

Template for Course Details

UG	Department: Metallurgical and Materials Engineering
Course Code:MTT-402	Course Name: Physical Metallurgy of Alloy Steels and Cast Irons
Credit:4	L-T-P: 3-1-0
Version:	Approved on:
Pre-requisite course:	
<p>Syllabus</p> <p>Advantages of alloy steels over plain carbon steels, classification of alloy steels, common alloying elements and their influence on properties of steel.Strengthening mechanisms in steels. Heat treatment of alloy steels. Thermo-mechanical treatment of steels, Microstructure – property correlation in steels, Effect of nonmetallic inclusions and residual elements on properties of steels.Composition, properties and applications of some low alloy steels.Composition, properties and applications of some high alloy steels.Composition, properties and applications of some alloy cast irons.</p> <p>Books:</p> <ol style="list-style-type: none"> 1. Laslie, W.C., Physical Metallurgy of Steels, McGraw Hill, NewYork, (Indian Edition) 2. ASM, Metals Handbook: Properties and selection, Vol. 1, 9th Ed.,Metal Park, Ohio. 3. Bain, E.C. and Paxton, H.W. Alloying Elements in Steels, ASM,Metal Park, Ohio. 4. Avner, Sidney H., Introduction to Physical Metallurgy, McGraw Hill,New York 5. Lakhtin, Yu, M., Engineering Physical Metallurgy and Heat Treatment, Mir Publishers, Moscow. 6. Honeycomb, R.W.K., Steels, Edwin Arnold, London. 7. Pickering, F.B., Physical Metallurgy and The Design of Steels,Applied Science Publishers Ltd., London. 8. Angus, H.T., Cast Iron – Physical and Engineering Properties,Butterworths, London. 9. Elliot, R., Cast Iron Technology, Butterworths, London. 	

Template for Course Details

UG	Department: Metallurgical and Materials Engineering
Course Code:MTT-404	Course Name:Nuclear Materials
Credit:4	L-T-P:3-1-0
Version:	Approved on:
Pre-requisite course:	
Syllabus Brief outlines of essential requirement of metals for nuclear energy programmes - Structural,fissile,moderator and control. Rare metals – Minerals and their occurrence in India. Extraction of uranium,thorium, zirconium, beryllium and plutonium and their processing. Indian reactors and atomic energy programmes.	
Books: 1. Symposium on rare metals – published by publication division department of atomic energy, Mumbai. 2. Nuclear reactor engineering – S.Glasston. 3. Extraction and metallurgy of uranium, , zirconium, thorium and beryllium – Pergamon press. 4. C.D.Harigton&A.D.Ruchle, Uranium production technology, Van Nostrand publication.	

Template for Course Details

UG	Department: Metallurgical and Materials Engineering
Course Code:MTT-406	Course Name:Physical Metallurgy of Special Purpose Alloys
Credit:4	L-T-P:3-1-0
Version:	Approved on:
Pre-requisite course:	
<p>Syllabus</p> <p>Special purpose metals & alloys of aluminium, magnesium, titanium, copper, nickel, lead, zinc and tin for critical appraisal of their application.</p> <p>Physical properties, electrical conductivity, thermal conductivity and magnetic properties. Alloying nature. Phase diagram of important alloy systems, Non-equilibrium modifications. Structure and properties changes. Theories and mechanism of heat treatment processes.</p> <p>Corrosion and oxidation characteristics.</p> <p>Deformation and heat treatment, effect of temperature, , alloying additions & impurities. Recovery, recrystallization and grain growth.</p> <p>Fabrication and joining techniques.</p> <p>Bearings, low melting point alloys and die-casting alloys.</p> <p>Books:</p> <ol style="list-style-type: none"> 1.ASM Metals Hand Book, Vol-2 2.ASM Metals Hand Book, Vol-3 3.Light Alloys- Metallurgy of the light metals by I.J.Polmear, Edward Arnold. 4.Engineering Materials: Properties and Selection by K.G.Budenski, PHI, New Delhi 6.Engineering Metallurgy, Part 1, by R.A.Higgins, ELBS/Edward Arnold 6.Introduction to Engineering Materials by Vernon John, Macmillan Education Ltd., London 	

Template for Course Details

UG	Department: Metallurgical and Materials Engineering
Course Code:MTT-408	Course Name: Advances in Extraction of Al, Cu and Zn
Credit:4	L-T-P: 3-1-0
Version:	Approved on:
Pre-requisite course:	
<p>Syllabus</p> <p>Aluminium: Developments in Production of Aluminium by Bayer's Process, alternatives to Bayer's Process, improvements in Hall and Heroult Process, alternatives to Hall and HeroultProcess.Copper: Flash smelting, principles of continuous copper extraction,various processes of continuous copper extraction. (Single step andmulti-step processes), copper losses in slags.Zinc: Imperial Smelting Process, Recovery of Cadmium and Cobalt in Zinc smelter, Advances in Hydro-metallurgical processing of Zinc.</p> <p>Books:</p> <ol style="list-style-type: none"> 1. Copper – The Science & Technology of Metal & its Alloys by Butts 2. Zinc - The Science & Technology of Metal & its Alloys by Methewson 3. Encyclopedia in Chemical Technology 4. Extractive Met. of Copper – Biswas& Davenport 	

Template for Course Details

UG	Department: Metallurgical and Materials Engineering
Course Code:MTT-410	Course Name:Non Ferrous Metallurgy of V, Ni, Mn, Mg, Mo, Co, Ta, W, and Ti
Credit:4	L-T-P: 3-1-0
Version:	Approved on:
Pre-requisite course:	
Syllabus Brief out line of essential requirement of Non-ferrous materials,Minerals, their occurrence in India. General methods of processing.Production Metallurgy of Vanadium, Nickel, Manganese, Magnesium,Molybdenium, Cobalt, Tantalum, Tungsten, Titanium and their properties and applications.Principles of Ion exchange, Solvent extraction. Recent developments in production of Non-ferrous Metals.	
Books: 1. H.S. Ray and R.Sridhar, Extractive Metallurgy of Non ferrous metals 2. C.G. Krishnadas Nair, Non-ferrous Metals strategy cum source book, IIM publication. 3. R.Bhimarao, K. Srinivasrao and Vibhuti N. Mishra, Non-ferrous Metals in the New Millennium, 2001.	

Template for Course Details

UG	Department: Metallurgical and Materials Engineering
Course Code:MTT-412	Course Name:Alloy Design
Credit:4	L-T-P: 3-1-0
Version:	Approved on:
Pre-requisite course:	
Syllabus Concept of alloy design, Steps in alloy design, Significance of alloy design.Single phase, dual phase and multiphase materials, Effect of matrix on properties of materials, Effect of size, shape and distribution of second phase on mechanical properties of alloys.Alloy design for better tensile strength, ductility, toughness, fatigue strength, creep strength, wear resistance and elevated temperature strength.High strength low alloy steels, Maraging steels, High speed steels,Hadfield steel and Super alloys.	
Books: 1. ASM Handbook, Vol.1 & 2, Properties and Selection: Metals Park,Ohio. 2. Boyer, H.E.(ed.), Selection of Materials for component Design:Source Book, American Society for Metals, Metals Park, Ohio. 3. Ashby, M.F. Materials Selection in Mechanical Design, New York Pergamon, 1992. 4. Ranganathan S., Arunachalam V.S. and Cahn R.W. (Eds.), Alloy Design, Indian Academy of Science, Bangalore, 1981. 5. Tien John K. and Ansell George S. (Eds.), Alloy and Microstructural Design, Academic Press.	

Template for Course Details

UG	Department: Metallurgical and Materials Engineering
Course Code:MTT-421	Course Name:Corrosion science and Engineering
Credit:4	L-T-P:3-1-0
Version:	Approved on:
Pre-requisite course:	
<p>Syllabus</p> <p>Corrosion principles Faraday's laws of electrolysis, current efficiency, current density, electrode potentials, EMF series, Galvanic series, Nernst Equations, Polarization, Mixed potential theory, Pourbaix-pH diagrams, Passivity – theory and application.</p> <p>Forms of corrosion: uniform, galvanic, crevice, pitting, intergranular, stress corrosion cracking, corrosion fatigue, hydrogen embrittlement, dealloying. Corrosion prevention and control by various methods- change of metal composition, design improvement, inhibitors, coatings and electrochemical methods of protection.</p> <p>Books:</p> <ol style="list-style-type: none"> 1. Mars G.Fontana; Corrosion Engineering, McGraw Hill, 3rd Edi. 1987. 2. Corrosion, Vol. 13, Metal Handbook, 9th Edi. Ohio, 1987. 3. S.K.Coubural, Corrosion Source book, Ed.NACE and ASM Metals Prk, Ohio, 1987. 4. C.R.Pludek, Design and corrosion contrl, Macmillan, London, 1977. 5. H.H.Uhlig, R.W.Revie, corrosion and its control, 3rd Edi. John Wiley, Singapore, 1991. 	

Template for Course Details

UG	Department: Metallurgical and Materials Engineering
Course Code:MTT-423	Course Name:NDT & Quality Control
Credit: 4	L-T-P: 3-1-0
Version:	Approved on:
Pre-requisite course:	
Syllabus Introduction: Need for inspection, types of inspection system, Quality of inspection, Reliability of defect detection and benefits of NDT examination.Visual Inspection: Basic principles, physical aids used for visual inspection and applications.Liquid Penetrant Inspection: Physical principles, procedures of testing, penetrant testing materials, penetrant testing methods,applications and limitations.Magnetic Particle Testing: Principle of MPT, Magnetizationtechniques, procedure used for testing a component, equipment used for MPT, Techniques used for ECT, Applications and limitations.Radiography: Basic principles, electromagnetic radiation sources,effect of radiation in film, radiographic imaging, inspection techniques,applications and limitations.Ultrasonic Testing: Basic principles of sound beam, ultrasonic transducers, type of display, inspection methods, identification of defects, immersion testing, applications and limitations.Acoustic Emission Testing (AET): Principles, technique,Instrumentation and applications. Miscellaneous tests.Reliability in NDT, statistical methods for quality control	
Books: 1. Introduction to Physical Metallurgy, S.H. Avner, McGraw Hill Co. 2. Testing of Metallic Materials, A.V.K. Suryanarayana, PHI,New Delhi	