

# ACADEMIC REGULATIONS COURSE STRUCTURE AND DETAILED SYLLABUS

## METALLURGY & MATERIAL TECHNOLOGY

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**B.TECH. FOUR YEAR DEGREE COURSE**  
(Applicable for the batches admitted from 2005-2006)



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY**  
KUKATPALLY, HYDERABAD - 500 072.

### METALLURGY & MATERIAL TECHNOLOGY I Year B.Tech. COURSE STRUCTURE

CODE	SUBJECT	T	P	C
HS05231	ENGLISH	2+1*	0	4
MA05363	MATHEMATICS - I	3+1*	0	6
PY05226	ENGINEERING PHYSICS	2+1*	0	4
MT05386	METALLURGICAL ANALYSIS	2+1*	0	4
ME05224	ENGINEERING MECHANICS	3+1*	0	6
CS05141	COMPUTER PROGRAMMING AND NUMERICAL METHODS	2+2*	0	4
ME05223	ENGINEERING GRAPHICS.	0	6	8
ME05230	ENGINEERING WORKSHOP PRACTICE.	0	3	4
HS05232	ENGLISH LANGUAGE AND COMMUNICATION SKILLS LAB.	0	3	4
MT05387	METALLURGICAL ANALYSIS LAB.	0	3	4
CS05142	COMPUTER PROGRAMMING AND NUMERICAL METHODS LAB.	0	6	8
<b>Total</b>		<b>21</b>	<b>21</b>	<b>56</b>

#### II Year

#### I Semester

CODE	SUBJECT	T	P	C
MA05364	MATHEMATICS - II	4+1*	0	4
HS05353	MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS	4+1*	0	4
CE05375	MECHANICS OF SOLIDS	4+1*	0	4
CS05434	OOPS THROUGH JAVA	4+1*	0	4
MT05450	PHYSICAL METALLURGY	4+1*	0	4
ME05552	THERMODYNAMICS AND KINETICS	4+1*	0	4
CS05338	JAVA LAB.	0	3	2
MT05451	PHYSICAL METALLURGY LAB.	0	3	2
<b>Total</b>		<b>30</b>	<b>6</b>	<b>28</b>

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**METALLURGY & MATERIAL TECHNOLOGY**

**COURSE STRUCTURE**

II Year		II Semester			
CODE	SUBJECT	T	P	C	
MA05365	MATHEMATICS - III	4+1*	0	4	
CE05374	MECHANICS OF FLUIDS	4+1*	0	4	
CE05239	ENVIRONMENTAL STUDIES	4+1*	0	4	
MT05271	FUELS, FURNACES AND REFRACTORIES	4+1*	0	4	
MT05391	METALLURGICAL THERMODYNAMICS	4+1*	0	4	
MT05410	MINERAL DRESSING	4+1*	0	4	
MT05272	FUELS, FURNACES AND REFRACTORIES LAB.	-	3	2	
MT05411	MINERAL DRESSING LAB.	-	3	2	
<b>TOTAL</b>		<b>30</b>	<b>6</b>	<b>28</b>	

**III Year** **I Semester**

CODE	SUBJECT	T	P	C	
EE05192	ELECTRICAL ENGINEERING	4+1*	0	4	
HS05352	MANAGEMENT SCIENCE	4+1*	0	4	
MT05368	MECHANICAL METALLURGY	4+1*	0	4	
MT05288	HEAT TREATMENT TECHNOLOGY	4+1*	0	4	
MT05336	IRON MAKING	4+1*	0	4	
MT05581	WELDING METALLURGY	4+1*	0	4	
MT05369	MECHANICAL METALLURGY LAB.	0	3	2	
MT05289	HEAT TREATMENT TECHNOLOGY LAB.	0	3	2	
<b>Total</b>		<b>30</b>	<b>6</b>	<b>28</b>	

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**COURSE STRUCTURE**

III Year		II Semester			
CODE	SUBJECT	T	P	C	
EC05069	BASIC ELECTRONICS	4+1*	0	4	
MT05429	NON FERROUS EXTRACTIVE METALLURGY	4+1*	0	4	
MT05372	MECHANICAL WORKING OF METALS	4+1*	0	4	
MT05267	FOUNDRY TECHNOLOGY	4+1*	0	4	
MT05525	STEEL MAKING	4+1*	0	4	
MM05457	POLYMERIC MATERIALS	4+1*	0	4	
MT05373	MECHANICAL WORKING OF METALS LAB.	0	3	2	
MT05268	FOUNDRY TECHNOLOGY LAB.	0	3	2	
<b>Total</b>		<b>30</b>	<b>6</b>	<b>28</b>	

**IV Year** **I Semester**

CODE	SUBJECT	T	P	C	
MT05203	ELECTRO METALLURGY AND CORROSION	4+1*	0	4	
MT05116	CERAMIC SCIENCE AND TECHNOLOGY	4+1*	0	4	
MT05458	POWDER METALLURGY	4+1*	0	4	
MT05583	X- RAY METALLOGRAPHY	4+1*	0	4	
	<b>ELECTIVE-I</b>	4+1*	0	4	
MT05514	SEMI CONDUCTORS AND MAGNETIC MATERIALS				
MT05428	NON DESTRUCTIVE TESTING				
ME05427	NON CONVENTIONAL SOURCES OF ENERGY				
CS05137	COMPUTER GRAPHICS				
	<b>ELECTIVE-II</b>	4+1*	0	4	
ME05108	CAD /CAM				
MT05341	LIGHT METALS AND ALLOYS				
MT05389	METALLURGICAL INSTRUMENTATION				
MT05560	TRANSPORT PHENOMENA IN METALLURGY				
MT05204	ELECTRO METALLURGY AND CORROSION LAB.	0	3	2	
MT05388	METALLURGICAL COMPUTATIONS LAB.	0	3	2	
<b>Total</b>		<b>30</b>	<b>6</b>	<b>28</b>	

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**METALLURGY & MATERIAL TECHNOLOGY**

**COURSE STRUCTURE**

IV Year	CODE	SUBJECT	II Semester		
			T	P	C
	MT05131	COMPOSITE MATERIALS <b>ELECTIVE-III</b>	4+1*	0	4
	MT05534	SUPER ALLOYS	4+1*	0	4
	MT05245	FERRO ALLOY TECHNOLOGY			
	CS05518	SIMULATION AND DATA PROCESSING			
	MT05243	EXPERIMENTAL TECHNIQUES IN METALLOGRAPHY <b>ELECTIVE-IV</b>	4+1*	0	4
	MT05390	METALLURGICAL PROBLEMS			
	ME05436	OPERATIONS RESEARCH			
	MT05430	NUCLEAR METALLURGY			
	MA05476	PROBABILITY AND STATISTICS			
	CA05315	INDUSTRY ORIENTED MINI PROJECT	-	-	2
	CA05515	SEMINAR	-	-	2
	CA05495	PROJECT WORK	-	-	12
	Total		15	0	28

NOTE: All University Examinations (Theory and Practical) are of 3 hours duration.

\* : Tutorials

T : Theory periods per week

P : Practical /Drawing Periods per week

C : Total Credits for the subject

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I Year B.Tech. MMT

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**(HS 05231) ENGLISH**

**1. INTRODUCTION :**

In view of the growing importance of English as a tool for global communication and the consequent emphasis on training students to acquire communicative competence, the syllabus has been designed to develop linguistic and communicative competence of Engineering students. The prescribed books and the exercises are meant to serve broadly as students' handbooks, to encourage them to develop their language skills. The two textbooks identified by the Board of Studies serve the purpose of illustrating the conceptual framework within which the syllabus is to be administered in the classroom. When a TEXT BOOK is prescribed content is generally paid attention to. However, the stress in this syllabus is on language acquisition and skill development, calling for both the teacher and the taught to go beyond the prescribed texts and innovate exercises and tasks.

**2. OBJECTIVES :**

- To promote the language proficiency of the students with emphasis on improving their LSRW skills.
- To impart training to the students through the syllabus and its theoretical and practical components.
- To improve communication skills in formal and informal situations.

**3. SYLLABUS :**

**Listening Skills :**

- Listening for general content
- Listening to fill up information gaps
- Intensive listening
- Listening for specific information
- Note-taking - guided and unguided
- Post-listening testing

**Speaking Skills :**

- Oral practice
- Developing confidence
- Introducing oneself/others
- Asking for/ giving information
- Describing objects/offering solutions
- Describing situations
- Role play
- Expressing agreement/disagreement

**Reading Comprehension**

- Skimming the text
- Understanding the gist of an argument
- Identifying the topic sentence
- Inferring lexical and contextual meaning
- Understanding discourse features
- Recognizing coherence/sequencing of sentences

**NOTE :** The student, through the training imparted to him/her by means of the text-based approach, will be examined in answering questions on an unseen passage.

**Writing Skills :**

- Writing a sentence
- Use of appropriate vocabulary
- Paragraph writing
- Coherence and cohesiveness
- Narration / description
- Interpreting data
- Formal and informal letter writing
- Sending e-mails
- Information transfer
- Editing a passage

**4. TEXTBOOKS PRESCRIBED :**

In order to improve the proficiency of the student in the acquisition of the four skills mentioned above, the following texts and course content, divided into Eight Units, are prescribed:

1. **LEARNING ENGLISH:** A Communicative Approach, Hyderabad: Orient Longman, 2005.(Selected Lessons)
2. **WINGS OF FIRE:** An Autobiography – APJ Abdul Kalam, Abridged version with Exercises, Hyderabad: Universities Press (India) Pvt. Ltd., 2004.

The following lessons from the prescribed texts are recommended for study :

**A. STUDY MATERIAL :****Unit – I**

1. **Astronomy** from **LEARNING ENGLISH: A Communicative Approach**, Orient Longman, 2005.
2. Chapters 1-4 from **Wings of Fire: An Autobiography – APJ Abdul Kalam, an abridged version with Exercises, Universities Press (India) Pvt. Ltd., 2004**

**Unit – II**

3. Information Technology from **LEARNING ENGLISH: A Communicative Approach, Orient Longman, 2005.**
4. Chapters 5-8 from **Wings of Fire: An Autobiography – APJ Abdul Kalam, an abridged version with Exercises, Universities Press (India) Pvt. Ltd., 2004**

**Unit – III**

5. Humour from **LEARNING ENGLISH: A Communicative Approach, Orient Longman, 2005.**
6. Chapters 9-12 from **Wings of Fire: An Autobiography – APJ Abdul Kalam, an abridged version with Exercises, Universities Press (India) Pvt. Ltd., 2004**

**Unit – IV**

7. Environment from **LEARNING ENGLISH: A Communicative Approach, Orient Longman, 2005.**

8. Chapters 13-16 from **Wings of Fire: An Autobiography – APJ Abdul Kalam, an abridged version with Exercises, Universities Press (India) Pvt. Ltd., 2004**

**Unit – V**

9. Inspiration from **LEARNING ENGLISH: A Communicative Approach, Orient Longman, 2005.**

10. Chapters 17-20 from **Wings of Fire: An Autobiography – APJ Abdul Kalam, an abridged version with Exercises, Universities Press (India) Pvt. Ltd., 2004.**

**Unit – VI**

11. Human Interest from **LEARNING ENGLISH : A Communicative Approach, Orient Longman, 2005.**

12. Chapters 21-24 from **Wings of Fire: An Autobiography – APJ Abdul Kalam, an abridged version with Exercises, Universities Press (India) Pvt. Ltd., 2004.**

\* Exercises from the lessons not prescribed shall also be used for classroom tasks.

**Unit – VII**

- Reading and Writing Skills
- Reading Comprehension
- Situational dialogues
- Report writing
- Letter writing
- Essay writing
- Information transfer

## Unit – VIII

Remedial English  
Common errors  
Subject-Verb agreement  
Use of Articles and Prepositions  
Tense and aspect

**Vocabulary – Synonyms & Antonyms, one-word substitutes, prefixes & suffixes, Idioms & phrases, words often confused.**

**TEXT BOOKS**

- Effective Technical Communication**, M Ashraf Rizvi, Tata McGraw-Hill Publishing Company Ltd.
- Everyday Dialogues in English**, Robert J Dixon, Prentice Hall of India Pvt Ltd., New Delhi.

**REFERENCES**

- Strengthen Your English**, Bhaskaran & Horsburgh, Oxford University Press
- English for Technical Communication**, K R Lakshminarayana, SCITECH
- Strategies for Engineering Communication**, Susan Stevenson & Steve Whitmore ( John Wiley and sons),
- English for Engineers: With CD**, Sirish Chaudhary, Vikas Publishing House Pvt. Ltd. With CD.
- Basic Communication Skills for Technology**, Andrea J Rutherford, Pearson Education Asia.
- Murphy's English Grammar with CD**, Murphy, Cambridge University Press
- A Practical Course in English Pronunciation, (with two Audio cassettes)**, Sethi, Sadanand & Jindal , Prentice –Hall of India Pvt Ltd., New Delhi.
- English for Professional Students**, by S S Prabhakara Rao.
- The Oxford Guide to Writing and Speaking**, John Seely, Oxford.
- Grammar Games**, Renvolucrî Mario, Cambridge University Press.

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**(MIA 05363) MATHEMATICS – I****UNIT – I**

Sequences – series – Convergences and divergence – Ratio test – Comparison test – Integral test – Cauchy's root test – Raabe's test – Absolute and conditional convergence. Rolle's theorem – Lagrange's Mean Value Theorem – Cauchy's Mean value Theorem – Generalized Mean Value theorem (Taylor's Theorem).

**UNIT – II**

Functions of several variables – Functional dependence– Jacobian– Maxima and Minima of functions of two variables with constraints or without constraints- Radius, Centre and Circle of Curvature – Evolutes and Envelopes.

**UNIT – III**

Curve tracing – Cartesian , polar and Parametric curves - Applications of integration to lengths , volumes and surface areas in Cartesian and polar coordinates.

**UNIT – IV**

Differential equations of first order and first degree – exact, linear and Bernoulli. Applications to Newton's Law of cooling, Law of natural growth and decay, Orthogonal trajectories-Non-homogeneous linear differential equations of second and higher order with constant coefficients with RHS term of the type  $e^{ax}$ ,  $\sin ax$ ,  $\cos ax$ , polynomials in  $x$ ,  $e^{ax}\sqrt{x}$ ,  $x\sqrt{x}$ , method of variation of parameters.

**UNIT – V**

Laplace transform of standard functions – Inverse transform – first shifting Theorem, Transforms of derivatives and integrals – Unit step function – second shifting theorem – Dirac's delta function – Convolution theorem – Periodic function - Differentiation and integration of transforms-Application of Laplace transforms to ordinary differential equations.

**UNIT – VI**

Multiple integrals - double and triple integrals – change of variables – change of order of integration.

**UNIT – VII**

Vector Calculus: Gradient- Divergence- Curl and their related properties of sums-products- Laplacian and second order operators. Vector Integration - Line integral – work done – Potential function – area- surface and volume integrals.

**UNIT – VIII**

Vector integral theorems: Green's theorem- Stoke's and Gauss's Divergence Theorem. Verification of Green's - Stoke's and Gauss's Theorems – Cylindrical, Spherical coordinates-Expressions Grad, div, curl in spherical and cylindrical coordinates.

**TEXT BOOKS :**

1. A text book of Engineering Mathematics Volume – 1, 2005  
T.K.VIyengar, B.Krishna Gandhi and others, S.Chand and Company.
2. Engineering Mathematics, B.V.Ramana, Tata McGraw-Hill 2003.

**REFERENCES :**

1. Engineering Mathematics-I, 2002, P.Nageswara Rao, Y.Narsimhulu, Prabhakara Rao, Deepthi Publishers
2. Engineering Mathematics- I, 2004, Dr.Shahnaz Bathul, Right Publishers.
3. Engineering Mathematics, S.K.V.S. Sri Rama Chary, M.Bhujanga Rao, Shankar, B.S. Publications 2000.
4. Engineering Mathematics-I Rukmangadhachary, Pearson Education.
5. A Text book of Engineering Mathematics, VP Mishra, Galgotia Publications.
6. Engineering Mathematics – I, Sankaraiiah, VGS Book Links, Hyderabad.

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2+1 0 4**(PY05226) ENGINEERING PHYSICS****UNIT – I**

**INTERFERENCE** Introduction - Superposition of waves - Young's double slit experiment - Coherence - Interference in thin films by reflection - Newton's rings.  
**DIFFRACTION** Introduction - Fresnel and Fraunhofer diffraction - Fraunhofer diffraction at a single slit & at a double slit - Circular aperture - Diffraction grating - Grating spectrum - Resolving power of a grating - Rayleigh's criterion for resolving power.

**UNIT II**

**POLARIZATION** Introduction - Representation of polarized and unpolarized light - Polarization by reflection - Malus law - Double refraction - Nicol prism - Circular and Elliptical polarization -Quarter wave plate - Half wave plate.  
**ULTRASONICS** Introduction - Production of Ultrasonic waves - Magnetostriction method - Piezo electric method - Detection of Ultrasonics - Properties of Ultrasonics  
 - Use of Ultrasonics for non-destructive testing - Applications of Ultrasonics.

**UNIT III**

**ACOUSTICS OF BUILDINGS** Basic requirement of acoustically good hall - Reverberation and time of reverberation – Sabine's formula for reverberation time  
 - Measurement of absorption coefficient of a material - Factors affecting the architectural acoustics and their remedy.

**SUPERCONDUCTIVITY** General properties - Meissner effect - Penetration depth

- Type I and Type II superconductors - Flux quantization - Josephson Effect - BCS Theory - Applications of superconductors.

**UNIT IV**

**LASERS** Introduction - Characteristics of Lasers - Spontaneous and Stimulated Emission of radiation - Einstein's coefficients - Population inversion - Ruby Laser - Helium-Neon Laser - Semiconductor Laser - Applications of Lasers in Industry, Scientific and Medical fields.

**UNIT V**

**FIBER OPTICS** Introduction - Principle of optical fiber - Acceptance angle and Acceptance cone - Numerical aperture - Step-index fiber and transmission of signal in SI fiber - Graded-index fiber and transmission of signal in GI fiber - Attenuation in optical fibers - Advantages of optical fibers in communication - Application of optical fibers in Medicine and Sensors.

**UNIT VI**

**MAGNETIC PROPERTIES** Permeability - Magnetization - Origin of magnetic moment - Classification of magnetic materials - Dia, Para and Ferro magnetism - Hysteresis curve - Soft and Hard magnetic materials - anti-Ferro and Ferri magnetism - Ferrites and their applications.

**CRYSTAL STRUCTURES** Introduction - Space lattice - Basis - Unit cell - Lattice parameter - Crystal systems - Bravais lattices - Structure and Packing fractions of Simple cubic - Body Centred Cubic - Face Centred Cubic crystals - Structures of Diamond, ZnS, NaCl, CsCl.

**UNIT VII**

**CRYSTAL PLANES & X-RAY DIFFRACTION** Directions and Planes in crystals - Miller Indices - Separation between successive [h k l] planes - Diffraction of X-rays by Crystal planes - Braggi's Law - Laue method - Powder method.

**UNIT VIII**

**DEFECTS IN SOLIDS** Imperfections in Crystals - Point defects - Schottky and Frenkel defects - Energy for formation of a Vacancy - Equilibrium concentration of Schottky and Frenkel defects - Line defects - Edge and Screw dislocation - Burger's Vectors.

**TEXT BOOKS:**

1. **Engineering Physics** by R.K.Gaur - S.L. Gupta; Dhanpat Rai and Sons.
2. **Applied Physics** by Dr. M.Chandra Shekar & Dr.P.Appala Naidu; V.G.S. Book links.

**REFERENCES :**

1. **Engineering Physics** by Dr.M. Arumugam; Anuradha Agencies
2. **Physics Volume 2**, by Halliday, Resnick and Krane; John Wiley & Sons
3. **Engineering Physics** by M.N.Avadhanulu & P.G. Kshirasagar; S.Chand &Company Ltd.
4. **Engineering Physics** by P.V.Naik; Pearson Education
5. **Materials Science and Engineering** by V. Raghavan; Prentice-Hall India
6. **Engineering Physics (Vol.1)** by M.D. Khanna and V. Balaswamy; Vikas Publishing House Pvt. Ltd., New Delhi

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I Year B.Tech. MMT

T P C  
2+1 0 4**(MT05386) METALLURGICAL ANALYSIS****UNIT-I**

Importance of chemical analysis, scope of metallurgical analysis, classification of various methods used in metallurgical analysis. Solution preparations, normality, molarity, molality, Equivalent weight. Dissolution of ores in general, dissolution of metals and alloys.

**UNIT-II**

Chemical Analysis - Basic Principles - theory of indicators -Conventional solution methods for qualitative analysis of ores, fluxes, slags, metals and refractories.

**UNIT-III**

Qualitative analysis of common non-ferrous alloys such as brasses, bronzes and solders. Estimation of C, S, Si, Mn and P in cast iron and steel.

**UNIT-IV**

Estimation of Cr, Ni, Mo, W and V in alloy steels.

**UNIT-V**

Determination of iron in iron ore, manganese in manganese ores, lime in limestone, fire-assay of precious metals.

**UNIT-VI**

Instrumental analysis: Importance of instrumental analysis -Comparison with standard wet chemical methods - Fundamental Physicochemical principles involved and equipment required in absorptiometry i.e, colorimetry and spectrophotometry, colorimetric titration.

**UNIT-VII**

Spectroscopy, potentiometry, amperometric titration.

**UNIT-VIII**

Calorimetric titrations, polarography, conductometry, electro-analysis and flame photometry.

**TEXT BOOK:**

1. S.K.Jain-Metallurgical analysis.

**REFERENCES**

1. Agarwal, B.C. and Jain S.P., A Text Book of Metallurgical Analysis, Khanna Publishers, Delhi -1963.
2. Iyer V.G., Metallurgical Analysis: BHU Press, Varanasi.
3. Snell Foster D and Frank M Biffen: Commercial methods of analysis / Che. Publishing Co.,1964.
4. Vogel AI., A Text Book of Quantitative Inorganic Analysis Longman ELBS 1962.
5. Willard H.H.etal: Instrumental Methods of analysis Van Nostrand.

**(ME05224) ENGINEERING MECHANICS****UNIT-I**

**Introduction to Engg. Mechanics-Basic Concepts, Systems of Forces:** Coplanar concurrent Forces-Components in Space -Resultant-Moment of Force and its application

-Couples and resultant of Force Systems . Equilibrium of Systems of Forces: Free Body Diagrams, Equations of Coplanar Systems and Spatial systems.

**UNIT-II**

**Friction:** Types of Friction-Limiting Friction -Laws of friction-Static and Dynamic Frictions-Motion of Bodies: Wedge, Screw-jack and Differential Screw-jack.

**UNIT-III**

**Transmission of Power: Belt-Drives:** Open, Crossed and Compound-Length of Belt, Tensions, Tight side, Slack side, Initial and Centrifugal-Power transmitted and condition for Max. Power.

**UNIT-IV**

**Centroid:** Centroids of simple figures (from basic principles ) - Centroids of Composite Figures.

**Centre of Gravity:** Centre of gravity of simple body (from basis principles), centre of gravity of composite bodies, pappus theorem.

**UNIT-V**

**Area moments of inertia:** Definition-Polar Moment of Inertia, Transfer theorem.

Moments of Inertia of Composite figures, Product of Inertia, Transfer formula for product of Inertia, Mass moment of Inertia: Moment of Inertia of Masses, Transfer formula for Mass moment of Inertia, mass moment of inertia of composite bodies.

**UNIT-VI**

**Kinematics:** Rectilinear and Curvilinear motions-Velocity and Acceleration-Motion of Rigid Body-Types and their analysis for planar motion. Kinetics: Analysis as a particle and analysis as a rigid body in Translation-Central Force motion-Equations of Plane motion-Fixed axis Rotation -rolling Bodies.

**UNIT-VII**

**Work-Energy method:** Equations for Translation. Work-Energy Applications to particle Motion, Connected System-Fixed axis Rotation and Plane motion.

**UNIT-VIII**

**Mechanical vibrations:** Definitions, Concepts-Simple Harmonic motion-Free vibrations, simple and compound pendulums-Torsional Vibrations.

**TEXT BOOKS:**

1. Engineering Mechanics / Ferdinand . L. Singer / Harper - Collins.
2. Engg. Mechanics / S.S. Bhargati & J.G. Rajasekhara

**REFERENCES:**

1. Engg. Mechanics / Irving. H. Shames Prentice - Hall.
2. Engg. Mechanics / Timoshenko & Yound.
3. Engg. Mechanics Umesh Regl / Tayal.
4. Engg. Mechanics / R. V. Kulkarni & R.D. Askhekar
5. Strength of Materials & Applied Mechanics / IB Prasad
6. Text Book in Applied Mechanics / Malhotra, Subramanian, Gahlot and Rathore / New age.
7. Engg. Mechanics / KL Kumar / Tata McGraw Hill.
8. Engg. Mechanics / Rajasekharan



**(CS05141) COMPUTER PROGRAMMING AND NUMERICAL METHODS****UNIT-I:**

Algorithm, flowchart, program development steps, basic structures of C language, C tokens, data types and sizes, declaration of variables, assigning values, arithmetic, relational and logical operator, increment and decrement operators, conditional operator, bit-wise operators, type conversions, expressions, evaluation, input-output statements, blocks, if and switch statement, while, do-while and for statements, C programs covering all the above aspects.

**UNIT-II:**

One dimensional & Two dimensional arrays, initialization, string variables-declaration, reading, writing, Basics of functions, String handling function, user-defined functions, recursive functions, variables and storage classes, scope rules, block structure, header files, C preprocessor, example C programs.

**UNIT-III:**

Pointer and Arrays: Pointers and addresses, Pointers and Arrays, Pointers And function arguments, Address arithmetic, character pointers and functions, pointers to pointers, multi-dimensional arrays, initialization of pointer arrays, command line arguments, pointers to functions.

**UNIT-IV:**

Structures: Definition, initializing, assigning values, passing of structures as arguments, Arrays of structures, pointers to structures, self referential structures. Unions and files, C program examples.

**UNIT-V:**

Linear DataStructures: Introduction to DataStructures, representing stacks and queues in C using arrays, Infix, Postfix & Prefix programs, circular queues.

**UNIT-VI:**

Solution of Algebraic and Transcendental Equations : Introduction - The Bisection Method - The Method of False Position - The Iteration Method - Newton-Raphson Method.

**UNIT-VII:**

Interpolation: Introduction- Errors in Polynomial Interpolation - Finite differences- Forward Differences-Backward differences -Central differences - Symbolic relations and separation of symbols-Differences of a polynomial-Newton's formulae for interpolation - Central difference interpolation Formulae - Gauss' Central Difference Formulae -Interpolation with unevenly spaced points-Lagrange's Interpolation formula.

**UNIT-VIII:**

Numerical Differentiation and Integration: The Cubic Spline Method - Trapezoidal rule - Simpson's 1/3 Rule -Simpson's 3/8 Rule- Boole's and Weddle's Rules. Numerical solution of Ordinary Differential equations: Solution by Taylor's series Picard's Method of successive Approximations-Euler's Method-Runge-Kutta Methods -Predictor-Corrector Methods- Adams-Moulton Method -Milne's Method.

**TEXT BOOKS:**

1. C And Data structures - P.Padmanabham, BS Publications
2. The C Programming Language, B.W. Kernighan, Dennis M.Ritchie, PHI/ Pearson Education.

**REFERENCES:**

1. C & Data Structures, Ashok N.Kamthane, Pearson Education.
2. The C Programming Language, B.W. Kernighan, Dennis M.Ritchie, PHI/ Pearson Education
3. C & Data Structures - Prof. P.S.DeshPande, Prof O.G.Kakde, Wiley Dreamtech Pvt. Ltd., NewDelhi.
4. DataStructures Using C - A.S.Tanenbaum, PHI/Pearson education
5. Applied Numerical methods for Engineers using MATLAB and C, Robert J. Schilling, Sandra L. Harries, Thomson.
6. Numerical Methods in C, J.G.Kori, Laxmi publications.
7. Introductory Methods of Numerical Analysis: S.S.Sastry, Prentice Hall of India, Pvt Ltd.

**(ME05223) ENGINEERING GRAPHICS****UNIT-I**

**Introduction to Engineering Drawing:** Principles of Engineering Graphics and their significance, Engineering Drawing- Drawing Instruments and their use - Conventions in Drawing - Lettering - BIS conventions. Scales used in Engineering practice and representative Fraction, the principles - Construction of plain Diagonal and vernier scales.

**UNIT-II**

**Plane Geometric Drawing:** Construction of polygons- Inscription and superscription of polygon given the diameter of the circles. Curves used in Engineering Practice and their constructions Conic sections including the rectangular Hyperbola-General method only. Cycloid. Epicycloid and Hypercycloid- Trochoids Involute.

**UNIT-III**

**Drawing of projections or views, Orthographic Projection in First angle projection only:** Principles of Orthographic Projections- Conventions- Projections of Points and lines inclined to both planes, true Length, traces. Projections of plane regular geometric figures- auxiliary planes inclined to both planes.

**UNIT-IV**

Projections of Regular solids- Auxiliary views. Sections or Sectional views of Right Regular Solids- Prism, cylinder, Pyramid, Cone Auxiliary views.

**UNIT-V**

Development of surfaces of Right Regular Solids- Prism, Cylinder Pyramid and Cone.

Interpretation of Right Regular Solids- Intersection of Cylinder Vs Cylinder. Cylinder Vs Prism. Cylinder Vs Cone.

**UNIT-VI**

**Isometric Projection:** Principles of Isometric Projection- Isometric Scale- Isometric Views- Conventions- Isometric views of Lines, Plane figures, Simple and Compound Solids- Isometric Projection of Spherical parts.

**UNIT-VII**

**Transformation of Projections:** Conversion of Isometric views to orthographic views and Vice-versa- Conventions.

**UNIT-VIII**

**Perspective Projections:** Perspective viewpoints, Lines, Plane figures and simple solids (General method only)

**TEXT BOOKS:**

Engineering Drawing - N.D. Bhat / Charotar.

**REFERENCES:**

1. Engineering Drawing - Narayana and Kanniah / Scitech publishers.
2. Engineering Drawing and Graphics- Venugopal / New age.

**(ME05230) ENGINEERING WORKSHOP PRACTICE****SYLLABUS****1. TRADES FOR EXERCISES:**

(Any seven trades from the following with minimum of three simple exercises in each trade and also study of Tools used).

1. Carpentry
2. Fitting
3. Tin-Smithy and Development of jobs carried out and soldering.
4. Black Smithy
5. House-wiring
6. Foundry
7. Plumbing.
8. IT Workshop-I
9. IT workshop-II

**II TRADES FOR DEMONSTRATION & EXPOSURE:**

1. Demonstration of power tools – Pneumatic Tools, Electrical Tools
2. Welding - ARC Welding/Gas Welding/Plasma Welding
3. Machine Shop
4. Metal Cutting - Hacksaw, Power Saw, Gas Cutting, Arc Cutting.
5. Metal Cutting (water plasma)

## HYDERABAD

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**(HS 05232) ENGLISH LANGUAGE COMMUNICATION SKILLS LAB**

The language Lab focuses computer-aided multi-media instruction and language acquisition to achieve the following targets :

- To expose the students to a variety of self-instructional, learner-friendly modes of language learning.
  - To help the students cultivate the habit of reading passages from the computer monitor, thus providing them with the required facility to face computer-based competitive exams such GRE, TOEFL, GMAT etc.
  - To enable them to learn better pronunciation through stress on word accent, intonation, and rhythm.
  - To train them to use language effectively to face interviews, group discussions, public speaking.
  - To initiate them into greater use of the computer in resume preparation, report writing, format-making etc.
- However, depending upon the available infrastructure and budget, the above targets can also be achieved by procuring the minimum required equipment suggested for the establishment of a Conventional Lab the details of which are given below. The Lab should cater to the needs of the students to build up their confidence to help them develop leadership qualities through their communicative competence.

**SYLLABUS :**

The following course content is prescribed for the English Language Laboratory Practice :

1. Introduction to Phonetics.
2. Introduction to Vowels and Consonants and associated Phonetic symbols.
3. Introduction to Accent, Intonation and Rhythm.
4. Situational Dialogues / Role Play.
5. Public Speaking.
6. Debate
7. Group discussions
8. Facing Interviews
9. Resume preparation
10. e-correspondence

**Minimum Requirement :**

- Computer aided multi media language lab with 30 systems with LAN facility.
- Conventional Language Lab. with audio and video systems, speakers, head phones and a teacher console to accommodate 30 students.

**Suggested Software :**

- Cambridge Advanced Learners' Dictionary with exercises
- The Rosetta Stone English Library
- Clarity Pronunciation Power
- Mastering English in Vocabulary, Grammar, Spellings, Composition
- Dorling Kindersley series of Grammar, Punctuation, Composition etc.
- Language in Use, Foundation Books Pvt Ltd
- Learning to Speak English - 4 CDs
- Microsoft Encarta
- Murphy's English Grammar, Cambridge
- Time series of IQ Test, Brain-teasers, Aptitude Test etc.
- English in Mind; Herbert Puchta and Jeff Stranks with Meredith Levy,Cambridge.

**BOOKS SUGGESTED FOR ENGLISH LAB :**

1. Developing Communication Skills by Krishna Mohan & Meera Benjeri (Macmillan)
2. Speaking English Effectively by Krishna Mohan & NP Singh (Macmillan)
3. Better English Pronunciation by JDO Connor (UBS – Cambridge)
4. Oxford Practice Grammar with Answers. John Eastwood, Oxford
5. Handbook of English Grammar and Usage, Mark Lester and Larry Beason, Tata McGraw-Hill
6. A text book of English Phonetics for Indian Students by T.Balasuubramanian (Macmillan)
7. Lingua TOEFL CBT Insider, by Dreamtech
8. TOEFL & GRE( KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
9. English Skills for Technical Students, WBSCTE with British Council, OL
10. A Handbook of English for Competitive Examinations, by B Shyamala Rao, Blakie Books, Chennai.

**DISTRIBUTION AND WEIGHTAGE OF MARKS :****ENGLISH LANGUAGE LABORATORY PRACTICE**

1. The practical examinations for the English Language Laboratory practice shall be conducted as per the University norms prescribed for the core engineering practical sessions.
2. For the English Language lab sessions, there shall be a continuous evaluation during the year for 25 sessional marks and 50 End Examination marks. Of the 25 marks, 15 marks shall be awarded for day-to-day work and 10 marks to be awarded by conducting Internal Lab Test(s). The End Examination shall be conducted by the teacher concerned with the help of another member of the staff of the same department of the same institution.

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**(MT05387) METALLURGICAL ANALYSIS LAB**

1. Estimation of Iron in Iron ore. - to determine the percentage of Iron in Iron Ore by  $KMnO_4$  method and  $K_2Cr_2O_7$  method.
2. Estimation of Silicon in Cast Iron.
3. Estimation of Carbon in Steel by Strohleln apparatus method.
4. Estimation of Copper in Brass by Electrolytic method.
5. Estimation of manganese in cast iron.
6. Estimation of Chromium in Steel.
7. Estimation of Sodium and Potassium in Chloride Salts by Flame Photometry.
8. Estimation of lime in Limestone.
9. Estimation of the concentration of  $KMnO_4$  in the solution using Digital Spectrophotometer.
10. Estimation of Sulphur and Phosphorus in cast irons.
11. Estimation of Chromium in Stainless steels.
12. Estimation of Mn, Cr and Si in Ferro-Alloys

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**(CS05142) COMPUTER PROGRAMMING AND NUMERICAL METHODS LAB**

1. Write a C program the evaluates the following algebraic expressions after reading necessary values from the user:
  - a)  $ax+b/ax-b$
  - b)  $2.5 \log x + \cos 320 + |x^2 - y^2| + v 2xy$
  - c)  $1/\alpha \sqrt{2\pi} e^{-(x-m)^2/2\sigma^2}$
2. Write a C program for the following
  - a) Printing three given integers in ascending order
  - b) Sum of  $1 + 2 + 3 + \dots + n$
  - c)  $1 + x^2/2! + x^2/4! + \dots$  upto ten terms
  - d)  $x + x^3/3! + x^5/5! + \dots$  upto 7th digit accuracy
  - e) Read x and compute  $Y = 1$  for  $x > 0$   
 $Y = 0$  for  $x = 0$   
 $Y = -1$  for  $x < 0$
3. Write C program using FOR statement to find the following from a given set of 20 integers.
  - i) Total number of even integers.
  - ii) Total number of odd integers.
  - iii) Sum of all even integers.
  - iv) Sum of all odd integers.
4. Write a C program to obtain the product of two matrices A of size (3X3) and B of size (3X2). The resultant matrix C is to be printed out along with A and B. Assume suitable values for A & B.
5. Using switch-case statement, write a C program that takes two operands and one operator from the user, performs the operation and then prints the answer. (consider operators +, -, /, \* and %).
6. Write C procedures to add, subtract, multiply and divide two complex numbers (x+iy) and (a+ib). Also write the main program that uses these procedures.
7. A cloth show room has announced the following seasonal discounts on purchase of items.
 

Purchase Amount/Discount (Percentage)Mill Cloth/Handloom items1-100-5.0101-2005.07.5201-3007.510.0Above 30010.015.0

Write a C program using switch and if statements to complete the net amount to be paid by a customer.

8. Given a number, write C program using while loop to reverse the digits of the number. Example 1234 to be written as 4321.
9. The Fibonacci sequence of numbers is 1, 1, 2, 3, 5, 8... based on the recurrence relation  
 $f(n) = f(n-1) + f(n-2)$  for  $n > 2$ .  
 Write C program using do-while to calculate and print the first  $n$  fibonacci numbers.
11. Write a C program to extract a portion of a character string and print the extracted string. Assume that  $m$  characters are extracted starting with the  $n$ th character.
12. Write a function that will scan a character string passed as an argument and covert all lower case characters into their upper case equivalents.
13. Implement the following data structures using Arrays  
 i) Stacks ii) Linear Queues iii) Circular queues
14. Simple expression evaluator, that can handle +, -, / and \*.
15. Implement the algorithms for the following Iterative Methods Using C to find one root of the equation  $f(x) = x \sin x + \cos x = 0$   
 a) Bisection b) False Position  
 c) Newton-Raphson d) Successive Approximation
16. Implement the algorithms for the following iterative methods using C to find one root of the equation  
 $9x^1 + 2x^2 + 4x^3 = 20$   
 $x^1 + 10x^2 + 4x^3 = 6$   
 $2x^1 - 4x^2 + 10x^3 = -15$ .
17. Write Computer programs to implement the Lagrange interpolation and Newton-Gregory forward interpolation.
18. Implement in 'C' the linear regression and polynomial regression algorithms.
19. Implement Traezoidal and Simpson methods.

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### (MA05364) MATHEMATICS – II

#### UNIT – I

Matrices : Elementary row transformations – Rank – Normal form - Echelon form – Consistency – Solution of system of simultaneous linear homogeneous and non-homogeneous equations.

#### UNIT – II

Eigen values, eigen vectors – properties – Cayley-Hamilton Theorem - Inverse and powers of a matrix by Cayley-Hamilton theorem – Diagonalization of matrix. Calculation of powers of matrix – Modal and spectral matrices. Real matrices – Symmetric, skew - symmetric, orthogonal, Linear Transformation - Orthogonal Transformation. Complex matrices: Hermitian, Skew-Hermitian and Unitary – Eigen values and eigen vectors of complex matrices and their properties.

#### UNIT-III

Quadratic forms- Reduction of quadratic form to canonical form – Rank - Positive, negative definite - semi definite - Index - signature - Sylvester law.

#### UNIT –IV

Fourier Series: Determination of Fourier coefficients – Fourier series – even and odd functions – Fourier series in an arbitrary interval – even and odd periodic continuation – Half-range Fourier sine and cosine expansions.

#### UNIT-V

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – solutions of first order linear (Lagrange) equation and nonlinear (standard type) equations. Method of separation of variables – Classification of second order linear Partial Differential Equations, solutions of one dimensional heat equation, wave equation and two-dimensional Laplace's equation under initial and boundary conditions.

#### UNIT –VI

Fourier integral theorem – Fourier sine and cosine integrals. Fourier transform – Fourier sine and cosine transforms – properties – inverse transforms – Finite Fourier transforms.

z-transform – inverse z-transform - properties – Damping rule – Shifting rule – Initial and final value theorems. Convolution theorem – Solution of difference equation by z-transforms.

## UNIT-VIII

Wave lets – The Haar wavelets – A wavelet expansion - Multiresolution analysis with Haar Wavelets - General construction of wavelets and multiresolution analysis - Shannon wavelets.

## TEXT BOOKS:

1. A Text book of Engineering Mathematics Volume – II, 2005  
T.K.V.lyengar, B.Krishna Gandhi and others, S.Chand and Company.
2. Engineering Mathematics, B.V.Ramana, Tata McGraw-Hill 2003.

## REFERENCES:

1. Engineering Mathematics–II, 2002, P.Nageswara Rao, Y.Narsimhulu, Prabhakara Rao
2. Engineering Mathematics, S.K.V.S. Sri Rama Chary, M.Bhujanga Rao, Shankar, B.S.Publications 2000.
3. Advanced Engineering Mathematics (eighth edition), Erwin Kreyszig, John Wiley & Sons (ASIA) Pvt. Ltd. 2001.
4. Advanced Engineering Peter V.O'Neil Thomson Brooks/Cole.
5. Advanced Engineering Mathematics, Merle C.Potter, J.L.Goldberg, E.F.Abrufadel, Oxford University Press. Third Edition 2005.
6. Engineering Mathematics – II, 2005, Sankaraiah, VGS Book Links, Hyderabad.

## (HS05353) MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

## UNIT-I:

**Introduction to Managerial Economics:** Definition, Nature and Scope Managerial Economics–Demand Analysis: Demand Determinants, Law of Demand and its exceptions.

## UNIT-II:

**Elasticity of Demand:** Definition, Types, Measurement and Significance of Elasticity of Demand. Demand Forecasting: Factors governing demand forecasting: methods of demand forecasting (survey methods, statistical methods, expert opinion method, test marketing, controlled experiments, judgmental approach to demand forecasting)

## UNIT -II:

**Theory of Production and Cost Analysis :** Production Function – Isoquants and Isocosts, MRTS, Least Cost Combination of Inputs, Production function, Laws of Returns, Internal and External Economies of Scale.

**Cost Analysis:** Cost concepts, Opportunity cost, Fixed Vs.Variable costs, Explicit costs Vs.Implicit costs, Out of pocket costs vs. Imputed costs. Break-even Analysis (BEA)-Determination of Break-Even Point (simple problems)-Managerial Significance and limitations of BEA.

## UNIT-IV:

**Introduction to Markets & Pricing strategies:**Market structures: Types of competition, Features of Perfect competition, Monopoly and Monopolistic Competition. Price-Output Determination in case of Perfect Competition and Monopoly. Pricing Strategies

## UNIT-V:

**Business & New Economic Environment:**Characteristic features of Business, Features and evaluation of Sole Proprietorship, Partnership, Joint Stock Company, Public Enterprises and their types, Changing Business Environment in Post-liberalization scenario

**UNIT-VI:**

**Capital and Capital Budgeting:**Capital and its significance, Types of Capital, Estimation of Fixed and Working capital requirements, Methods and sources of raising finance.Nature and scope of capital budgeting, features of capital budgeting proposals, Methods of Capital Budgeting: Payback Method, Accounting Rate of Return (ARR) and Net Present Value Method (simple problems)

**UNIT-VII:**

**Introduction to Financial Accounting:**Double-Entry Book Keeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments).

**UNIT-VIII:**

**Financial Analysis through ratios:** Computation, Analysis and Interpretation of Liquidity Ratios (Current Ratio and quick ratio), Activity Ratios (Inventory turnover ratio and Debtor Turnover ratio), Capital structure Ratios (Debt-Equity ratio, Interest Coverage ratio), and Profitability ratios (Gross Profit Ratio, Net Profit ratio, Operating Ratio, P/E Ratio and EPS).

**TEXT BOOKS:**

1. Aryasri: Managerial Economics and Financial Analysis, 2/e, TMH, 2005.
2. Varsney & Maheswari: Managerial Economics, Sultan Chand, 2003.

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4+1 0 4**(CE05375) MECHANICS OF SOLIDS****UNIT – I**

**SIMPLE STRESSES AND STRAINS:** Elasticity and plasticity – Types of stresses and strains – Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio and volumetric strain – Elastic moduli and the relationship between them – Bars of varying section – composite bars – Temperature stresses.  
Strain energy – Resilience – Gradual, sudden, impact and shock loadings.

**UNIT – II**

**SHEAR FORCE AND BENDING MOMENT:** Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, u.d.l., uniformly varying loads and combination of these loads – Point of contraflexure – Relation between S.F., B.M and rate of loading at a section of a beam.

**UNIT – III**

**FLEXURAL STRESSES:** Theory of simple bending – Assumptions – Derivation of bending equation:  $M/I = f/y = E/R$  Neutral axis – Determination bending stresses – section modulus of rectangular and circular sections (Solid and Hollow), I, T, Angle and Channel sections – Design of simple beam sections.

**UNIT – IV**

**SHEAR STRESSES:** Derivation of formula – Shear stress distribution across various beams sections like rec tangular, circular, triangular, I, T angle sections.

**UNIT – V**

**ANALYSIS OF PIN-JOINTED PLANE FRAMES:** Determination of Forces in members of plane, pin-jointed, perfect trusses by (i) method of joints and (ii) method of sections. Analysis of various types of cantilever and simply – supported trusses- by method of joints, method of sections and tension coefficient methods.

## UNIT – VI

**DEFLECTION OF BEAMS :** Bending into a circular arc – slope, deflection and radius of curvature – Differential equation for the elastic line of a beam – Double integration and Macaulay's methods – Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, - U.D.L uniformly varying load. Mohr's theorems – Moment area method – application to simple cases including overhanging beams.

## UNIT – VII

**THIN CYLINDERS:** Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and Volumetric strains – changes in dia, and volume of thin cylinders – Riveted boiler shells – Thin spherical shells.

## UNIT – VIII

Thick cylinders – lamé's equation – cylinders subjected to inside and out side pressures – compound cylinders.

## TEXT BOOKS:

1. Strength of Materials by Andrew Pytel and Ferdinand L. Singer Longman.
2. Strength of Materials by Jondar; Galgotia Publications.

## REFERENCES:

1. Strength of Materials by Bensal, Lakshmi Publications.
2. Strength of Materials by S.Tumoshenko.
3. Strength of Materials by R.S.Khurmi; S.Chand & Co. 2005.

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**(CS05434) OOPS THROUGH JAVA**

## UNIT-I:

**Introduction:** Creation of Java, importance of Java to internet, byte code, Java buzzwords, OOP Principles, Encapsulation, Inheritance and Polymorphism, data types, variables, declaring variables, dynamic initialization, scope and life time of variables, arrays, operators, control statements, type conversion and casting, compiling and running of simple Java program.

## UNIT-II:

**Classes and Objects:** Concepts of classes and objects, class fundamentals Declaring objects, assigning object reference variables, introducing methods, constructors, usage of static with data and methods, usage of final with data, access control, this key word, garbage collection, overloading methods and constructors, parameter passing – call by value, recursion, nested classes and inner classes, exploring the String class.

## UNIT-III:

**Inheritance:** Basic concepts, member access rules, usage of super key word, forms of inheritance, method overriding, abstract classes, dynamic method dispatch, using final with inheritance, the Object class.

## UNIT-IV:

**Packages and Interfaces:** Defining, Creating and Accessing a Package, Understanding CLASSPATH, importing packages, differences between classes and interfaces, defining an interface, implementing interface, applying interfaces, variables in interface and extending interfaces.

## UNIT-V:

**Exception Handling and Multithreading:** Concepts of Exception handling, types of exceptions, usage of try, catch, throw, throws and finally keywords, Built-in exceptions, creating own exception sub classes, Concepts of Multithreading, differences between process and thread, thread life cycle, creating multiple threads using Thread class, Runnable interface, Synchronization, thread priorities, inter thread communication, daemon threads, deadlocks, thread groups.



**UNIT-VI:**

**Event Handling:** Events, Event sources, Event classes, Event Listeners, Delegation event model, handling mouse and keyboard events, Adapter classes.

**AWT:** Concepts of components, container, panel, window, frame, canvas, Font class, Color class and Graphics.

**UNIT-VII:**

**AWT Controls:** Buttons, Labels, Text fields, Text area, Check boxes, Check box groups, Lists, Choice, Scrollbars, Menus, Layout Managers – Flow, Border, Grid, Card and Gridbag.

Swing – JApplet, JFrame and JComponent, Icons and Labels, Handling threading issues, text fields, buttons – The JButton class, Check boxes, Radio buttons, Combo boxes, Tabbed Panes, Scroll Panes, Trees, and Tables.

Applets – Concepts of Applets, differences between applets and applications, life cycle of an applet, types of applets, creating applets, passing parameters to applets.

**UNIT-VIII:**

**Networking and Java Library:** Basics of Networking, InetAddress, TCP/IP sockets, Datagrams, URL, URL connection, String handling, java.util, java.io and java.net packages.

**TEXT BOOKS:**

1. The Complete Reference Java J2SE 5<sup>th</sup> Edition, Herbert Schildt, TMH Publishing Company Ltd, NewDelhi/PHI
2. Big Java 2<sup>nd</sup> Edition, Cay Horstmann, John Wiley and Sons.

**REFERENCES:**

1. Java How to Program, Sixth Edition, H.M.Dietel and P.J.Dietel, Pearson Education.
2. Core Java 2, Vol 1, Fundamentals, Cay.S.Horstmann and Gary Cornell, Seventh Edition, Pearson Education.
3. Core Java 2, Vol 2, Advanced Features, Cay.S.Horstmann and Gary Cornell, Seventh Edition, Pearson Education.
4. Beginning in Java 2, Iver Horton, Wrox Publications.

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**(MT05450) PHYSICAL METALLURGY****UNIT – I**

Microscopy; Metallurgical Microscope, principles and construction, types of objectives and eyepieces, common defects of lenses, electron Microscope.

**UNIT – II**

Structure of Metals, Hume-Rotherys classification of metals, metallic bond-crystal structure of metals, coordination number, relationship between lattice parameter and atomic radius, packing factor and density calculations, interstitials, polymorphism, plane and directional indices, transformation of indices.

**UNIT – III**

Constitution of Alloys: Necessarity of alloying; types of solid, Hume-Rotherys rules, Intermediate alloy phases, electro-chemical compounds, size factor, compounds and electron phases.

**UNIT – IV**

Equilibrium Diagrams: Experimental methods for construction of equilibrium diagrams, Isomorphous alloy systems, types of Nucleation, determination of the size of critical nucleus, equilibrium cooling and heating of alloys, lever rule, coring, miscibility gaps – eutectic reactions.

**UNIT – V**

Transformation in solid state, allotropy, order-disorder transformation, eutectoid, peritectoid reaction and complex phase diagrams, relation between equilibrium diagrams and physical properties of alloys.

**UNIT – VI**

Study of important binary phase diagrams Fe-Fe<sub>3</sub>C, Cu-Zn, Cu-Sn, and Al-Cu.

**UNIT – VII**

Phase transformations in steels pearlitic, martensitic and bainitic transformations cooling curves.

**UNIT – VIII**

Isothermal transformation diagrams, transformations on continuous cooling.

**TEXT BOOK:**

1. Introduction to Physical Metallurgy – S.H. Avner

**REFERENCES:**

1. Engineering Physical Metallurgy and Heat Treatment – Y. Laktin.
2. Elements of Physical Metallurgy – A.Guy
3. Metallographic laboratory practice – Kehl
4. Principles of Physical Metallurgy – Smith, M.
5. Introduction to Metallurgy – A.H. Cottrell
6. Physical Metallurgy principles-Reed Hill et al
7. Metallurgy for Engineers-Clark and Varney.

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**(ME05552) THERMODYNAMICS AND KINETICS**

**UNIT-I**

Objectives and limitations to thermodynamics, concepts of system and state, heterogeneous and homogeneous systems, extensive and intensive properties of system, thermodynamic variables, thermodynamic equilibrium and Zeroth law of thermodynamics. Reversible and irreversible processes.

**UNIT-II**

First Law of thermodynamics:

Historical outlines, nature of first law, relationship between heat and work, internal energy and the first law of thermodynamics, calculations of work, constant capacity, reversible adiabatic processes, reversible isothermal pressure or volume changes of an ideal gas, joules experiment, Joule-Thompson experiment, Joule-Thompson co-efficient enthalpy change with temperature. Kirchoff's equation. Study state and unsteady state flow analysis.

**UNIT-III**

Second law of thermodynamics: Efficiency of a cyclic process, Carnot cycle, Carnot theorem, second law of thermodynamics, concept of entropy, entropy and quantification of irreversibility, reversible processes, thermodynamic temperature scales.

**UNIT-IV**

Free energy functions: Purposes of the new functions, definition of Helmholtz and Gibbs free energy change, meaning of thermodynamically possible process, determination of  $\Delta G$  from thermal data useful relationships between free energies and other thermodynamic functions, Maxwell's equation and Gibbs-Helmholtz equation.

**UNIT-V**

Third law of thermodynamics: Background of third law deductions from third law, applications of third law, and other methods of obtaining  $\Delta S^0$  for a reaction.

**UNIT-VI**

Fugacity, activity and equilibrium constant: Concepts of fugacity, activity and equilibrium constant variation of the equilibrium constant with temperature, Tabular methods recording thermodynamic data, sigma functions.

**UNIT-VII**

Clausius – Clapeyron equation: Introduction, derivation of the Clausius – Clapeyron equation for single substance, Duhrenes rule for the estimation of the vapour pressures of an element, Intergration of Clausius – Clapeyron equation.

**UNIT-VIII**

Kinetics: Kinetics of chemical process, Molecularity and order of a reaction, zero order reactions, first order, second order reactions, Determination of order of reaction, collision theory, theory of absolute reaction rates, consecutive and simultaneous reactions, catalysis in chemical reactions.

**TEXT BOOK:**

1. Introduction to Metallurgical Thermodynamics – D.R. Gaskell

**REFERENCES:**

1. Physical chemistry for Metallurgists – J. Mackowiak
2. An Introduction to Thermodynamics – V.C. Roy
3. Thermodynamics of solids-R.S.Swain
4. Physical chemistry of metals-L.S.Darken & Gurry
5. An Introduction to thermodynamics-Y.V.C.Rao
6. Fundamentals of thermodynamics-Somntag et al
7. Fundamentals of Engineering- M.J.Morax & H.N.Shapiro.

**(CS05338) JAVA LAB**

1. Write a Java program that prints all real solutions to the quadratic equation  $ax^2 + bx + c = 0$ . Read in a, b, c and use the quadratic formula. If the discriminant  $b^2 - 4ac$  is negative, display a message stating that there are no real solutions.
2. The Fibonacci sequence is defined by the following rule. The first two values in the sequence are 1 and 1. Every subsequent value is the sum of the two values preceding it. Write a Java program that uses both recursive and non recursive functions to print the nth value in the Fibonacci sequence.
3. Write a Java program that prompts the user for an integer and then prints out all prime numbers up to that Integer.
4. Write a Java program that checks whether a given string is a palindrome or not. Ex: MADAM is a palindrome.
5. Write a Java program for sorting a given list of names in ascending order.
6. Write a Java program to multiply two given matrices.
7. Write a Java Program that reads a line of integers, and then displays each integers, and the sum of all the integers (use string to kenizer class)
8. Write a Java program that reads on file name from the user then displays information about whether the file exists, whether the file is readable, whether the file is writable, the type of file and the length of the file in bytes.
9. Write a Java program that reads a file and displays a file and displays the file on the screen, with a line number before each line.
10. Write a Java program that displays the number of characters, lines and words in a text file.
11. Write a Java program that:
  - a) Implements stack ADT.
  - b) Converts infix expression into Postfix form.

12. Write an applet that displays a simple message.
13. Write an applet that computes the payment of a loan based on the amount of the loan, the interest rate and the number of months. It takes one parameter from the browser: Monthly rate; if true, the interest rate is per month; Otherwise the interest rate is annual.
14. Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the + - X % operations. Add a text field to display the result.
15. Write a Java program for handling mouse events.
16. Write a Java program for creating multiple threads
17. Write a Java program that correctly implements producer consumer problem using the concept of inter thread communication.
18. Write a Java program that lets users create Pie charts. Design your own user interface (with swings & AWT)
19. Write a Java program that allows the user to draw lines, rectangles and OUs.
20. Write a Java program that implements a simple client/server application. The client sends data to a server. The server receives the data, uses it to produce a result, and then sends the result back to the client. The client displays the result on the console. For ex: The data sent from the client is the radius of a circle, and the result produced by the server is the area of the circle.
21. Write a Java program that illustrates how run time polymorphism is achieved.

**(MT05451) PHYSICAL METALLURGY LAB****LIST OF EXPERIMENTS**

1. Preparation and study of Crystal models.
2. Study of: Specimen cutting machine  
Specimen mounting press  
Grinding and polishing equipment
3. Study of various Metallurgical Microscopes and use of leveling press
4. Metallographic preparation of ferrous specimen for Microscopic examination
5. Preparation of non-ferrous specimen for Metallographic examination
6. Preparation and Metallographic study of pure metals like Iron, Copper and Aluminium.
7. Measurement of lattice parameters of various crystal structures and calculation of packing factors and size of vacancies.
8. Drawing of the Binary phase diagrams of Isomorphous simple Eutectic and partial solubility diagram with interpretation.
9. Drawing of complex binary phase diagrams and identification of points, lines and areas in them.
10. Identification of Microstructures of steels
11. Estimation of Carbon content of steels using metallurgical microscope and Spark test.

**(MA05365) MATHEMATICS III****UNIT I**

Special functions : Gamma and Beta Functions – Their properties – evaluation of improper integrals. Bessel functions – properties – Recurrence relations – Orthogonality; Legendre polynomials – Properties – Rodrigue's formula – Recurrence relations – Orthogonality.

**UNIT II**

Functions of a complex variable – Continuity – Differentiability – Analyticity – Properties – Cauchy-Riemann equations in Cartesian and polar coordinates. Harmonic and conjugate harmonic functions – Milne – Thompson method.

**UNIT III**

Elementary functions: Exponential, trigonometric, hyperbolic functions and their properties – General power  $Z$  ( $c$  is complex), principal value.

**UNIT IV**

Complex integration: Line integral – evaluation along a path and by indefinite integration – Cauchy's integral theorem – Cauchy's integral formula – Generalized integral formula.

**UNIT V**

Complex power series: Radius of convergence – Expansion in Taylor's series, Maclaurin's series and Laurent series. Singular point – Isolated singular point – pole of order  $m$  – essential singularity.

**UNIT VI**

Residue – Evaluation of residue by formula and by Laurent series - Residue theorem. Evaluation of integrals of the type

- (a) Improper real integrals  $\int_{-\infty}^{\infty} f(x)dx$  (b)  $\int_{-\infty}^{\infty} f(\cos\theta, \sin\theta)d\theta$   
 (c)  $\int_{-\infty}^{\infty} e^{imx}f(x) dx$  (d) Integrals by indentation.

**UNIT VII**

Argument principle – Rouché's theorem – determination of number of zeros of complex polynomials - Maximum Modulus principle - Fundamental theorem of Algebra, Liouville's Theorem.

**UNIT VIII**

Conformal mapping: Transformation by,  $lnz$ ,  $z^2$ ,  $z/(n$  positive integer),  $\sin z$ ,  $\cos z$ ,  $z + a/z$ . Translation, rotation, inversion and bilinear transformation – fixed point – cross ratio – properties – invariance of circles and cross ratio – determination of bilinear transformation mapping 3 given points .

**TEXT BOOKS:**

1. A text book of Engineering Mathematics Volume – III - T.K.Vijengar, B.Krishna Gandhi and others, S.Chand and Company , 2005.
2. Engineering Mathematics, B.V.Ramana, Tata McGraw-Hill 2003.

**REFERENCES:**

1. Engineering Mathematics–III - P.Nageswara Rao, Y.Narsimhulu, Prabhakara Rao, 2002.
2. Engineering Mathematics - S.K.V.S. Sri Rama Chary, M.Bhujanga Rao, Shankar, B.S.Publications 2000.
3. Advanced Engineering Mathematics - Erwin Kreyszig, John Wiley & Sons (ASIA) Pvt. Ltd., Eighth edition, 2001.
4. Advanced Engineering - Peter V.O'Neil , Thomson Brooks/Cole.
5. Engineering Mathematics – III, Sankaraiah, VGS Book Links, Hyderabad, 2005.

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**(CE05374) MECHANICS OF FLUIDS****UNIT I**

**Fluid Properties And Fluid Statics:** Density, Specific weight, Specific gravity, viscosity, Vapour pressure, compressibility; Pressure at a point, Pascal's law, pressure variation with temperature, density and attitude. Hydrostatic law, Piezometer, Simple and differential manometers, pressure gauges, total pressure and center of pressure plane, vertical and inclined surfaces. Buoyancy and stability of floating bodies.

**UNIT II**

**Fluid Kinematics:** Stream line, path line, streak line, stream tube, classification of flows, steady, unsteady, uniform, non-uniform, laminar, turbulent, rotational, irrotational flows; one, two and three dimensional flows Continuity equation in 3D flow, stream function, velocity potential function.

**UNIT III**

**Fluid Dynamics:** Surface and Body forces Euler's and Bernoulli's equation derivation, Navier- stokes equation (explanation only) Momentum equation - applications, vortex Free and Forced. Forced vortex with free surface.

**UNIT IV**

Similitude and Flow Measurement Similarly laws, distorted models. Flow through Venturimeters and Orificemeter, flow through notches and weirs, Viscosimeters, Hot-wire Anemometers, Pitot tube. Flow through nozzles.

**UNIT V**

Approximate solutions of N.S. Equations - Boundary layer- concepts, Prandtl contribution, Characteristics of boundary layer along a thin flat plate Von-karman's momentum integral equation (No derivation), laminar and turbulent Boundary layers, BL in transition, separation of BL, control of BL separation, flow around submerged objects, Drag and lift types of drag magnus effect.

## UNIT VI

**Closed Conduit Flow:** Characteristics of real fluids Reynolds experiment Darcy's equation, Minor losses pipes in series pipes in parallel Total energy line and hydraulic gradient line.

## UNIT VII

Exact Solutions of Navier Stokes Equations. Flow between parallel plates, flow through long tubes - Flow through inclined tubes, Turbulent flow, variation of friction factor with Reynolds Number Mody's chart.

## UNIT VIII

Flow of Compressible Fluid: Introduction, Thermodynamic relations, basic equations of compressible flow, velocity of sound wave in a fluid for isothermal and adiabatic process, mach number and its applications, mach angle, Propagation of Pressure waves and stagnation properties

## TEXT BOOKS:

1. Fluid Mechanics Hydraulics and Hydraulics Machines Modi & Seth, Standard publications, New Delhi.
2. Engineering Fluid Mechanics by K.L.Kumar, S.Chand & Co.

## REFERENCES:

1. Fluid Mechanics Frnk in white Mc-Grawhill.
2. Fluid Mechanics - John F.Dauglas, Pearson Educations publishers.
3. Fluid Mechanics & Hydraulic Machines - D. Ramadurgalah, Newage Publishers 2005-

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## (CE 05239) ENVIRONMENTAL STUDIES

## UNIT - I

**Multidisciplinary nature of Environmental Studies:** Definition, Scope and Importance – Need for Public Awareness.

## UNIT - II

**Natural Resources :** Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems - Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. - Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. - Energy resources: Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources. Case studies. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

## UNIT - III

**Ecosystems :** Concept of an ecosystem. - Structure and function of an ecosystem. - Producers, consumers and decomposers. - Energy flow in the ecosystem - Ecological succession. - Food chains, food webs and ecological pyramids. - Introduction, types, characteristic features, structure and function of the following ecosystem:

- a. Forest ecosystem
- b. Grassland ecosystem
- c. Desert ecosystem
- d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

## UNIT - IV

**Biodiversity and its conservation :** Introduction - Definition: genetic, species and ecosystem diversity. - Bio-geographical classification of India - Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values - Biodiversity at global, National and local levels. - India as a mega-diversity nation - Hot-sports of biodiversity - Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. - Endangered and endemic species of India - Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

## UNIT - V

**Environmental Pollution :** Definition, Cause, effects and control measures of :

- a. Air pollution
- b. Water pollution
- c. Soil pollution
- d. Marine pollution
- e. Noise pollution
- f. Thermal pollution
- g. Nuclear hazards

**Solid waste Management :** Causes, effects and control measures of urban and industrial wastes. - Role of an individual in prevention of pollution. - Pollution case studies. - Disaster management: floods, earthquake, cyclone and landslides.

## UNIT - VI

**Social Issues and the Environment :** From Unsustainable to Sustainable development -Urban problems related to energy -Water conservation, rain water harvesting, watershed management -Resettlement and rehabilitation of people; its problems and concerns. Case Studies -Environmental ethics: Issues and possible solutions. -Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies. -Wasteland reclamation. -Consumerism and waste products. -Environment Protection Act. -Air (Prevention and Control of Pollution) Act. -Water (Prevention and control of Pollution) Act -Wildlife Protection Act -Forest Conservation Act -Issues involved in enforcement of environmental legislation. -Public awareness.

## UNIT - VII

**Human Population and the Environment :** Population growth, variation among nations. Population explosion - Family Welfare Programme. -Environment and human health. -Human Rights. -Value Education. -HIV/AIDS. -Women and Child Welfare. -Role of information Technology in Environment and human health. -Case Studies.

## UNIT - VIII

**Field work :** Visit to a local area to document environmental assets River /forest grassland/hill/mountain -Visit to a local polluted site-Urban/Rural/Industrial/ Agricultural Study of common plants, insects, birds. -Study of simple ecosystems-pond, river, hill slopes, etc.

## TEXTBOOK :

1. Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.

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## (MT05271) FUELS, FURNACES AND REFRACTORIES

## UNIT I

Introduction to Fuels technology Classification of fuels Origin and classification of coal Analysis of Coal Proximate and ultimate analysis.

## UNIT II

Pulverized fuels Principle of Carbonization Manufacture of Metallurgical coke Properties of Metallurgical Coke Testing of Coke.

## UNIT III

Principles of production of fuel oils from crude.  
Manufacture, properties and uses of

- a) Producer gas
- b) Water gas

Properties and uses of Blast furnace gas and coke oven gas; cleaning of Blast furnace gas.

## UNIT IV

Steady State Heat Transfer: Importance of Heat transfer, conduction through plane, cylindrical, Spherical and compound walls, shape factor and effect of variable thermal conductivity

## UNIT V

Furnaces: Characteristic features of vertical shaft furnaces, reverberatory furnaces, Arc and Induction furnaces. Tube and muffle type resistance furnaces, continuous furnaces. Sources of heat losses in furnaces and heat balance.

## UNIT-VI

Pyrometry: Thermo electric pyrometry- peltier and Thomas e.m.f's. Thermo-electric power of thermocouples. Required properties of thermocouples. Noble and base metal thermocouples. Thermo-pile. Measurement of e.m.f by Milli-voltmeters and potentiometers. Thermometer; optical and radiation pyrometer.

**UNIT VII**

Refractories: Desirable properties of Refractories. Methods of classification. Modes of failure of refractories in service and their prevention. Manufacturing methods and properties of Fireclay, Silica  
Magnesite and Chrome-Refractories.

**UNIT-VIII**

Testing of Refractories. Applications of refractories in the metallurgical industries.

**TEXT BOOK:**

1. Furnaces, Fuels and refractories O.P.Gupta, Khanna Publishers.

**REFERENCES:**

1. Elements of fuel technology -HIMMUS
2. Refractories Norton
3. Refractories-R. Chisti.
4. Furnaces-J.D.Gilchrist
5. Pyrometry-W.P.woodd& J.M.corck
6. Fuels Furnaces, Refractories& Pyrometry-A.V.K.Surya Narayana.
7. Elements of heat transfer- Jakob&Hawkins.
8. Elements of thermodynamics& heat transfer- Obert & Young.
9. Control systems & Instrumentation S.Bhasker.

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4+1 0 4**(MT05391) METALLURGICAL THERMODYNAMICS****UNIT-I**

DIFFUSION: Ficks law of diffusion and its application, Kirkendal effect, Darken's equations, the Metano Method.

**UNIT-II**

Determination of intrinsic diffusivities, self-diffusion in pure metals, Temperature dependence of the diffusion coefficient, diffusion along the grain boundaries and surfaces.

**UNIT-III**

ELLINGHAM DIAGRAMS: Introduction, calculation of equilibrium constants from standard free energy changes, general description of Ellingham diagrams, Interpretation of two or more free energy change Vs. temperature lines taken together, derivation and uses of the oxygen, nomographic scale in Richardsons diagrams.

**UNIT-IV**

THERMAL PROPERTIES: Specific heats of solids, classical, Einstein and Debyes' Model of the lattice, specific heat of solids.

**UNIT-V**

Anharmonicity, thermal expansion, thermal conductivity of solids, lattice thermal conductivity and thermo-electric effects.

**UNIT-VI**

SOLUTIONS: Composition, partial molal quantities, ideal solutions, Raoult's Law, actual (Nonideal) solutions, Sieverts law, Gibbs' - Duhem equation, integration of Gibbs' - Duhem equation, Excess thermodynamics quantities.

**UNIT-VII**

APPLICATION TO PHASE DIAGRAMS: Concept of chemical potential, equality of chemical potentials in equilibrated phases, Derivation of Gibb's phase rule, solidus and liquidus lines for an ideal solution, calculation of liquidus line for eutectic systems.

**UNIT-VIII**

REVERSIBLE CELLS: Electro- Chemical cells, galvanic cells, chemical and electrical energy, thermodynamics of Electro-chemical cells, standard electrode potentials, sign convention of electrode potentials, application of Gibbs - Helmholtz equation to galvanic cells. Concentration Cells.

**TEXT BOOK:**

1. Physical Chemistry of Metals - LS Darken and Gurry

**REFERENCES:**

1. Thermodynamics of solids RA Swain
2. Physical Metallurgy Principles - RH Reed Hill.
3. Physical Chemistry for Metallurgist - J. Mackowick
4. Material science; A First course-Raghavan



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**(MT05410) MINERAL DRESSING****UNIT I**

Scope and objectives of ore dressing. Sampling of ores by different methods. Theory of liberation of minerals.

Crushers: -Jaw, Gyratory, Cone, Rolls and toothed roll crushers.

**UNIT II**

Types of grinding operations like batch and continuous dry and wet grinding, open circuit and closed circuit grinding. Grinding Mills: Ball mills, theory of ball mill operation, rod and tube mills. Comminution laws: - Rittinger's laws, Kick's law and Bond's law.

**UNIT III**

Sizing: Study of laboratory sizing techniques and reporting of sizing data.

Industrial sizing units: Types of screen surfaces. Grizzlies, trommels, vibrating and shaking screens.

Movement of solids in fluids: Stokes and Newton's laws. Terminal velocity and its relation with size. Relation between time and velocity. Relation between distance traveled and velocity. Equal settling ratio, Free and hindered settling ratios.

Quantifying concentrating operations: Ratio of concentration, recovery, selectivity index and economic recovery.

**UNIT IV**

Classification of classifiers, study of settling cones, rake classifier, spiral classifier and cyclones.

**UNIT V**

Heavy media separation: Principles, flow chart, different media used. Heavy media separation using heavy liquids and heavy suspensions. Washability curves for easy, normal and difficult coal.

**UNIT VI**

Jigging: Theory of jigging.

Jigging machines: hand jig, harz jig, denner jig baum jig, Hancock jig, James coal jig and hally/n jig. Design considerations in a jig.

Tabling: -study of stratification on a table. Shaking tables, wilfley table. Humphrey's spiral classifier.

**UNIT VII**

Flotation: Principles of flotation. Factors affecting flotation. Classification of collectors and frothers. Regulators factors affecting their efficiency.

Flotation machines: -Pneumatic and mechanical flotation cells. Application of flotation process for Cu, Pb and Zn ores.

**UNIT VIII**

Magnetic separation processes and electrostatic separation process.

**TEXT BOOK:**

1. Principles of Mineral Dressing by A.M. Gaudin.

**REFERENCES:**

1. Elements of Ore Dressing by A.F. Taggart
2. Mineral processing technology- A. Willis
3. Ore dressing practices-S.K. Jain.

**(MT05272) FUELS, FURNACES AND REFRACTORIES LAB**

1. To conduct proximate analysis of Coal
2. To conduct ultimate analysis of Coal
3. To find the Flash and Fire points of fuel oil by "PENSKY MARTINS" open and closed cup apparatus.
4. To find the flash and points of fuel oil by ABEL'S Flash point apparatus
5. To find the viscosity of lubricant oil by using
  - a. Red-wood-I Viscometer
  - b. Red-wood-II Viscometer
  - c. Saybolt Viscometer
6. To find the calorific value of solid and liquid fuels by using "Bomb Calorimeter"
7. To find the calorific value of gaseous fuels by using "Junker's Gas Calorimeter"
8. To study various types of refractories and find their densities, Hardness and slag penetration.

**(MT05411) MINERAL DRESSING LAB****List of Experiments**

1. Sampling of an ore from the bulk by
  - i) Coning and quartering method
  - ii) Riffle sampler methods
2. Sizing by Sieve analysis of crushed ore
3. Verification of Stoke's Law.
4. Determining the reduction ratio of a jaw crusher.
5. Study of the variation of reduction ratio with process variables in Rolls crusher.
6. Study of the process variables on reduction ratio and particle size distribution in ball mill.
7. To find the grindability index of ores.
8. Verification of Laws of Communiton.
9. Determination of the efficiency of a magnetic separator.
10. Determination of the efficiency of a jig.
11. Study of the particle separation by fluid flow using wilfley table.
12. Determination of the efficiency of a pneumatic separator.
13. To study the concentration of metallic and non-metallic ores by Froth-Flotation process.

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**(EE05192) ELECTRICAL ENGINEERING**

**UNIT I**

**BASIC CONCEPTS:** SI Units - Ohm's law, series, and parallel circuits, Kirchhoff's laws, Star-delta transformation (Simple Problems) Force on a current carrying conductor in magnetic field electromagnetic induction, Faraday's law, Lenz's law Self and mutual inductances.

**UNIT II**

**A.C. CIRCUIT FUNDAMENTALS:** Average and rms values of Sinusoidal quantity representation of alternating quantities by phasors single phase series and parallel circuits (Simple problems) Series resonance three phase balanced systems single and three phase power calculations.

**UNIT III**

**D.C. GENERATORS:** Principle of operation of DC machines emf equation types of generators Magnetization and Load characteristics of DC generators

**UNIT-IV**

**D.C. MOTORS:** Principle of operation of DC Motor, Types of Motors, Back EMF Equation, Characteristics of DC motor, Torque Equation, DC Motor Starter (Three Point starter), Efficiency Calculation, Swinburne's Test and speed control.

**UNIT V**

**TRANSFORMERS:** Construction and principle of operation of single-phase transformer emf equation O.C. & S.C. tests efficiency and regulation

**UNIT-VI**

**INDUCTION MOTORS:** Principle and operation of three-phase induction motors types of motors, Squirrel cage and slip ring motor slip torque characteristics.

**UNIT-VII**

**ALTERNATORS:** Principle and operation of alternators O.C. & S.C. tests regulation by synchronous impedance method.

**UNIT VIII**

**ELECTRICAL INSTRUMENTS:** Electrical Instruments: Basic principles of indicating instruments moving coil and moving iron instruments (Ammeters and voltmeters).

**TEXT BOOKS:**

1. Introduction to Electrical Engineering by M.S.Naidu and S.Kamakshiah, TMH
2. Basic Electrical Engineering by T.K. Nagasarkar and M.S.Sukhija, Oxford University Press, 2005

**REFERENCES:**

1. Theory and Problems of Basic Electrical Engineering by D.P.Kothari & I.J. Nagrath Pearson Education/PHI
2. Essentials of Electrical and Computer Engineering by David V.Kerns,Jr, J.David Jrwin; Pearson Education.

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**(HS05352) MANAGEMENT SCIENCE**

**UNIT I**

Introduction to Management: Concepts of Management and organization- nature, importance and Functions of Management, Taylor's Scientific Management Theory, Fayol's Principles of Management, Mayo's Hawthorne Experiments, Maslow's Theory of Human Needs, Douglas McGregor's Theory X and Theory Y, Herzbergs Two-Factor Theory of Motivation, Systems Approach to Management, Leadership Styles, Social responsibilities of Management.

**UNIT-II**

Designing Organizational Structures: Basic concepts related to Organization - Departmentation and Decentralization, Types of mechanistic and organic structures of organization (Line organization, Line and staff organization, functional organization, Committee organization, matrix organization, Virtual Organization, Cellular Organization, team structure, boundary less organization, inverted pyramid structure, lean and flat organization structure) and their merits, demerits and suitability.

**UNIT III**

Operations Management: Principles and Types of Plant Layout-Methods of production (Job, batch and Mass Production), Work Study -Basic procedure involved in Method Study and Work Measurement-Statistical Quality Control: chart, R chart, c chart, p chart, (simple Problems), Acceptance Sampling, Deming's contribution to quality.

**UNIT IV**

Materials Management: Objectives, Need for Inventory control, EOQ, ABC Analysis, Purchase Procedure, Stores Management and Stores Records.  
Marketing: Functions of Marketing, Marketing Mix, Marketing Strategies based on Product Life Cycle, Channels of distribution

**UNIT V**

Human Resources Management (HRM): Concepts of HRM, HRD and Personnel Management and Industrial Relations (PMIR), HRM vs.PMIR, Basic functions of HR Manager: Manpower planning, Recruitment, Selection, Training and Development, Placement, Wage and Salary Administration, Promotion, Transfer, Separation, Performance Appraisal, Grievance Handling and Welfare Administration, Job Evaluation and Merit Rating.

**UNIT VI**

Project Management (PERT/CPM): Network Analysis, Programme Evaluation and Review Technique (PERT), Critical Path Method (CPM), Identifying critical path, Probability of Completing the project within given time, Project Cost Analysis, Project Crashing. (Simple problems)

**UNIT VII**

Strategic Management: Mission, Goals, Objectives, Policy, Strategy, Programmes, Elements of Corporate Planning Process, Environmental Scanning, Value Chain Analysis, SWOT Analysis, Steps in Strategy Formulation and Implementation, Generic Strategy alternatives.

**UNIT VIII**

Contemporary Management Practices: Basic concepts of MIS, End User Computing, Materials Requirement Planning (MRP), Just-In-Time (JIT) System, Total Quality Management (TQM), Six sigma and Capability Maturity Model (CMM) Levels, Supply Chain Management, Enterprise Resource Planning (ERP), Performance Management, Business Process outsourcing (BPO), Business Process Re-engineering and Bench Marking, Balanced Score Card.

**TEXT BOOKS:**

1. Ayasri: Management Science, TMH, 2004.
2. Stoner, Freeman, Gilbert, Management, 6th Ed, Pearson Education, New Delhi, 2004.

**REFERENCES:**

1. Kotler Philip & Keller Kevin Lane: Marketing Management 12/e, PHI, 2005
2. Koontz & Wehrich: Essentials of Management, 6/e, TMH, 2005
3. Thomas N.Duenning & John M.Ivancevich Management Principles and Guidelines, Biztantra,2003.
4. Kanishka Bedi, Production and Operations Management, Oxford University Press, 2004.
5. Memoria & S.V.Gauker, Personnel Management, Himalaya, 25/e, 2005
6. Samuel C.Certo: Modern Management, 9/e, PHI, 2005
7. Schermerhorn, Capling, Poole & Wiesner: Management, Wiley, 2002.
8. Parnell: Strategic Management, Biztantra,2003.
9. Lawrence R Jauch, R.Gupta &William F.Gluck:Business Policy and Strategic Management, Frank Bros.2005.
10. L.S.Srinath: PERT/CPM, Affiliated East-West Press, 2005.

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**(MT05368) MECHANICAL METALLURGY****UNIT- I**

Metallurgical Fundamentals: Critical resolved shear stress. Defects in crystalline materials Point defects and line defects. The concept of dislocation - Edge dislocation and screw dislocation. Interaction between dislocations, sessile dislocation, glissile dislocation, Energy of a dislocation, dislocation climb, jogs, Forces on dislocations. Frank Reed source, slip and twinning.

**UNIT- II**

Hardness Test: Methods of hardness testing Brinell, Vickers, Rockwell, Rockwell superficial, Shore and Poldi methods, Microhardness test, relationship between hardness and other mechanical properties.

**UNIT III**

Fracture: Elementary/theories of fracture, Griffiths theory of brittle fracture, Ductile Fracture, Notch sensitivity.

**UNIT IV**

The Tension Test: Mechanism of elastic action, linear elastic properties. Engineering stress-strain and True stress-strain curve. Tensile properties, conditions for necking, effect of temperature and strain rate on tensile properties.

**UNIT V**

The Compression Test: Elastic and in-elastic action in compression, elastic and in-elastic properties in compression. compression Test.

**UNIT VI**

The Impact Test: Notched bar impact test and its significance. Charpy and Izod Tests, fracture toughness testing - COD and CTOD tests, significance of transition temperature curve, Metallurgical factors affecting on transition temperature, temper embrittlement.

**UNIT- VIII**

Fatigue Test: Introduction, Stress cycles, S-N Curve, Effect of mean stress, Mechanism of fatigue failure, effect of stress concentration, size, surface condition and environments on fatigue. Effect of metallurgical variables on fatigue. Low cycle fatigue - High cycle fatigue.

**UNIT -VIII**

Creep and Stress Rupture: Introduction, The creep curve, Stress-rupture test, Structural changes during creep, Mechanism of creep deformation, theories of creep. Fracture at elevated temperature, Effect of Metallurgical variables on creep.

**TEXT BOOK:**

1. Mechanical Metallurgy - GE Dieter

**REFERENCES:**

1. Engineering Materials Science - CW Richards
2. Mechanical behavior of material-A.H.Courteny
3. Mechanical behavior-Ed.Wulf.
4. Mechanical Metallurgy White & LeMay.

**(MT052288) HEAT TREATMENT TECHNOLOGY****UNIT-I**

**PRINCIPLES OF HEAT TREATMENT:** Austenitic Transformation, Pearlitic Transformation, Bainitic Transformation, Martensitic Transformation, Annealing, Normalizing, Hardening, mechanism of heat removal during quenching, quenching media, size and mass effect, hardenability, tempering, austempering, manufacturing, deep freezing.

**UNIT-II**

Surface heat treatment, carburizing, cyaniding, flame and induction hardening, residual stresses, deep freezing, thermo mechanical treatments: HTMT, LTMT, Austforming, Isoforming, Cryoformy.

**UNIT-III**

**EFFECT OF ALLOY ELEMENTS:** Purpose of alloying, effect of alloying elements on ferrite, cementite, Fe-Fe<sub>3</sub>C system, tempering and TTT Curves.

**UNIT-IV**

**ALLOY STEELS:** Structural and constructional steels, maraging steels, tool and die steels.

**UNIT-V**

Corrosion and heat resistant steels, Hadfield steels, magnetic steels and alloys, free machining steels.

**UNIT-V**

**CAST IRONS:** White cast iron, grey cast iron, spheroidal graphite iron, malleable cast iron, alloy cast iron.

**UNIT-VII**

**NON-FERROUS METALS AND ALLOYS:** Precipitation hardening, aging treatment, study of copper and its alloys, aluminum and its alloys, nickel and its alloys.

**UNIT-VIII**

Heat treatment furnaces and their design, atmosphere control vacuum heat treatment etc.

**TEXT BOOK:**

1. Heat Treatment Principle and Techniques-Rajan & Shanna

**REFERENCES:**

1. Physical Metallurgy Lakhtin-Mir Publishers
2. Physical Metallurgy - Clark and Varney
3. Physical Metallurgy Principles - Reed Hill
4. Physical metallurgy-Ragavan
5. Heat Treat ment of metals-Zakharv-Mir Publishers

**(MT05336) IRON MAKING****UNIT-I**

**Development of iron making:** Bloomery-stacks-catalon forge-stukofen-B.F.Occurrence and distribution of iron ores in India and in the world. Preparation of iron ores.

**UNIT-II**

**Sintering:** Principles, raw materials and DL.machine.Mecchanism of sintering:sintering bonds. Factors affecting sintering efficiency. Pelletisation: Theory of pelletisation, Water-particles system. Production of green pellets: disk and drum pelletisers, Induartion of pellets: Shaft, traveling grate.

**UNIT-III**

**Blast furnace coke:** Functions, properties and uses.B.F profile and designs considerations. Furnace lining. Furnace cooling system. Hoisting equipment.B.F. Stoves. BF gas cleaning system and gas uses.

**UNIT-IV**

**Physical chemistry of reduction of iron ores:** Physical and chemical factors affecting reduction of ores. Relevant CO/CO<sub>2</sub> and H<sub>2</sub>/H<sub>2</sub>O diagram. Controls of C, Si, S, P in metals and slags.

**UNIT-V**

**Blast furnace slags:** Its constitution. Effect of CaO, SiO<sub>2</sub>, Al<sub>2</sub>O<sub>3</sub> and MgO on fluidity of slags. Uses of slags.

**UNIT-VI**

**Blast furnace operation:** Blowing in, blowing out, fanning and draughting. BF irregularities and their control/remedies.

Development of BF: HTP, humidification of blast. O<sub>2</sub> enrichment, hot blast temperature, BF additives, and top charging systems.

**UNIT-VII**

**Burden calculations:** Raceways parameters. Factors affecting it.

Alternative routes of iron making: Electric pig iron smelting, low shaft and small shaft.BF.Cclassification of sponge iron making. HYL, Kin Krupp-Renn, Midrex process.

**UNIT-VIII**

Production of wrought iron.

**TEXT BOOK:**

1. Modern Iron making Dr. R.H. Tupkary

**REFERENCES:**

1. Blast furnace theory and practice Vol. 1 and 2 edited by Julius H. Strassburger.
2. Principles of blast furnace Iron Making A.K. Biswas.
3. Making, shaping and treating of steels by United Steel Corporation, Pittsburgh
4. Manufacture of Iron & steel Vol-I-G.R.Bashforth.

**(MT05581) WELDING METALLURGY**

**UNIT I & II**

The principles and theory, mechanism and key variables of different welding processes, types of tooling and equipment, microstructure of fusion and heat affected zone, welding stresses, pre and post treatments.

**UNIT-III**

Advantages, disadvantages and field of application of the welding with reference to the following welding processes; Gas welding, Arc welding, submerged arc welding, TIG, MIG, Plasma arc welding.

**UNIT IV**

Electron Beam welding (including EMPOR) spot-welding, Laser welding, diffusion welding.

**UNIT-V**

Welding of structural steel, welding of cast iron, welding of stainless steel and other high-alloyed steels.

**UNIT-VI**

Welding of copper and its alloys, welding of aluminium and its alloys, joining of dissimilar alloys.

**UNIT VII**

Welding defects and remedies.

**UNIT VIII**

Mechanism, Techniques and scope of brazing, soldering and adhesive bonding processes.

**TEXT BOOK:**

1. Welding Technology-R.S.Parmar.

**REFERENCES:**

1. JF Lancaster: Welding Metallurgy
2. Little : Welding and Welding Technology
3. Agarwal Manghmani: Welding Engineering
4. BE Rossi: Welding Engineering

**(MT05369) MECHANICAL METALLURGY LAB**

**List of Experiments:**

1. Hardness Test: to determine the Brinell Hardness Values of values of ferrous and non-ferrous samples.
2. Tension Test:
  - To determine the elastic modulus, ultimate tensile strength, breaking stress, percentage elongation
3. Torsion Test:
  - To determine the modulus of rigidity of given material.
4. Impact Testing:
  - To determine the charpy and Izod (V & U Groove notch) values of a given material at room temperature.
5. Fatigue Test:
  - To determine the number of cycles to failure of a given material at a given stress.
6. Magnetic flaw detector:
  - To inspect a given material for cracks.
7. Liquid penetrant Test:
  - To detect the surface flaws in a given materials by die penetrant.
8. Ultrasonic flaw detection:
  - To inspect a given material for locating cracks
9. To detect the surface flaws in steel by fluorescent penetrant method
10. To determine the Rockwell hardness values of heat treated steels.
11. To find the microhardness of phases by using vickers hardness tester.
12. To study the radiographs of weldments.

**(MT05289) HEAT TREATMENT TECHNOLOGY LAB**

**List of Experiments:**

1. Annealing of medium carbon steel and observation of microstructure.
2. Normalizing of medium carbon steel and observation of microstructure.
3. Hardening of medium carbon steel and observation of microstructure.
4. Study of tempering characteristics of water quenched steel.
5. Study of age hardening phenomena in duralumin.
6. Spheroidizing of a given high carbon steel.
7. Determination of hardenability of medium carbon steel by Jominy end Quench Test.
8. To conduct Re-crystallization studies on cold worked copper.

**(EC05069) BASIC ELECTRONICS**

**UNIT I****Semiconductor materials and Junction diodes**

Classification of solids, energy levels, intrinsic and extrinsic semiconductor, conduction in metals and semiconductors.

Semiconductor diodes : Diode under forward bias condition, diode under reverse bias condition, current-voltage characteristics of PN junction diode, Diode as a switch, as a rectifier, Half wave rectifier, Full wave rectifier, Rectifier with filters.

**UNIT II****BJT and FETs**

Bipolar Junction Transistor structure, principle of operation of npn and pnp transistor, Transistor (BJT) configurations CB, CE, CC. Relation between  $I_C$ ,  $I_B$  and  $I_E$  currents – Input and output characteristics of BJT – Junction Field Effect Transistor : Physical structure, principle of operation, current-voltage characteristics, JFET configuration as CS, CD & CG.

**UNIT III****SCR and Thyristor**

Principles of operation and characteristics of SCR, Triggering of SCR, Diac and Triac, Thyristor characteristics, phase controlled half and full wave rectification.

**UNIT IV****Feedback Amplifiers**

Feedback principles, advantages of negative feedback amplifier, feedback amplifier topologies, analysis, effect of negative feedback on  $R_i$ ,  $R_o$ ,  $A_v$  and  $A_f$  of an amplifier.

**UNIT V****Oscillators**

Classification of oscillators, principle of feedback oscillator, Barkhausen's criterion, RC phase shift oscillator, Hartley and Colpitts oscillators.

**UNIT VI**

Basic Timer Circuits, Applications, welding control, Resistance welding, Energy storage welding.

**UNIT VII**

Induction and Dielectric heating, Ultrasonic generators and applications, Cathode Ray tube of CRO, simple applications.

**UNIT VIII****8085 Microprocessors**

Brief overview of 8085's architecture, A to D and D to A converter circuits and applications.

**TEXT BOOKS:**

1. Electronic Devices and Circuits – J. Millman and C.C. Halkias, TMH, 1998.
2. Industrial Electronics – G.K. Mithal, Khanna Publications, 19<sup>th</sup> Edn., 2003.

**REFERENCES:**

1. Electronic Devices and Circuits – K. Lal Kishore, B.S. Publications, 2<sup>nd</sup> edition, 2005.
2. Basic Electronics – Sedha and Mithal, S. Chand & Co.
3. Thyristors and Applications – M. Ram Murthy, East-West Press, 1977.
4. 8085 Microprocessors and Interfacing – R.S. Goankar.

**(MT05429) NON-FERROUS EXTRACTIVE METALLURGY****UNIT I**

**COPPER:** Principal Ore and Minerals: Matte smelting – Blast furnace, Reverberatory, Electric furnace, Flash; Converting; Continuous production of blister Copper; Fire refining; Electrolytic refining; Hydro-Metallurgical copper extraction; Leaching processes, Recovery of copper from leach solutions; Electro-winning.

**UNIT II**

**ZINC:** General Principles: Horizontal and vertical retort processes: Production in a Blast furnace: Leaching purification: Electrolysis, Refining.

**UNIT III**

**LEAD:** Blast furnace smelting, Refining of lead bullion

**UNIT IV:**

**ALUMINIUM:** Bayer process, Hall - Heroult process, Anode effect: Efficiency of the process, Refining, Alternative processes of aluminium production.

**UNIT V:**

**MAGNESIUM:** Production of a hydrous Magnesium chloride from sea water and magnesite. Electro-winning practice and problem, refining, Pidgeon and Hansgrig processes.

**UNIT-VI**

**TITANIUM:** Upgrading of ilmenite, chlorination of titania, Kroll's process. Refining.

**UNIT VII:**

**URANIUM:** Acid and alkali processes for digestion of uranium ores, Purification of crude salt, Production of reactor grade  $UO_2$  and uranium.

**UNIT-VIII**

Simplified flow sheets for the extraction of nickel, tungsten and gold. Review of non-ferrous metal industries in India.

**TEXT BOOKS:**

1. Extraction of Non-Ferrous Metals - HS Ray, KP Abraham and R. Sridhar
2. Metallurgy of Non-Ferrous Metals - WH Dennis

**REFERENCES:**

1. Rare Metals Hand book - C.A. Hampel
2. Nuclear Reacto General Metallurgy - N. Sevryukov, B. Kuzmin and Y. heilshchevr
3. Engineering - S. Glass Stone and A. Sesonkske.
4. Nuclear Chemical Engineering - Manstion Bendict and Thomas H. Pigfort

**(MT05372) MECHANICAL WORKING OF METALS****UNIT I:**

**STRESS AND STRAIN RELATIONSHIP FOR ELASTIC BEHAVIOUR:** Description of stress at a point. State of stress in two dimensions. Mohr's circle of stress in two dimensions, state of stress in three dimensions. Mohr's circle of stress in three dimensions. Description of strain at point.

**UNIT II:**

**ELEMENTS OF THEORY OF PLASTICITY:** The flow curve. True stress and true strain. Von Mises distortion energy criterion, maximum shear stress or Tresca criterion. Octahedral shear stress and shear strain. Basics of the theories of plasticity.

**UNIT III:**

**FUNDAMENTALS OF METAL WORKING:** Classification of forming processes, Mechanics of metal working for slab method and uniform deformation energy method. Cold working, Recovery, recrystallisation and grain growth, hot working, Strain-Rate effects, Work of plastic deformation.

**UNIT IV:**

**FORGING:** Classification of forging processes, forging equipment. Forging in plane strain. Open-die forging, closed-die forging, Forging of a cylinder in plane-strain. Forging defects, powder metallurgy forging.

**UNIT V:**

**ROLLING OF METALS:** Classification of rolling process, rolling mills. Hot rolling, cold rolling, rolling of bars and shapes, forging and geometrical relationships in rolling.

**UNIT VI:**

Simplified analysis of rolling load, rolling variables, problems and defects in rolled products. Theories of hot rolling, torque and horsepower, theories of cold rolling, torque and horsepower.

**UNIT VII:**

**EXTRUSION:** Classification of extrusion processes, extrusion equipment. Hot extrusion. Deformation and defects in extrusion. Analysis of the extrusion process. Cold extrusion. Extrusion of tubing and production of seamless pipe and tubing.

**UNIT VIII:**

**DRAWING OF RODS, WIRES AND TUBE:** Rod and wire drawing, tube drawing processes, residual stresses in rod, wire and tubes.

**TEXT BOOK:**

1. Mechanical Metallurgy by GE Dieter (3<sup>rd</sup> edition)

**REFERENCES:**

1. Mechanical working of metals-Avitzur.
2. Engineering Metallurgy-Parill-Higgins.



**(MT05267) FOUNDRY TECHNOLOGY****UNIT I**

Scope and development of Foundry. Types of foundries.

**PATTERNS:** Materials for patterns, types of patterns; functions and pattern allowance.

**MOULDING MATERIALS:** Moulding sands, properties and selection of materials and additives used.

**UNIT II**

**CASTING PROCESSES AND EQUIPMENT:** Green and dry sand moulding; shell moulding, CO<sub>2</sub> moulding, Core moulds and cores, Plaster mould casting, composite mould casting, Investment casting.

**UNIT III:**

Permanent mould casting, pressure die-casting, Gravity die-casting and centrifugal casting, Types of moulding equipment.

**UNIT IV:**

**GATING AND RISERING:** Gate nomenclature, gate types and types of risers.

**UNIT V:**

**SOLIDIFICATION OF METALS:** Nucleation crystal growth, Freezing of metals and alloys, Dendritic freezing, Coring and segregation, ingot defects, Flow of metals in moulds.

**UNIT VI**

**MELTING OF FERROUS ALLOYS:** Melting of Gray iron and cupola. Cupola operation and control. Effect on chemical composition, carbon equivalent and effect of alloying elements on foundry characteristics. Melting of non-ferrous alloys: Melting of Aluminium and copper alloys production processes: Production of Gray Iron, ductile iron. Malleable iron castings.

**UNIT VII**

**MODERN DEVELOPMENTS:** Recently developed processes - V-forming full mould process - Furon-no-bake sand moulds and cores. Continuous casting. Cold setting and self-setting processes.

**UNIT VIII**

**CASTING DEFECTS:** Casting defects arising due to moulding, coring melting and poring practice.

**TEXT BOOKS:**

1. Principles of Metal casting by Heine, Loper and Rosenthal.
2. Foundry Technology – Dhruvendra Kumar & S.K. Jain

**REFERENCES:**

1. Metals Handbook Vol. 5 published by ASM, Ohio.
2. Foundry Technology-Jain
3. Foundry Technology Principle-T.V.Rama Rao

**(MT05525) STEEL MAKING****UNIT-I**

Classification of Steel making Processes.

Early steel making processes: Cementation and crucible processes. Raw materials for steel making. Factors affecting efficiency of steel making.

**UNIT-II**

Principles of Steel making:- Decarburisation, desilicization, Dephosphorisation and desulphurisation. Principles of deoxidation. Types of deoxidation:-Precipitation, diffusion and treatment with synthetic slags,molecular and ionic theory of slags.

**UNIT-III**

Construction and process details in acid and basic Bessemer converters and open-hearth furnace. Improvement and modification of the above process.

**UNIT-IV**

Construction and process details in LD, LD-AC, Kaldo and rotor steel making processes. Bottom blown O<sub>2</sub> processes. Combined blow processes. Continuous steel making process: - BISRA, IRSID & WORCRA Process.

**UNIT-V**

Construction details of electric arc furnace: production of steel . Induction furnace for steel making.

**UNIT-VI**

Teeming Practices: - Direct, bottom and uphill Teeming methods. Casting pit side practice.

**UNIT-VII**

Solidification of steels. Ingot defects and remedies; secondary steel making processes. Vacuum treatment of steels.

**UNIT-VIII**

Continuous casting of steels. Electro slag refining process. Vacuum arc remelting process. Brief outline of manufacture of alloy steels.

**TEXT BOOK:**

1. Modern Steelmaking – Dr. R.H. Tupkary and V.H. Tupkary

**REFERENCES:**

1. Making Shaping and Treating of Steels by United States Steel Corporation, Pittsburg.
2. Open Hearth furnace practice - Bornatsky,
3. Manufacture of Iron and Steel, Vol. II by Gr Bashforth

**(MM05457) POLYMERIC MATERIALS****UNIT-I**

**Introduction to polymers and plastics:** Conception of polymers, formation of polymers, types of polymers reactions such as addition and condensation, Mechanism of polymerization - Thermoplastic and Thermosetting materials methods of polymerization.

**UNIT -II**

**Polymeric structure, raw materials and properties:** Classification of polymers, raw materials for polymers and their sources. Brief study of structure of polymers and properties. Glass transition temperature and its significance. Crystallinity of polymeric materials, effect of time, temperature, catalysts and solvents on polymer properties, molecular weight of polymers.

**UNIT -III**

Compounding and fabrication of plastics, calendaring and casting.

**UNIT – IV**

Functions of the following types of additives used in Polymers.

- |                   |                    |                       |   |
|-------------------|--------------------|-----------------------|---|
| 1. Fillers        | 2. Lubricants      | 3. Reinforcing agents | 4. Plasticizers                         |
| 5. Stabilizers    | 6. Antioxidants    | 7. Inhibitors         | 8. Promoters                            |
| 9. Catalysts      | 10. Refarfers      | 11. Limitators        | 12. Colorants                           |
| 13. Cross-linking | 14. Blowing agents | 15. Photo degradants  | 16. Bio-degradants, laminated polymers. |

**UNIT - V**

**Thermoplastics:** Methods of addition polymerization, raw materials, manufacturing methods, properties and uses of the following ethenoid polymers:

Polyethene (LDPE and HDPE), Polypropylene, Poly Vinyl Chloride, Polystyrene, Expanded polystyrene, Polyetra fluorethylene.

**UNIT – VI**

**Thermosetting resins:** Introduction of thermosetting polymers, methods of condensation polymerization, raw materials, manufacturing method, properties and uses of Phenol- Formaldehyde resin, Urea-formaldehyde resins, alkyl resins.

**UNIT – VII**

Raw materials, manufacturing methods, properties and uses of the following plastics Acetals, Nylons, Polymethyl, Methocrylate (PMMA), Saturated polyesters – PETP and PC, Cellulose acetate and viscose rayon.

**UNIT – VIII**

Introduction of natural rubbers and synthetic rubbers like Buna-S, Buna-N, Thiokol, Polyurethane rubber and Silicon rubber.

**TEXT BOOK:**

1. Polymer science – Gowrikar

**REFERENCES:**

1. Polymer Science & technology-Joel fried
2. Material Science –V.D.Kodgire.
3. Introduction to materials science & engineering-courtny & Hall

**(MT05373) MECHANICAL WORKING OF METALS LAB****LIST OF EXPERIMENTS:**

1. Determination of formability of a sheet by erichson cupping test.
2. To verify Hall-Petch relation in mild steel specimens.
3. To study the work hardening and strain rate sensitivity of metal.
4. To determine Strain hardening exponent (n) and strength co-efficient (K) of a given material.
5. To study the forging operations in the production of a hook.
6. To observe the microstructure of weld joint.
7. To study the phenomenon of stress corrosion cracking.
8. To study the annealing of cold worked metal.
9. To conduct the ring compression test to determine the friction factor.

**(MT05268) FOUNDRY TECHNOLOGY LAB****LIST OF EXPERIMENTS:**

1. Preparation of gating system using green sand.
2. Study of particle size distribution of the sand.
3. Study of the variation of permeability of the green sand with clay and water.
4. Determination of the variation of sand properties like green hardness, green compact strength with additives in sands.
5. Determination of the variation of hot compact hardness and hot shear strength with additivesn sands.
6. Determination of clay content in sand.
7. Determination of the shatter index of green sand.
8. Founding of Al and Cu alloys in a pit furnace and casting into light components.
9. Study Charge calculations and melting practice of cast iron in a cupola.
10. Preparation of a shell-by-shell moulding process.
11. Non-destructive testing of a few cast iron components.

**(MT05203) ELECTRO METALLURGY AND CORROSION****UNIT - I**

Applied electrochemistry - electrochemical methods of analysis estimation by electrolysis.

**UNIT - II**

Electrophoresis-measuring instruments for experimental study of electro-chemistry.

**UNIT -III**

Review of electrochemical Principles. –Faradays laws-Electrode potentials – Cathodic and anodic reactions- polarization over voltage.

**UNIT -IV**

General discussion on the electro winning of metals eg. Cu, Zn, metallic clouds, anode effect. Differences between electro winning and electro refining.

**UNIT -V**

Current efficiency, throwing power, electro plating of Cu, Ni, Cr, Zn and alloy Plating. Testing methods of electro deposite.

**UNIT-VI**

Introduction, classification, forms of corrosion. Uniform corrosion, galvanic corrosion, and galvanic series. Beneficial applications of galvanic corrosion, Pitting corrosion, season cracking, dezincification. Crevice corrosion, stress corrosion cracking, Intergranular corrosion, weld decay,Knife-line attack, Erosion corrosion, fretting corrosion.

**UNIT -VII**

Corrosion protection methods, selection of materials for corrosion services, selection of environment-use of inhibitors, surface protection methods including painting, metallic coating.

**UNIT-VIII**

Cathodic protection, sacrificial anode. Difference between cathodic and anodic protection.

**TEXT BOOKS:**

1. Introduction to Electrometallurgy & Corrosion byR.Sharans,Narain-Standard Publishers.
2. Corrosion Engineering-Mars G.Fontana

**REFERENCES:**

1. Electro metallurgy-Blum.
2. Material science- Van Vlack
3. Elements of Physical Metallurgy-A.Guy.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY**  
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IV Year B.Tech. MMT I Semester  
**(MT05116) CERAMIC SCIENCE AND TECHNOLOGY**

**UNIT - I**  
**Introduction:** Definition – Classification of Ceramics – Traditional Ceramics – Structural Ceramics – Fine Ceramics – Bio ceramics – Ceramic super conductors.

**UNIT - II**  
**Structure of Ceramic Crystals:** Atomic structure – Interatomic bonds – Atomic bonding in Solids – Crystal structures – Grouping of ions and Pauling's rules – Oxide structures – Silicate structures – Glass formation – Models of glass structure – Types of glasses.

**UNIT – III**  
**Ceramic Phase - Equilibrium Diagrams:**  
Two component systems  
a)  $Al_2O_3 - SiO_2$       b)  $BaO - TiO_2$

**UNIT – IV**  
Three component systems  
 $MgO - Al_2O_3 - SiO_2$

**UNIT – V**  
**Powder Preparation Techniques:**  
Preparation of  $Al_2O_3$ ,  $ZrO_2$ ,  $SiC$ ,  $Si_3N_4$  BN &  $B_4C$  Powder by various Techniques.

**UNIT – VI**  
**Powder Preparation Techniques:** Sol-gel technology – Precipitation, Co-precipitation – Hydrothermal precipitation.

**UNIT – VII**  
**Ceramic Processing Techniques:** Hot Pressing – Hot Isostatic Pressing - (HIP).

**UNIT – VIII**  
Sintering – Sinter / HIP - Injection moulding - Slip casting - Tape casting - Gel casting - Extrusion

**TEXT BOOKS:**  
1. Introduction to Ceramics – W.D. Kingery et al – John Wiley  
2. FINCER proceedings of workshop on fine ceramics synthesis, properties and applications – T.R. Rammohan et al.

**REFERENCE:**  
1. Hand Book of Fibre-reinforced composite materials - Ed. Lubin.

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IV Year B.Tech. MMT I Semester  
**(MT05458) POWDER METALLURGY**

**UNIT – I**  
**Introduction:** Emergence and importance of powder metallurgy: Comparison of powder metallurgy with other fabrication techniques, its scope and limitations.

**UNIT – II**  
**Characterization and production of powders:** General characteristics of metal powders, particle shape flow rate, apparent density, and specific surface area, particle size distribution.

**UNIT – III**  
**Determination of powder characteristics:** different methods of production of metal powders: influence of manufacturing process on powder characteristics.

**UNIT – IV**  
**Consolidation of Metal Powders:** **Compaction:** Theory of consolidation: Pressure transmission in powders; compressibility and compactibility of powders; Green strength; Hot isostatic pressing; Powder rolling.

**UNIT – V**  
**Consolidation of Metal Powders II: Sintering:** Mechanisms of Sintering; Factors affecting sintering; Activated sintering; Liquid phase sintering; Sintering atmospheres; Properties of sintered parts.

**UNIT – VI**  
**Applications:** Porous parts: Self-lubricating bearings, filters: Dispersion strengthened materials:  $Cu / Al_2O_3$ , Sintered Aluminum Powder.

**UNIT –VII**  
Electrical and Magnetic materials, Tungsten lamp filaments, electrical contacts, welding electrodes.

**UNIT – VIII**  
Soft magnetic materials (Fe, Fe-N); Permanent magnets (Alnico,  $SnCo_5$ ), Cemented carbides; Cermets.

**TEXT BOOK:**  
1. Powder metallurgy – A.K. Sinha

**REFERENCES:**  
1. Introduction to powder metallurgy – J.S. Hirshhorn  
2. Treatise on Powder metallurgy – C. Goetzal Vol 1& II  
3. Powder Metallurgy principles – F.V. Lenei

**(MT05583) X-RAY METALLOGRAPHY****UNIT - I**

Introduction - Production and properties of x-rays. Stereographic projection Bragg's law of diffraction. Diffraction directions and diffraction methods.

**UNIT - II**

Intensity of Diffracted beams - Scattering by an electron by an atom, by a unit cell, structure-factor calculations: factors to be considered in calculating the intensities.

**UNIT - III**

Experimental Methods - Laue Photographs: Powder photographic methods, Debye-Scherrer methods, focussing cameras, pinhole photographs: Diffractometer measurements.

**UNIT - IV**

Applications - Orientation of single crystals, Laue method, Diffractometer method, effect of plastic deformation, the structure of polycrystalline Aggregates, crystal size crystal perfection, crystal orientations:

**UNIT-V**

Determination of crystal structure, precise lattice parameter measurements.

**UNIT - VI**

Applications - phase - diagram determination.

**UNIT-VII**

Order-disorder transformation: chemical analysis by Diffraction.

**UNIT-VIII**

Qualitative analysis, quantitative analysis, stress measurement.

**TEXT BOOK:**

1. Elements of X-ray diffraction by BD Cullity

**REFERENCES:**

1. Structure of Metals - GS Barrett and TB Masalski. 2nd Edition.
2. X-ray diffraction methods - EW Nuffield.

**(MT05514) SEMI CONDUCTORS AND MAGNETIC MATERIALS****(ELECTIVE-I)****UNIT-I**

Review of electron theory of metals; Electrical and thermal conductivity – Classical approach and quantum mechanical considerations; Resistivity of pure metals and alloys; and ordered alloys; thermoelectric phenomena.

**UNIT-II**

Semiconductors: Band structures, intrinsic semiconductors, extrinsic semiconductors; Hall effect; Elemental and compound Semiconductors and their application; Super conductivity; super conducting materials; Structure and application.

**UNIT-III**

Ferromagnetism: Ferromagnetic domains; Hysteresis loops, magnetostriction and magnetoelectricity; origin of Hysteresis due to domain wall movement; soft magnetic alloys.

**UNIT-IV**

Factors determining the permeability of metals and alloys: Effect of fundamental properties on permeability, Ni-Fe alloys, Fe-Co alloys, high permeability of iron and ferritic iron, Si – Fe alloys and Cu – Ni alloys.

**UNIT-V**

Amorphous ferromagnetic alloys and Ferro fluids: Preparation and structure of amorphous ferromagnetic and its application; Ferro fluids;

**UNIT-VI**

Ferri magnetic material; Spiral structure; Theory of ferrimagnets; magnetic structures of ferrites; permeability of ferrites; stress-induced anisotropy in ferrites; Applications of soft ferrites.

**UNIT-VII**

Permanent magnetic materials: Energy product of a permanent magnet material; Behavior of permanent magnets under dynamic or recoil conditions; Alnicos; Fe-Cr-Co alloys.

**UNIT-VIII**

Cu-Ni-Fe and Cu-Ni-Co alloys; Fe-Co-Mo alloys, Pt-Co alloys; Permanent magnets based on the intermetallic compound  $\text{Sm}_2\text{Ca}_2$  Coercivity mechanisms; Applications of permanent magnetic; Temperature dependence of magnetic properties of permanent magnets;

**TEXT BOOKS:**

1. R.E. Hummel: Electronic Properties of materials.
2. R.A. Macurie: Ferromagnetic Materials structure and properties.

**REFERENCE:**

1. An Introduction to Materials science-H.L.Mancini.

**(MT05428) NON-DESTRUCTIVE TESTING  
(ELECTIVE-I)**

**UNIT-I**  
INTRODUCTION: VISUAL METHODS: Optical aids, In-situ metallography, Optical holographic methods, Dynamic inspection.

**UNIT-II**  
PENETRANT FLAW DETECTION: Principles: Process: Penetrant systems: Liquid-penetrant materials: Emulsifiers: cleaners developers: sensitivity: Advantages: Limitations: Applications.

**UNIT-III**  
RADIOGRAPHIC METHODS: Limitations: Principles of radiography: sources of radiation, Ionising radiation - X-rays sources, gamma-rays sources Recording of radiation: Radiographic sensitivity: Fluoroscopic methods: special techniques: Radiation safety.

**UNIT-IV**  
ULTRASONIC TESTING OF MATERIALS: Advantages, disadvantages, Applications, Generation of: Ultrasonic waves, general characteristics of ultrasonic waves: methods and instruments for ultrasonic materials testing: special techniques.

**UNIT-V**  
MAGNETIC METHODS: Advantages, Limitations, Methods of generating fields: magnetic particles and suspending liquids Magnetography, field sensitive probes: applications. Measurement of metal properties.

**UNIT-VI**  
ELECTRICAL METHODS: Eddy current methods: potential-drop methods, applications.

**UNIT-VII**  
ELECTROMAGNETIC TESTING: Magnetism: Magnetic domains: Magnetization curves: Magnetic Hysteresis: Hysteresis-loop tests: comparator - bridge tests Absolute single-coil system: applications.

**UNIT-VIII**  
OTHER METHODS: Acoustic Emission methods: Acoustic methods: Leak detection: Thermal inspection.

**TEXT BOOK:**  
1. Non-Destructive Testing by P. Halmshaw

**REFERENCE:**  
1. Metals Handbook Vol.II, Nondestructive inspection and quality control

**(ME05427) NON-CONVENTIONAL SOURCES OF ENERGY  
(ELECTIVE-I)**

**UNIT - I**  
PRINCIPLES OF SOLAR RADIATION: Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power - Physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, Solar radiation on tilted surface, Instruments for measuring solar radiation and sun shine, solar radiation data.

**UNIT - II**  
SOLAR ENERGY COLLECTION: Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

**UNIT - III**  
SOLAR ENERGY STORAGE AND APPLICATIONS: Different methods, sensible, latent heat and stratified storage, solar ponds. Solar applications - solar heating/cooling techniques, solar distillation and drying, Photovoltaic energy conversion.

**UNIT - IV**  
WIND ENERGY: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria

**UNIT - V**  
BIO-MASS: Principles of Bio-Conversion, Anaerobic /aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C. Engine operation, and economic aspects.

**UNIT - VI**  
GEOTHERMAL ENERGY: Resources, types of wells, methods of harnessing the energy potential in India.

**UNIT - VII**  
OCEAN ENERGY – OTEC: Principles, utilization, setting of OTEC plants, thermodynamic cycles. Tidal and Wave energy: Potential and conversion techniques, mini-hydel power plants, their economics.

**UNIT – VIII**  
DIRECT ENERGY CONVERSION: Need for DEC, Carnot cycle, limitations, Principles of DEC. Thermo-electric generators, Seebeck, Peltier and Joule Thompson effects, figure of merit, materials, applications, MHD generators, principles, dissociation and ionization, hall effect, magnetic flux, MHD accelerator, MHD engine, power generation systems, electron gas dynamic conversion, economic aspects. Fuel cells, principle, faraday's laws, thermodynamic aspects, selection of fuels and operating conditions.

- TEXT BOOKS:**
1. Renewable Energy Resources / Tiwari and Ghosal / Narosa
  2. Non-conventional Energy Sources / G.D. Rai

- REFERENCES:**
1. Renewable Energy Sources / Twidell & Weir
  2. Solar Energy / Sukhatme
  3. Solar Power Engineering / B.S. Magal Frank Kreith & J.F. Kreith
  4. Principles of Solar Energy / Frank Kreith & John F Kreider
  5. Non-Conventional Energy / Ashok V Desai / Wiley Eastern
  6. Non-Conventional Energy Systems / K Mittal / Wheeler
  7. Renewable Energy Technologies / Ramesh & Kumar / Narosa
  8. Energy Technology – S Rao and B B Parulakar

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**(CS05137) COMPUTER GRAPHICS**  
(ELECTIVE-I)

**UNIT-I**  
Introduction, Application areas of Computer Graphics, overview of graphics systems, video-display devices, and raster-scan systems, random scan systems, graphics monitors and workstations and input devices (p.nos 22-90 of text book-1).

**UNIT-II**  
Output primitives: Points and lines, line drawing algorithms, mid-point circle and ellipse algorithms, Filled area primitives: Scan line polygon fill algorithm, boundary-fill and flood-fill algorithms (p.nos 103-123, 137-145, 147-150, 164-171 of text book-1, p.nos. 72-99 of text book-2).

**UNIT-III**  
2-D geometrical transforms: Translation, scaling, rotation, reflection and shear transformations, matrix representations and homogeneous coordinates, composite transforms, transformations between coordinate systems (p.nos 204-227 of text book-1).

**UNIT-IV**  
2-D viewing: The viewing pipeline, viewing coordinate reference frame, window to view-port coordinate transformation, viewing functions, Cohen-Sutherland and Cyrus-beck line clipping algorithms, Sutherland –Hodgeman polygon clipping algorithm (p.nos 237-249, 257-261 of text book -1, p.nos. 111-126 of text book-2).

**UNIT-V**  
3-D object representation: Polygon surfaces, quadric surfaces, spline representation, Hermite curve, Bezier curve and B-Spline curves, Bezier and B-Spline surfaces. Basic illumination models, polygon-rendering methods. (p.nos 324-331, 340-342, 347-364, 516-531, 542-546 of text book-1, p.nos 473-529, 721-739 of text book-2).

**UNIT-VI**  
3-D Geometric transformations: Translation, rotation, scaling, reflection and shear transformations, composite transformations.  
3-D viewing: Viewing pipeline, viewing coordinates, view volume and general projection transforms and clipping (p.nos 427-443, 452-481 of text book -1).

**UNIT-VII**  
Visible surface detection methods: Classification, back-face detection, depth-buffer, scan-line, depth sorting, BSP-tree methods, area sub-division and occtree methods(p.nos 489-505 of text book -1, Chapter 15 of of text book-2).

**UNIT-VIII:**

Computer animation: Design of animation sequence, general computer animation functions, raster animation, computer animation languages, key frame systems, motion specifications. ( p.nos 604-616 of text book -1, chapter 21 of text book-2)

**TEXT BOOKS:**

1. "Computer Graphics C version", Donald Hearn and M.Pauline Baker, Pearson Education
2. "Computer Graphics Principles & practice", second edition in C, Foley, VanDam, Feiner and Hughes, Pearson Education.

**REFERENCES:**

1. "Computer Graphics", second Edition, Donald Hearn and M.Pauline Baker, PHI/Pearson Education.
2. "Computer Graphics Second edition", Zhigand xiang, Roy Plastock, Schaum's outlines, Tata Mc-Graw hill edition.
3. Procedural elements for Computer Graphics, David F Rogers, Tata Mc Graw hill, 2<sup>nd</sup> edition.
4. "Principles of Interactive Computer Graphics", Neuman and Sproul, TMH.
5. Principles of Computer Graphics, Shalini Govil, Pai, 2005, Springer.
6. Computer Graphics, Steven Harrington, TMH.

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**(ME05108) CAD/CAM**

(ELECTIVE-II)

**UNIT – I**

Computers in Industrial Manufacturing, Product cycle, CAD / CAM Hardware, Basic structure, CPU, Memory types, input devices, display devices, hard copy devices, storage devices.

**UNIT – II**

Computer Graphics: Raster scans graphics coordinate system, database structure for graphics modeling, transformation of geometry, 3D transformations, mathematics of projections, clipping, hidden surface removal.

**UNIT – III**

Geometric modeling: Requirements, geometric models, geometric construction models, curve representation methods, surface representation methods, modeling facilities desired.

**UNIT – IV**

Drafting and Modeling systems: Basic geometric commands, layers, display control commands, editing, dimensioning, solid modeling, constraint based modeling.

**UNIT – V**

Numerical control: NC, NC modes, NC elements, NC machine tools, structure of CNC machine tools, features of Machining center, turning center, CNC Part Programming: fundamentals, manual part programming methods, Computer Aided Part Programming.

**UNIT – VI**

Group Tech: Part family, coding and classification, production flow analysis, advantages and limitations, Computer Aided Processes Planning, Retrieval type and Generative type.

**UNIT – VII**

Material requirement planning, manufacturing resources planning, DNC, AGV, ASRS, Flexible manufacturing systems – FMS equipment, system layouts, FMS control.



**UNIT – VIII**

CIM: Integration, CIM implementation, major functions in CIM, Benefits of CIM, Lean manufacturing, Just-in-time.

**TEXT BOOK:**

1. CAD / CAM Principles and Applications – 2<sup>nd</sup> edition, P.N. Rao, Tata Mc. Graw Hill

**REFERENCES:**

1. CAD / CAM Theory and Practice / Ibrahim Zeid / TMH
2. CAD / CAM / CIM / Radhakrishnan and Subramanian / New Age
3. Principles of Computer Aided Design and Manufacturing / Farid Amirouche / Pearson
4. Computer Numerical Control Concepts and programming / Warren S Seames / Thomson.

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4+1 0 4**(MT05341) LIGHT METALS AND ALLOYS****(ELECTIVE-II)****UNIT-I**

Aluminum and its alloys: Extraction – Properties – Applications .

**UNIT-II**

Wrought and Casting Alloys (Al-Cu, Al-Mn, Al-Si, Al-Mg, Al-Si-Mg, Al-Zn, Al-Li) – Corrosion resistance of Al alloys.

**UNIT – III**

Properties of light metals - Extraction of Beryllium.

**UNIT-IV**

Extraction of Ti – Properties – Applications.

**UNIT – V**

Titanium and its alloys.

**UNIT-VI**

Magnesium – Classification – Casting alloys – Wrought alloys-properties and applications of Mg alloys.

**UNIT-VII**

Zinc and its alloys.

**UNIT-VIII**

Zirconium and its alloys.

**TEXT BOOK:**

1. Materials in Industry - W. J. Patton

**REFERENCES :**

1. Introduction to Physical Metallurgy – S.H. Avner
2. Engineering Physical Metallurgy – Lakhin
3. ASM Metals Handbook Vol-1 & 2

**(MT05389) METALLURGICAL INSTRUMENTATION**  
(ELECTIVE-II)**UNIT – I**

**HIGH TEMPERATURE INSTRUMENTATION:** Methods of obtaining high temperatures – resistance furnace calculation of wire size and length, oil metal and salt baths furnace for temperatures above 1000<sup>o</sup>C, Refractories for laboratory furnace and other methods of heating.

**UNIT – II**

Temperature measuring instruments like thermal expansion thermometers, thermocouples, pyrometric millivoltmeters, potentiometers, and Resistance thermometers, Radiation Pyrometers.

**UNIT – III**

Automatic control of temperature – control of furnace power, position controllers, on-off control, proportion controls anticipating devices, proportional plus derivative control Temperature programming.

**UNIT – IV**

Vacuum instrumentation: Pumps and systems like Rotary mechanical pumps, Roots pump, Gaddae molecular pump, vapor pumps, getter-ion pumps, and choice of pumps.

**UNIT – V**

Measuring gauges for low pressures – Discharge tubes, Melody gauge, Heat conductivity, manometers, ionization vacuum gauges. Beyard-Alpert gauge, leak detection.

**UNIT – VI**

Instrumentation for calorimetry: Instruments used for the measurement of enthalpy, specific heat, heat measurement, pulse method for specific heat, liquid metal solution calorimeter.

**UNIT – VII**

Electrical instrumentation: Measuring instruments – potentiometers, Bridges, DC voltmeters and Ammeters

**UNIT – VIII**

Automation in measurements of internal friction and elastic modulus: Automatic counters for torsional pendulum, precise frequency measurement in torsional pendulum, Automatic measurement of  $Q^{-1}$  activation energy measurement, Measurement of concentration in solid solutions, studies of the viscous behavior of grain boundaries

**TEXT BOOK:**

1. Experimental techniques in metallurgy-Cherapin & malik

**(MT05560) TRANSPORT PHENOMENA IN METALLURGY**  
(ELECTIVE-II)**UNIT – I**

Fick's law of Diffusion, Diffusion Coefficients for gases, Gas diffusion- Equimolar counter diffusion of two gas components.

**UNIT – II**

Diffusion of one ideal gaseous component through a second stagnant ideal gas composed of ideal gas, liquid diffusion, diffusion in solids.

**UNIT – III**

Diffusion in turbulent flow, similarity between heat and mass transfer for several engineering systems- fluids flowing in turbulent motion through pipes.

**UNIT – IV**

Gases flowing at right angles to cylinders, gases flowing parallel to flat plates, heat and mass transfer in free convection, humidification.

**UNIT – V**

Newton's law of viscosity, Non-Newtonian fluids, theory of viscosity of gases at low density, theory of viscosity of liquids.

**UNIT – VI**

Velocity distributions in laminar flow-shell momentum balances, flow of a falling film, flow through a circular tube.

**UNIT –VII**

The equations of change for isothermal systems-equation of continuity equation of motion, velocity distributions in turbulent flow-fluctuations and time-smoothed quantities, time-smoothing of the equations for change of an incompressible fluid.

**UNIT – VIII**

Macroscopic balances for isothermal systems-Macroscopic mass balance, macroscopic momentum balances.

**TEXT BOOKS:**

1. Elements of Heat Transfer-M. Jakob and GA Hawkins.
2. Transport Phenomena. -RB Bird, WE Steward and EN Light Foot

**(MT05204) ELECTRO METALLURGY & CORROSION LAB****LIST OF EXPERIMENTS:**

1. Electroplating of copper on brass and to study the influence of current density on current efficiency.
2. Electroplating of Nickel using watt's bath and to study the influence of current density on current efficiency.
3. To anodise the given aluminium sample and to colour with a dye and to measure the thickness of the oxide film.
4. To determine the throwing power of electroplating bath.
5. Electroplating of chromium on mild steel and to study the influence of current density on current efficiency.
6. To understand the principles in galvanic cell corrosion using "Ferroxyll" indicating test solution.
7. To study the effect of inhibitors on corrosion of mild steel in an acidic solution.
8. To construct pourbaix diagrams using electro chemical thermodynamic data.
9. To study the pitting corrosion of aluminium, stainless steel in suitable environments.
10. To conduct electropolishing of stainless steel using Nitric acid batch.
11. To conduct electrodeless plating of tin on glass.
12. To conduct electroforming on hard plastics.

**(MT05388) METALLURGICAL COMPUTATIONS LAB****LIST OF EXPERIMENTS:**

1. Simulation of Phase diagram
2. Programming to solve the problems on conduction, convection and radiation
3. Computing heat and mass calculations of chemical reactions
4. Programming to test a thermodynamically feasible process
5. Determination of Crystal structures using computer principles
6. Simulation of Gating and Riserling
7. Computer plotting of Sieve analysis data
8. Computer programs to determine charge input to get the required output of product in a blast furnace.

**TEXT BOOKS:**

1. Computer oriented Numerical methods – V. Rajaraman (PHI Publications)
2. Computer programming and Numerical methods – S. Saran

**REFERENCES**

1. Numerical methods in engineering – Mario G. Salvadori and Melvin L. Baron  
Matrix operation on Computer – L.L. Brinud (LCUE Publication)

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**(MT05131) COMPOSITE MATERIALS**

**UNIT -I**

**INTRODUCTION:** Definition – Classification of Composite materials based on structure – based on matrix.

**UNIT -II**

Advantages of composites – application of composites – functional requirements of reinforcement and matrix.

**UNIT - III**

**FIBERS:** Preparation, properties and applications of glass fibers, carbon fibers, Kevlar fibers and metal fibers – properties and applications of whiskers, particle reinforcements.

**UNIT - IV**

**MANUFACTURING OF ADVANCED COMPOSITES:** Polymer matrix composites: Preparation of Moulding compounds and prepregs – hand lay up method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding.

**UNIT -V**

Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing.

**UNIT -VI**

Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering.

**UNIT -VII**

Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving.

**UNIT - VIII**

**RESPONSE OF COMPOSITES TO STRESS:** (a) Iso Strain condition (b) Iso Stress condition (c) Load friction shared by the fibers.

**TEXT BOOKS:**

1. Material Science and Technology – Vol 13 – Composites by Cahn – VCH, West Germany

2. Composite Materials – K.K.Chawla

**REFERENCE:**

1. Hand Book of reinforced concrete-ed-Lubin

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**(MT05534) SUPER ALLOYS**

(ELECTIVE-III)

**UNIT -I**

**INTRODUCTION:** Introduction to super alloys, Guide to selection of super alloys, Wrought super alloys, Heat Resistant castings.

**UNIT -II**

**PHYSICAL METALLURGY:** Microstructure of wrought Heat-Resisting Alloys, Microstructure of Ni-base & Co-base heat-resistant casting alloys. Temperature and Time-dependent Transformation. Application to Heat Treatment of High Temperature Alloys.

**UNIT -III**

Relationship of properties to Microstructure in super alloys. Fracture properties of super alloys. High temperature corrosion and use of castings for protection.

**UNIT -IV**

Effect of Physical Metallurgy and process variables on the microstructure of wrought super alloys. Process and Metallurgical factors affecting on superalloys and other high temperature materials.

**UNIT - V**

**MELTING PROCESS:** Melting of Super alloys: Principles and practices of vacuum Induction Melting and Vacuum Arc melting.

**UNIT -VI**

**FORMING METHODS:** Forming and Fabrication of super alloys: Recent developments in P/M of super alloys-Production of components by Hot-Isostatic Pressing.

**UNIT -VII**

Casting methods - Improving turbine blade performance by solidification control-The development of single crystal turbine blades.

**UNIT -VIII**

Quality of super alloy castings: Heat Treating of Heat resistant alloys.

**TEXT BOOKS:**

1. Super alloys: Source book: Mathew J. Donachie. Jr. editor : 1984.

2. The super alloys: edited by Chester T. Sins and William C HaageI: 1972.

**REFERENCE**

1. Campbell IE High temperature technology, John wiley and sons Inc.;1956

**(MT05245) FERRO ALLOY TECHNOLOGY**  
(ELECTIVE-III)**UNIT-I**

**Introduction:** Types of Ferro alloys and their uses. Present status of ferroalloy industry in India. Future plans and developments.

**UNIT-II**

**Principles:** Physicochemical aspects of ferroalloys. Production by various methods.

**UNIT-III**

Furnace types and its design, refractories.

**UNIT-IV**

Mechanical equipment, auxiliaries, electric power in to heat. Furnace power supply. Working voltage, power factor and efficiency.

**UNIT-V**

**Production:** Production of ferro-silicon-calcium, ferromanganese (high and low carbon).

**UNIT-VI**

Ferro-chrome(high and low carbon),Ferro-molybdenum.

**UNIT-VII**

Ferro-tungstun,ferro-titanium,ferro-vanadium.

**UNIT-VIII**

**Lay out:** Lay out of a ferro alloy,plant and its production economics.

**TEXT BOOKS:**

1. Riss M. And Khodorovsky V-Production ferroalloys Mir Publishers,Moscow 1967.
2. Symposium on ferro alloys NIML Technical J.Feb 1962.  
World ferrochrome producers:Met bull.

**(CS05518) SIMULATION AND DATA PROCESSING**  
(ELECTIVE-III)**UNIT-I**

Roots of algebraic equations by Bisection method, false position method, Newton Raphsonb method, Secant method and quasi-Newton method.

**UNIT-II**

Solution of simultaneous equations by Gauss elimination method, Gauss Jordan methods Solution of simultaneous equations by Gauss elimination method, Gauss Jordan method, Dolittle (Grouit's methods, Cholesky method). Numerical Integration: Trapezoidal and Simpson's rule. Dolittle (Grouit's methods, Cholesky method). Least square curve fitting: Linear and Polynomial.

**UNIT-III**

Interpolation, extrapolation and Numerical differentiation, Linear, Newton and Lagrange methods. Solution of ordinary differential equations- Rungakutta method, Euler's method.

**UNIT-IV****Metallurgical Engineering Problems:**

- a) Heat and Mass calculations of chemical Reactions.
- b) Heat Transfer

**UNIT-V**

- a) Physical Metallurgy and Heat Treatment.
- b) Thermodynamics.

**UNIT-VI**

- a) Gating and Riserling.
- b) Burden calculations.

**UNIT-VII**

- a) Determination of crystal structure.
- b) Sieve analysis.

**UNIT-VIII**

Simulation of phase diagrams and blast furnace.

**REFERENCES:**

1. Computer oriented Numerical Methods: Rajaraman(PHI Publications)
2. Computer Programming and Numerical Methods: S.Saran.
3. Numerical Methods In Engineering-Mario G.Salvadori & Meloin L.Baron(PHI publications)
4. Matrix operations on the computer –LL Bruid(LCUE publications)

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**(MT05243) EXPERIMENTAL TECHNIQUES IN METALLOGRAPHY**  
(ELECTIVE-III)

**UNIT – I** - Polishing methods; Etching methods; light sources in optical microscopy; Numerical aperture, Resolution, depth of focus.

**UNIT-II** - Objective and eyepiece in optical microscope; lense defects; Optical methods of enhancing contrast dark field illumination; Polarized light phase contrast; Filters.

**UNIT-III** - Wave nature of electrons; Electron wavelengths; Interaction of electron beams with matter; effect of crystal structure; Representation of diffraction patterns- Reciprocal lattice and Reflecting sphere.

**UNIT-IV** - Electron microscope: Electron gun; Electromagnetic lenses and their observations; Resolving power; Depth of field and depth of focus; Fresnel's fringer; Bright and dark field; selected area diffraction; Advantage and disadvantages of electron microscope.

**UNIT-V** - Specimen preparation for the TEM; Replica methods; Preparation of thin foils from bulk specimens; direct formation of thin films.

**UNIT-VI** - Transmission electron microscopy: Brief description of CTM; Consideration of resolution; Topographical studies; Image contrast from stacking faults; Twinning; double diffraction and kikuchi lines.

**UNIT-VII** - Scanning electron microscope; basic principles; resolving power; specimen requirement for SEM; preparatory methods for SEM specimen.

**UNIT-VIII** - Application of SEM: Different types of modes used in SEM and their applications.

**TEXT BOOKS**

1. The Principles of metallography laboratory practices –George L.Khei-Eurasia publishing house(Pvt Ltd)
2. Transmission electron Microscopy of metals –Garet Thomas.-John wiley and sons.

**REFERENCES:**

1. Modern Metallographic Techniques & their application – victor phillips.
2. Physical Metallurgy, Part – I – RW Chao and P. Haasan.
3. Experimental Techniques in Physical Metallurgy – VT Cherepin and AK Mallik.
4. Electron Microscopy in the study of materials –P.J.Grundy.

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**(MT05390) METALLURGICAL PROBLEMS**  
(ELECTIVE-IV)

**UNIT-I**

Stoichiometric calculations. Burden calculations.

**UNIT-II**

Mass balance and Energy balance calculations. Problems based on Principles of thermodynamics

**UNIT-III**

Problems based on Kinetics of Metallurgical Processes

**UNIT-IV**

Problems on Heat Transfer.

**UNIT-V**

Problems on theoretical flame temperature.

**UNIT-VI**

Problems on pyrometallurgy.

**UNIT-VII**

Problems based on Electro Metallurgical processes.

**UNIT-VIII**

Problems of Hydro Metallurgical processes.

**TEXT BOOK**

1. Metallurgical problems-Butts

**REFERENCES :**

1. Non-Ferrous Extractive Metallurgy-Bray.
2. Elements of Heat transfer. -Jakob & Hawkins.

**(ME05436) OPERATIONS RESEARCH**  
(ELECTIVE-IV)**UNIT – I**

Development – Definition – Characteristics and Phases – Types of models – operation Research models – applications.

**ALLOCATION:** Linear Programming Problem Formulation – Graphical solution – Simplex method – Artificial variables techniques -Two-phase method, Big-M method – Duality Principle.

**UNIT – II**

**TRANSPORTATION PROBLEM** – Formulation – Optimal solution, unbalanced transportation problem – Degeneracy. Assignment problem – Formulation – Optimal solution - Variants of Assignment Problem- Traveling Salesman problem.

**SEQUENCING** – Introduction – Flow –Shop sequencing – n jobs through two machines – n jobs through three machines – Job shop sequencing – two jobs through 'm' machines.

**UNIT – III**

**REPLACEMENT:** Introduction – Replacement of items that deteriorate with time – when money value is not counted and counted – Replacement of items that fail completely, group replacement.

**UNIT – IV**

**THEORY OF GAMES:** Introduction – Minimax (maximin) – Criterion and optimal strategy – Solution of games with saddle points – Rectangular games without saddle points – 2 X 2 games – dominance principle – m X 2 & 2 X n games -graphical method.

**UNIT – V**

**WAITING LINES:** Introduction – Single Channel – Poisson arrivals – exponential service times – with infinite population and finite population models– Multichannel – Poisson arrivals – exponential service times with infinite population single channel Poisson arrivals.

**UNIT – VI**

**INVENTORY:** Introduction – Single item – Deterministic models – Purchase inventory models with one price break and multiple price breaks – shortages are not allowed – Stochastic models – demand may be discrete variable or continuous variable – Instantaneous production. Instantaneous demand and continuous demand and no set up cost.

**UNIT – VII**

**DYNAMIC PROGRAMMING:** Introduction – Bellman's Principle of optimality – Applications of dynamic programming- capital budgeting problem – shortest path problem – linear programming problem.

**UNIT – VIII**

**SIMULATION:** Definition – Types of simulation models – phases of simulation – applications of simulation – Inventory and Queuing problems – Advantages and Disadvantages – Simulation Languages.

**TEXT BOOK:**

1. Operations Research / S.D.Sharma-Kedarnath.

**REFERENCES:**

1. Operations Research /A.M.Natarajan,P.Balasubramani,A. Tamilarasi/Pearson Education.
2. Operations Research: Methods and Problems / Maurice Saseini, Arthur Yaspian and Lawrence Friedman
3. Operations Research / R.Pannerseivam,PHI Publications.
4. Operations Research / Wagner/ PHI Publications.
5. Operation Research /J.K.Sharma/MacMillan.
6. Introduction to O.R./Hiller & Libermann (TMH).
7. O.R/Wayne L.Winston/Thomson Brooks/cole
8. Introduction to O.R /Taha/PHI

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**(MT05430) NUCLEAR METALLURGY**  
(ELECTIVE-IV)

**UNIT – I - ELEMENTARY NUCLEAR PHYSICS AND CHEMISTRY:** Structure of nucleus, radioactivity, binding energy; nuclear interaction; fission and fusion; nuclear reaction; energy release and chain reactions; neutron cross-section; multiplication and criticality concepts and factors.

**UNIT – II -** Mechanisms of moderation, radiation detection, radiation effects on fissile and non fissile materials; radiation damage and radiation growth; thermal cycling; protection against radiations.

**UNIT – III - Reactor components:** Types of reactors and classification.

**UNIT – IV -** Materials for nuclear reactors: Considerations in selection and properties of common materials used as fuels, their physical and chemical properties; canning materials; coolants; control rods; reflectors and shielding materials.

**UNIT –V -** Production of reactor materials: Occurrence and general characteristics of nuclear minerals and their production.

**UNIT – VI - Indian resources:** Flow sheets of processing of nuclear minerals for the production of nuclear grade uranium, thorium, beryllium and zirconium with emphasis on basic scientific principles involved; production and enriched uranium and fabrication of fuel elements.

**UNIT – VII -** Processing of irradiated fuel for recovery of Plutonium

**UNIT – VIII -** Nuclear power production in India and its economics.

**TEXT BOOK:**

Wright JC -Metallurgy in Nuclear Power Technology: Iliffe Book Ltd., 1962

**REFERENCES:**

1. Wilkinson WD and Mirphy WF Nuclear Reactor Metallurgy Van Nostrand 1958
2. Symposium on Rare materials: Indian Institute of Metals.
3. Glasstone S and Snesonske A; Principles of Nuclear Reactor Engineering: Macmillan, London.
4. Grainger L Uranium and Thorium: George Newnes Ltd., London.
5. Gurinsky DH and Dienes JL Nuclear Fuels, Macmillan.
6. US Atomic Energy Commission, Reactor Hand book Material Mc. Graw Hill Book Co. 1955
7. Proceedings of the symposium on Nuclear Science and Engineering – Bhabha Atomic Research Centre, Bombay.

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**(MA05476) PROBABILITY AND STATISTICS**  
(ELECTIVE-IV)

**UNIT-I**  
Probability: Sample space and events Probability The axioms of probability - Some elementary theorems - Conditional probability Baye's theorem.

**UNIT-II**  
Random variables Discrete and continuous Distribution Distribution function.

**UNIT-III**  
Distribution - Binomial, poisson and normal distribution related properties.

**UNIT-IV**  
Sampling distribution: Populations and samples - Sampling distributions of mean (known and unknown) proportions, sums and differences.

**UNIT-V**  
Estimation: Point estimation interval estimation - Bayesian estimation.

**UNIT-VI**  
Test of Hypothesis Means and proportions Hypothesis concerning one and two means Type I and Type II errors. One tail, two-tail tests.

**UNIT-VII**  
Tests of significance Student's t-test, F-test, test. Estimation of proportions.

**UNIT VIII**  
Curve fitting: The method of least squares Inferences based on the least squares estimations - Curvilinear regression multiple regressions correlation for univariate and bivariate distributions.

**TEXT BOOKS:**

1. Probability and statistics for engineers:Erwin Miller And John E.Freund. Prentice-Hall of India Pvt. Ltd., Sixth edition.
2. Text book of Probability and Statistics by Dr.Shahnaz Bathul, V.G.S.Publishers 2003.

**REFERENCES:**

1. Probability, Statistics and Random Processes Dr.K.Murugesan & P.Gurusamy by Anuradha Agencies.
2. Advanced Engineering Mathematics (Eighth edition), Erwin Kreyszig, John Wiley and Sons (ASIA) Pvt. Ltd., 2001.
3. Probability and Statistics for Engineers: G.S.S.Bhishma Rao,itech., Second edition 2005.