Lecture method.

Text Books:

Sr. No	Author	Title	Publication
1	Zbigniew D. Jastrzebski	Nature And Properties Of Engg. Materials	Toppan Printing Company, Limited, Japan.
2	Lawerence H. Van Vlack	Elements of Material Science	Addison –Wesley Publishing Company, INC, London.

Reference Books:

Sr. No	Author	Title	Publication
1	Gupta A.K and Gupta R.C	Material Science	S. Chand and Company Limited.

Learning Resources: OHP-Transparencies, books.

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
	SECTION I				
1	Structure of Solids	03	02	--	05
2	Colloids &Polymers	10	05	05	20
3	Rubbers	03	02	--	05
4	Glasses	03	--	02	05
5	Ceramics	03	--	02	05
	SECTION II				
6	Adhesives	03	03	02	08
7	Lubricants	05	--	03	08
8	Composites	05	--	03	08
9	Insulating Materials	05	--	03	08
10	Magnetic Materials	05	--	03	08
	Total	**45**	**12**	**23**	**80**

(Prof.N.S.Kadam)
Prepared By

(Prof.S.B.Kulkarni)
Secretary, PBOS

(Prof.P.B.Kamble)
Chairman, PBOS