

**CHHATTISGARH SWAMI VIVEKANAND TECHNICAL  
UNIVERSITY, BHILAI**

**SCHEME OF TEACHING AND EXAMINATION**

**M. Tech. in Steel Technology**

**FIRST SEMESTER**

S. No.	Board of Study	Subject Code	Subject	Periods Per Week			Scheme Of Exam			Total Marks	Credit [L + (T+P) ] 2
				L	T	P	ESE	CT	TA		
1.	Metallurgical Engineering	456111 (38)	Ferrous Thermodynamics & Kinetics	3	1	0	100	20	20	140	4
2.	Metallurgical Engineering	456112 (38)	Equipment Maintenance Technology	2	1	0	100	20	20	140	4
3.	Metallurgical Engineering	456113 (38)	Physical Metallurgy, Corrosion & Surface Engineering	3	1	0	100	20	20	140	4
4.	Metallurgical Engineering	456114 (38)	Sinter Making & Blast Furnace Technology	3	1	0	100	20	20	140	3
5.	Metallurgical Engineering	456115 (38)	Material Science	2	1	0	100	20	20	140	3
6.	Metallurgical Engineering	456121 (38)	Process Control in Iron making LAB	0	0	6	75	0	75	150	3
7.	Metallurgical Engineering	456122 (38)	Physical Metallurgy LAB	0	0	6	75	0	75	150	3
<b>Total</b>				<b>13</b>	<b>5</b>	<b>12</b>	<b>650</b>	<b>100</b>	<b>250</b>	<b>1000</b>	<b>24</b>

L – Lecture, T – Tutorial, P – Practical, ESE- End Semester Exam , CT- Class Test, TA – Teacher’s Assessment

**CHHATTISGARH SWAMI VIVEKANAND TECHNICAL  
UNIVERSITY, BHILAI**

Semester : **M. Tech.- I**

Branch : **M. Tech. Steel Technology**

Subject : **Ferrous Thermodynamics & Kinetics**

Code : **456111 (38)**

Total Theory Periods : **28**

Total Tutorial Periods : **10**

Total Marks in End Semester Examination : **100**

Minimum number of class tests to be conducted : **02**

**UNIT-I**

Thermodynamics & its application in iron & steel making. First law of thermodynamics  
Concepts of heat capacity, enthalpy, isothermal & adiabatic processes.

**UNIT-II**

Second & third law of thermodynamics, entropy, reversibility, irreversibility & criteria of  
equilibrium. Temperature dependence of entropy, interpretation of entropy, concept of  
free energy, Fugacity, activity & equilibrium.

**UNIT-III**

Ellingham-Rechardson diagram and its practical importance. Solutions, ideal, non-ideal  
solutions, Henry's Law, Gibbs-Duham equation, chemical potential, phase rule & its  
applications.

**UNIT-IV**

Introduction to metallurgical kinetics in iron & steel making heterogenous reaction  
kinetics, gas-solid, solid-liquid, liq-liq & solid-solid systems.

**UNIT-V**

Practical examples & numerical calculations in iron & steel making.

**Recommended Books :**

1. Metallurgical Thermodynamics - Darken & Garry
2. Chemical & Metallurgical Thermodynamics – M L Kapoor
3. Metallurgical Thermodynamics – A Ghosh

**CHHATTISGARH SWAMI VIVEKANAND TECHNICAL  
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Semester : **M. Tech.- I**

Branch : **M. Tech. Steel Technology**

Subject : **Equipment Maintenance Technology**

Code : **456112 (38)**

Total Theory Periods : **30**

Total Tutorial Periods : **10**

Total Marks in End Semester Examination : **100**

Minimum number of class tests to be conducted : **02**

**UNIT-I**

Types of Maintenance : Preventive, Condition based, RCM, TPM

**UNIT-II**

Manufacturing Management : Planning, job routing, types of spares, Production processes of spares through engineering shops. Material & inventory management, SCM

**UNIT-III**

Advanced Maintenance Management : CBMS, CMMS, MMIS, ERP, Tribology.

**UNIT-IV**

Hydraulics : Basic hydraulic systems, Servo techniques, Electro-hydraulics, hydraulic machines, PLC based hydraulic system.

**UNIT-V**

Bearing Engineering & Lubrication : antifriction bearing, hydro-dynamic bearing. Selection & application of bearing. Oils & lubrication used in steel plants

**Recommended Books :**

1. Maintenance Policy & Procedures - Larry Bush
2. Industrial Hydraulics Systems & Circuits - Bhagwati Prasad Gupta
3. Maintenance & Spare parts Management - P. Gopalakrishna

**CHHATTISGARH SWAMI VIVEKANAND TECHNICAL  
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Semester : **M. Tech.- I**

Branch : **M. Tech. Steel Technology**

Subject : **Physical Metallurgy, Corrosion and  
Surface Engineering**

Code : **456113 (38)**

Total Theory Periods : **30**

Total Tutorial Periods : **10**

Total Marks in End Semester Examination : **100**

Minimum number of class tests to be conducted : **02**

**UNIT-I**

Atomic & bond structures. Crystal defects, Concepts of phase & Phase diagram.

**UNIT-II**

Solid state phase transformation, Fe-Fe<sub>3</sub>C diagram, TTT diagram. Heat treatment techniques- annealing, normalizing, hardening, tempering, austempering & merrtempering of steel., hardenability, recovery recrystallization & grain growth, precipitation hardening.

**UNIT-III**

Diffusion in Solids- Fick's laws of diffusion, Solution to Fick's second law, Applications based on second law solution, The Kirkendall effect, The atomic model of diffusion, Other diffusion processes

**UNIT-IV**

Surface Engineering - Anodising, galvanizing, hard-facing, carburizing, nitriding etc, thermal spraying, hot dipping etc. induction hardening, flame hardening, Recent trends.

**UNIT-V**

Electro-chemical & thermodynamic principles of corrosion. Different forms of corrosion. Corrosion testing. High temperature corrosion. Cost of corrosion & corrosion prevention. Industrial corrosion problems

**Recommended Books :**

1. Corrosion of Iron & Steel - J.C. Hudson, J. Newton Friends
2. Physical Metallurgy – Y. Lakhtin
3. Physical Metallurgy for Engineers – Clark and Warue
4. Introduction to Physical Metallurgy – Sydney H. Avner
5. Physical Metallurgy Principle – Read Hal

**CHHATTISGARH SWAMI VIVEKANAND TECHNICAL  
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Semester : **M. Tech.- I**

Branch : **M. Tech. Steel Technology**

Subject : **Sinter Making & Blast Furnace Technology**      Code : **456114 (38)**

Total Theory Periods : **28**

Total Tutorial Periods : **10**

Total Marks in End Semester Examination : **100**

Minimum number of class tests to be conducted : **02**

**UNIT-I**

Agglomeration – Briquetting, Pelletising, and Sintering – manufacturing, uses, testing & recent advances.

**UNIT-II**

History of Iron Making, Raw materials & their occurrences in India. Basic design criteria of BF including hot blast stoves.

**UNIT-III**

Theory & practice of iron making in BF, Burden preparation, distribution & burden calculations.

**UNIT-IV**

BF Hot metal quality and its control. BF irregularities, Blowing in/Blowing out, External desiliconisation, desulphurisation, auxiliary fuel injection, process intensification & optimization.

**UNIT-V**

Alternative methods of Iron Making – DRI, HBI, Corex, Iron making-steel making interface.

**Recommended Books :**

1. Blast Furnace Iron Making-Theory & Practice.
2. Iron Making – R. S. Tupkari

**CHHATTISGARH SWAMI VIVEKANAND TECHNICAL  
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Semester : **M. Tech.- I**

Branch : **M. Tech. Steel Technology**

Subject : **Material Science**

Code : **456115 (38)**

Total Theory Periods : **28**

Total Tutorial Periods : **1**

Total Marks in End Semester Examination : **100**

Minimum number of class tests to be conducted : **02**

**UNIT-I**

Theory of alloying & classification of steels – special carbon, alloyed, micro-alloyed, stainless, tool steel, cast iron.

**UNIT-II**

Advanced Materials – Composite material, cermets, plastics, polymers, important non-ferrous metals used in steel industry-Brass, Bronze, Babbitt.

**UNIT-III**

Conductors & Resistors- The resistivity range, The free electron theory, Conduction by free electrons, Conductor & resistor materials, Superconducting materials.

**UNIT-IV**

Semiconductors - types of semiconductors & semiconductor devices.

**UNIT-V**

Magnetic Materials- Terminology and classification, Ferromagnetism and related phenomena, The hysteresis loop, Soft magnetic materials, Hard magnetic materials.

Dielectric materials - Polarization , Temperature and frequency effects, Electric breakdown, Ferroelectric materials.

**Recommended Books :**

1. Material Science & Engineering - V. Raghavan
2. Material Science – Van Vlack

**CHHATTISGARH SWAMI VIVEKANAND TECHNICAL  
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Semester : **M. Tech.- I**

Branch : **M. Tech. Steel Technology**

Subject : **Process Control in Iron Making Lab**

Code : **456121 (38)**

Total Practical Periods : **14**

Total Marks in End Semester Examination : **50**

1. Identifying the control parameters in Iron Making & sintering
2. Testing of Raw Materials for iron & sinter making
3. Process control in Sinter Making
4. Control of process parameters in iron making
5. Quality control in iron & sinter making & report writing

**CHHATTISGARH SWAMI VIVEKANAND TECHNICAL  
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Semester : **M. Tech.- I**

Branch : **M. Tech. Steel Technology**

Subject : **Physical Metallurgy Lab**

Code : **456122 (38)**

Total Practical Periods : **14**

Total Marks in End Semester Examination : **50**

1. Sample preparation for metallurgical investigation
2. Microstructure of steel, cast iron & important non-ferrous materials.
3. Sulphur print & macro testing
4. Failure investigation & report writing
5. Scanning Electron Microscopy