Template for Course Details

UG	Department: Metallurgical and Materials Engineering
Course Code:MTT-301	Course Name: Foundry Technology
Credit:4	L-T-P: 3-1-0
Version:	Approved on:
Pre-requisite course:	

Syllabus

Patterns: Functions, classification, materials, allowances and design considerations.Molding sands: General characteristics, ingradients, special additives, binders, their effect on the properties of mouldingsand,parting and facing materials, Cores and their types.Casting processes: Sand mould casting, shell mould, CO_2mould

Casting, centrifugal and investment casting, gravity die-casting and pressure die casting.

Solidification of castings.Gating and risering: basic requirements of gating and feeding system,design of gating system, types of gates, design of feeders, use of exothermic compounds, exothermic sleeves, chills and padding.

Melting furnaces: Selection of remelting furnace, simple sketch and brief description of gas fired and electric furnaces for melting of alloys.Cast iron foundry practice: Cupola melting practice, production of SG cast iron. Melting practice for Al, Mg and Cu.Casting defects: causes and remedies. Quality control in foundry.

Books:

1. R.W. Heine, C.R. Loper, P.C. Rosenthal, Principles of Metal Casting, Tata McGraw Hill Pub. Co. Ltd., New Delhi
2. P.L. Jain, Principles of foundry Technology, Tata McGraw Hill Co.Ltd., New Delhi.
3. P.L. Jain, Tool Engineering for Metal Casting Processes, Tata McGraw Hill Co. Ltd., New Delhi.
4. H.F. Taylor, M.C. Flemings, J. Wulf, Foundry Engineering, Wiley Eastern Ltd., Delhi.
5. Foundry Technology, D.Kumar&S.K.Jain, CBS, Publishers, New Delhi.
6. P.C. Mukherjee, Fundamentals of Metal Casting Technology,Oxford& 1BH Pub. Co. Pvt. Ltd., New Delhi.

Template for Course Details

UG	Department: Metallurgical and Materials Engineering
Course Code:MTT-303	Course Name: Particulate Materials
Credit:4	L-T-P: 3-1-0
Version:	Approved on:
Pre-requisite course:	

Syllabus

Introduction & Historical background of powder metallurgy. Powder Production: General principles of mechanical, chemical, atomization and electrolytic method of metal and alloy powders production.Powder Characterization: Chemical composition, Microstructure, size and size distribution, shape, surface area, flow rate, apparent andtape density. Compressibility, pyrophoricity and toxicity of metallic powders. Powder conditions: Annealing, mixing and blending and their mechanics, powder mixers. Cold compaction: Compaction in rigid dies, uniaxial and biaxial compaction, mechanical and hydraulic presses. Hot compaction: Hot pressing, extrusion and powder forging.

Sintering : Basic stages of sintering and mechanisms involved, liquid phase sintering, sintering furnaces, sintering atmospheres.Applications: Porous PM parts viz. bushes, filters, and bioimplants,dispersion strengthened materials, cemented carbides.

Books:

1. J.S. Hirbchorn – Introduction to Powder Metallurgy (APMI)
2. R.M. German – Powder Metallurgy Science (MPIF)
3. F.V. Lenel – Powder Metallurgy : Principles & Applications (MPIF)
4. A.K. Sinha – Powder Metallurgy
5. R.H.T. Dixon & A. Clayton – Powder Metallurgy for Engg.(Brighton)

Template for Course Details

UG	Department: Metallurgical and Materials Engineering
Course Code:MTT-305	Course Name: Non-Ferrous Extractive Metallurgy
Credit:4	L-T-P: 3-1-0
Version:	Approved on:
Pre-requisite course:	

Syllabus

Aluminium: Occurrence of Bauxite, Bayer's process for production of alumina. Alternatives to Bayer's Process. Hall-Heroult Process-Conventional and New Materials for construction of Aluminium reduction cell, Nature of electrolyte, Electrolysis of alumina with emphasis on physicochemical principles and secondary-reactions.Factors affecting current efficiency. Alternatives to Hall-Heroult Process. Refining of Aluminium.

Copper: Occurrence of copper ores. Roasting, Matte smelting,converting and refining process as applied to copper production andtheirphysico-chemical aspects.Single step and multistep continuous processes. Hydrometallurgical process for production of primary copper. Recovery of copper from copper slag. Treatment of refractory copper ores.Nickel& Cobalt: Ocurrence of Nickel & cobalt Ores.Pyrometallurgical& Hydrometallurgical techniques for Nickel andCobalt production and refining.Lead and Zinc: Occurrence of Lead and Zinc ores. Pyrometallurgicaland Hydrometallurgical Processes for lead and zinc production and their physico-chemical aspects. Refining of lead and zinc , Recovery of by products.

Books:

1. Extractive Met. Of Copper – Biswas&Daven Port
2. Extraction of Non-ferrous Metals – Ray/Shridhar
3. Non-ferrous Extractive Metallurgy – Bray

Template for Course Details

UG	Department: Metallurgical and Materials Engineering
Course Code:MTT-307	Course Name: Electrometallurgy & Corrosion
Credit:4	L-T-P: 3-1-0
Version:	Approved on:
Pre-requisite course:	

Syllabus

Principles: Faradays' laws of electrolysis, current efficiency, current density, electrode potentials, EMF series, Galvanic series, Nernst Equation, Polarisation, Mixed potential theory, Pourbaix-pH diagrams,passivity- theory &applications.Electrodeposition: Classification and mechanism of electrodeposition processes. Electroplating of copper, Nickel and Chromium. Alloy plating and electrolessplating.Corrosion: The relevance of corrosion studies, forms of corrosion,Uniform, Galvanic, Crevice, Pitting, intergranular, stress corrosion cracking, corrosion fatigue, hydrogen embrittlement, Dealloying.Corrosion prevention and control by various methods- change ofmetal composition, design improvement, inhibitors, coatings and electrochemical methods of protection.

Books:

1. An introduction to metallic corrosion & its prevention by Rajnarain
2. Corrosion Engineering by Mars G. Fontana
3. Electroplating by Lowenheim

Template for Course Details

UG	Department: Metallurgical and Materials Engineering
Course Code:MTT-309	Course Name: Solid State Phase Transformation
Credit:4	L-T-P: 3-1-0
Version:	Approved on:
Pre-requisite course:	

Syllabus

Nucleation and growth. Pearlitic, bainitic and martensitic transformations. Massive transformation, spinodaldecompositon.Order-disorder transformation Equilibrium phases, Metastable phases. Intermetallic compounds,Phaseequilibria.

Books:

1. Physical Metallurgy Principles, Robert E. Reed Hill, East-west Press, DvanNostrandcompny, New York.
2. Solid State Phase Transformations, V. Raghavan
3. An Introduction to Metallurgy, A.H.Cottrell

Template for Course Details

UG	**Department: Metallurgical and Materials Engineering**
Course Code:MTP-311	**Course Name:Powder Metallurgy**
Credit:2	**L-T-P: 0-0-3**
Version:	**Approved on:**
Pre-requisite course:	
Syllabus 1. Sampling metal powder 2. Determination of hydrogen loss for metal powder 3. Determination of acid insoluble in Cu powder 4. Determination of sieve analysis of metal powders 5. Determination of flow rate of free flowing metal powders using Hall flow meter 6. Determination of apparent density of free flowing metal powders using Hall Flow Meter 7. Determination of green strength for un-sintered P/M compact 8. Determination of compressibility of metal powder 9. Determination of density of compacted or sintered P/M product 10. Determination of tensile properties of P/M product	

Template for Course Details

UG	**Department: Metallurgical and Materials Engineering**
Course Code:MTP-313	**Course Name:Foundry**
Credit:2	**L-T-P: 0-0-3**
Version:	**Approved on:**
Pre-requisite course:	
Syllabus 1. Determination of basic properties of molding sand 2. Effect of varying moisture and clay content on permeability 3. Green compressive strength and shatter index of moulding sand 4. To find out grain fineness no. of silica sand 5. Melting and casting of Al-Si alloys & to study the effect of grain refinement and modifier 6. Casting defects and their remedial measures 7. Techniques to improve the efficiency of furnace 8. To study the recent modifications in cupola furnace	

Template for Course Details

UG	**Department: Metallurgical and Materials Engineering**
Course Code:MTP-315	**Course Name:Electrometallurgy and Corrosion**
Credit:2	**L-T-P: 0-0-3**
Version:	**Approved on:**
Pre-requisite course:	

Syllabus

1. Electroless deposition of Ag/ Ni/ Cu
2. Electroplating of Cu, Ni, Cr, Zn
3. Anodizing of Al utilizing H_2SO_4 and Oxalic acid bath
4. Thickness measurement of coatings
5. Use of inhibitors and study of its effect
6. Study of Cathodic protection
7. Galvanic series formation of important alloys
8. Corrosion rate determination using Weight loss measurement in acidic media
9. Corrosion rate determination using Weight loss measurement in alkaline media
10. Polarization experiment/ Study of Tafel plot
11. Basic study of electrochemical Impedance Spectroscopy