JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD.

B. TECH. METALLURGY AND MATEIRAL TECHNOLOGY

I YEAR

Code	Subject	L	T/P/D	C
A10001	English	2	-	4
A10002	Mathematics – I	3	1	6
A10302	Engineering Mechanics	3	-	6
A10004	Engineering Physics	3	-	6
A10005	Engineering Chemistry	3	-	6
A10501	Computer Programming	3	-	6
A10301	Engineering Drawing	2	3	6
A10581	Computer Programming Lab.	-	3	4
A10081	Engineering Physics & Engineering Chemistry Lab.	-	3	4
A10083	English Language Communication Skills Lab.	-	3	4
A10082	Engineering Workshop / IT Workshop	-	3	4
	Total	**19**	**16**	**56**

II YEAR I SEMESTER

Code	Subject	L	T/P/D	C
A30006	Mathematics – II	4	-	4
A30205	Electrical Engineering	4	-	4
A30104	Mechanics of Solids	4	-	4
A30505	Object Oriented Programming through JAVA	4	-	4
A31804	Physical Metallurgy	4	-	4
A30307	Thermodynamics and Kinetics	4	-	4
A30583	Java Lab	-	3	2
A31881	Physical Metallurgy Lab	-	3	2
	Total	**24**	**6**	**28**

II YEAR II SEMESTER

Code	Subject	L	T/P/D	C
A40007	Mathematics – III	4	-	4
A40103	Mechanics of Fluids	4	-	4
A40009	Environmental Studies	4	-	4
A41805	Fuels, Furnaces and Refractories	4	-	4
A41806	Metallurgical Thermodynamics	4	-	4
A42504	Mineral Processing	4	-	4
A41881	Fuels, Furnaces and Refractories Lab	-	3	2
A42582	Mineral Processing Lab	-	3	2
	Total	**24**	**6**	**28**

III YEAR I SEMESTER

Code	Subject	L	T/P/D	C
A50419	Basic Electronics	4	-	4
A51811	Non Ferrous Extractive Metallurgy	4	-	4
A51809	Mechanical Metallurgy	4	-	4
A51807	Heat Treatment Technology	4	-	4
A51808	Iron Production	4	-	4
A51810	Metal Joining Technology	4	-	4
A51882	Mechanical Metallurgy Lab	-	3	2
A51883	Heat Treatment Technology Lab	-	3	2
	Total	**24**	**6**	**28**

III YEAR II SEMESTER

Code	Subject	L	T/P/D	C
A60010	Managerial Economics and Financial Analysis	4	-	4
A61812	Mechanical Working of Metals	4	-	4
A62001	Foundry Technology	4	-	4
A61813	Powder Metallurgy	4	-	4
A61814	Steelmaking	4	-	4
	Open Elective :	4	-	4
A60018	Human Values and Professional Ethics			
A60117	Disaster Management			
A60017	Intellectual Property Rights			
A62082	Foundry Technology Lab	-	3	2
A60086	Advanced Communication Skills Lab	-	3	2
	Total	**24**	**6**	**28**

IV YEAR I SEMESTER

Code	Subject	L	T/P/D	C
A70014	Management Science	4	-	4
A71816	Electro Metallurgy and Corrosion	4	-	4
A71818	Material Characterization Techniques	4	-	4
A71821	Non Destructive Testing	4	-	4
	Elective I			
A71815	Ceramic Science and Technology			
A71824	X- Ray Diffraction			
A71817	Light Metals and Alloys			
A70008	Probability & Statistics	4	-	4
	Elective II			
A71823	Semi Conductors and Magnetic Materials			
A71820	Metallurgical Problems			
A71822	Polymeric Materials	4	-	4
A71885	Electro Metallurgy and Corrosion Lab	-	3	2
A71886	Metallurgical Computations Lab	-	3	2
	Total	**24**	**6**	**28**

IV YEAR II SEMESTER

Code	Subject	L	T/P/D	C
	Elective III			
A81825	Advanced Materials			
A81828	Nano Materials			
A81829	Nuclear Metallurgy	4	-	4
	Elective IV			
A81831	Super Alloys			
A81827	Ferro Alloy Technology			
A81830	Selection of Materials for Engineering Applications	4	-	4
A81826	Composite Materials	4	-	4
A80087	Industry Oriented Mini Project	-	-	2
A80089	Seminar	-	6	2
A80088	Project Work	-	15	10
A80090	Comprehensive viva	-	-	2
	Total	**12**	**21**	**28**

Note: All End Examinations (Theory and Practical) are of three hours duration.

T-Tutorial L – Theory P – Practical D-Drawing C – Credits

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

I Year B.Tech. MME	**L**	**T/P/D**	**C**
	2	**-/-/-**	**4**

ENGLISH

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 competencies of Engineering students. The prescribed books and the exercises are meant to serve broadly as students' handbooks.

In the English classes, the focus should be on the skills of reading, writing, listening and speaking and for this the teachers should use the text prescribed for detailed study. For example, the students should be encouraged to read the texts/selected paragraphs silently. The teachers can ask comprehension questions to stimulate discussion and based on the discussions students can be made to write short paragraphs/essays etc.

The text for non-detailed study is for extensive reading/reading for pleasure. Hence, it is suggested that they read it on their own the topics selected for discussion in the class. The time should be utilized for working out the exercises given after each section, as also for supplementing the exercises with authentic materials of a similar kind for example, from newspaper articles, advertisements, promotional material etc*.. However, the stress in this syllabus is on skill development, fostering ideas and practice of language skills.*

Objectives:

- To improve the language proficiency of the students in English with emphasis on LSRW skills.
- To equip the students to study academic subjects more effectively using the theoretical and practical components of the English syllabus.
- To develop the study skills and communication skills in formal and informal situations.

SYLLABUS:

Listening Skills:

Objectives

1. To enable students to develop their listening skill so that they may appreciate its role in the LSRW skills approach to language and improve their pronunciation
2. To equip students with necessary training in listening so that they can comprehend the speech of people of different backgrounds and regions

Students should be given practice in listening to the sounds of the language to be able to recognise them, to distinguish between them to mark stress and recognise and use the right intonation in sentences.

- Listening for general content
- Listening to fill up information
- Intensive listening
- Listening for specific information

Speaking Skills:

Objectives

1. To make students aware of the role of speaking in English and its contribution to their success.
2. To enable students to express themselves fluently and appropriately in social and professional contexts.

- Oral practice
- Describing objects/situations/people
- Role play – Individual/Group activities (Using exercises from the five units of the prescribed text: ***Skills Annexe - Functional English for Success)***
- Just A Minute(JAM) Sessions.

Reading Skills:

Objectives

1. To develop an awareness in the students about the significance of silent reading and comprehension.
2. To develop the ability of students to guess the meanings of words from context and grasp the overall message of the text, draw inferences etc.

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

NOTE : *The students will be trained in reading skills using the prescribed text for detailed study. They will be examined in reading and answering questions using 'unseen' passages which may be taken from authentic texts, such as magazines/newspaper articles.*

Writing Skills :

Objectives

1. To develop an awareness in the students about writing as an exact and formal skill
2. To equip them with the components of different forms of writing, beginning with the lower order ones.

- Writing sentences
- Use of appropriate vocabulary
- Paragraph writing
- Coherence and cohesiveness
- Narration / description
- Note Making
- Formal and informal letter writing
- Describing graphs using expressions of comparison

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 **Five Units**, are prescribed:

For Detailed study: **First Textbook: *"Skills Annexe -Functional English for Success***", Published by Orient Black Swan, Hyderabad

For Non-detailed study

1. **Second text book *"Epitome of Wisdom",*** Published by Maruthi Publications, Guntur

The course content and study material is divided into **Five Units.**

Unit –I:

1. Chapter entitled '***Wit and Humour***' from '**Skills Annexe' -Functional English for Success**, Published by Orient Black Swan, Hyderabad
2. Chapter entitled **'*Mokshagundam Visvesvaraya'*** from ***"Epitome of Wisdom",*** Published by Maruthi Publications, Hyderabad.

L-Listening For Sounds, Stress and Intonation
S-Greeting and Taking Leave, Introducing Oneself and Others (Formal and Informal Situations)
R- Reading for Subject/ Theme
W- Writing Paragraphs
G-Types of Nouns and Pronouns
V- Homonyms, homophones synonyms, antonyms

Unit –II

1. Chapter entitled "***Cyber Age"*** from "***Skills Annexe -Functional English for Success***" Published by Orient Black Swan, Hyderabad.
2 Chapter entitled **'*Three Days To See'*** from ***"Epitome of Wisdom",*** Published by Maruthi Publications, Hyderabad.
L – Listening for themes and facts
S – Apologizing, interrupting, requesting and making polite conversation
R- for theme and gist
W- Describing people, places, objects, events
G- Verb forms
V- noun, verb, adjective and adverb

Unit –III

1. Chapter entitled **'*Risk Management'*** from **"*Skills Annexe -Functional English for Success*"** Published by Orient Black Swan, Hyderabad
2. Chapter entitled **'*Leela's Friend'*** by R.K. Narayan from ***"Epitome of Wisdom",*** Published by Maruthi Publications, Hyderabad

L – for main points and sub-points for note taking
S – giving instructions and directions; Speaking of hypothetical situations
R – reading for details
W – note-making, information transfer, punctuation
G – present tense

V – synonyms and antonyms

Unit –IV

1. Chapter entitled '***Human Values and Professional Ethics'*** from "***Skills Annexe -Functional English for Success"*** Published by Orient Black Swan, Hyderabad
2. Chapter entitled ***'The Last Leaf'*** from ***"Epitome of Wisdom",*** Published by Maruthi Publications, Hyderabad

L -Listening for specific details and information
S- narrating, expressing opinions and telephone interactions
R -Reading for specific details and information
W- Writing formal letters and CVs
G- Past and future tenses
V- Vocabulary - idioms and Phrasal verbs

Unit –V

1. Chapter entitled '***Sports and Health'*** from ***"Skills Annexe -Functional English for Success***" Published by Orient Black Swan, Hyderabad
2. Chapter entitled ***'The Convocation Speech'*** by N.R. Narayanmurthy' from ***"Epitome of Wisdom",*** Published by Maruthi Publications, Hyderabad

L- Critical Listening and Listening for speaker's tone/ attitude
S- Group discussion and Making presentations
R- Critical reading, reading for reference
W-Project proposals; Technical reports, Project Reports and Research Papers
G- Adjectives, prepositions and concord
V- Collocations and Technical vocabulary
Using words appropriately
* Exercises from the texts not prescribed shall also be used for classroom tasks.

REFERENCES :

1. Contemporary English Grammar Structures and Composition by David Green, MacMillan Publishers, New Delhi. 2010.
2. Innovate with English: A Course in English for Engineering Students, edited by T Samson, Foundation Books.
3. English Grammar Practice, Raj N Bakshi, Orient Longman.
4. Technical Communication by Daniel Riordan. 2011. Cengage Publications. New Delhi.
5. Effective English, edited by E Suresh Kumar, A RamaKrishna Rao**,** P Sreehari, Published by Pearson
6. Handbook of English Grammar& Usage, Mark Lester and Larry Beason, Tata Mc Graw –Hill.
7. Spoken English, R.K. Bansal & JB Harrison, Orient Longman.
8. Technical Communication, Meenakshi Raman, Oxford University Press
9. Objective English Edgar Thorpe & Showick Thorpe, Pearson Education
10. Grammar Games, Renuvolcuri Mario, Cambridge University Press.
11. Murphy's English Grammar with CD, Murphy, Cambridge University Press.
12. Everyday Dialogues in English, Robert J. Dixson, Prentice Hall India Pvt Ltd.,
13. ABC of Common Errors Nigel D Turton, Mac Millan Publishers.
14. Basic Vocabulary Edgar Thorpe & Showick Thorpe, Pearson Education
15. Effective Technical Communication, M Ashraf Rizvi, Tata Mc Graw –Hill.
16. An Interactive Grammar of Modern English, Shivendra K. Verma and Hemlatha Nagarajan , Frank Bros & CO
17. A Communicative Grammar of English, Geoffrey Leech, Jan Svartvik, Pearson Education
18. Enrich your English, Thakur K B P Sinha, Vijay Nicole Imprints Pvt Ltd.,
19. A Grammar Book for You And I, C. Edward Good, MacMillan Publishers

Outcomes:

- Usage of English Language, written and spoken.
- Enrichment of comprehension and fluency
- Gaining confidence in using language in verbal situations.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

I Year B.Tech. MME	**L**	**T/P/D**	**C**
	3	**1-/-/-**	**6**

MATHEMATICS -I

Objectives: To learn

- The types of Matrices and their properties
- Concept of rank of a matrix and applying the concept of rank to know the consistency of linear equations and to find all possible solutions, if exist.
- The concept of eigenvalues and eigenvectors of a matrix is to reduce a quadratic form into a canonical form through a linear transformation.
- The mean value theorems and to understand the concepts geometrically
- The functions of several variables and optimization of these functions.
- The evaluation of improper integrals, Beta and Gamma functions
- Multiple integration and its applications.
- Methods of Solving the differential equations of 1^{st} and higher order
- The applications of the differential equations to Newton's law of cooling, Natural growth and decay, Bending of beams etc
- The definition of integral transforms and Laplace Transform
- Properties of Laplace transform
- Inverse Laplace Transform
- Convolution theorem
- Solution of Differential equations using Laplace transform

UNIT-I

Theory of Matrices: Real matrices – Symmetric, skew – symmetric, orthogonal. Complex matrices: Hermitian, Skew-Hermitian and Unitary Matrices. Idempotent matrix,

Elementary row and column transformations- Elementary matrix, Finding rank of a matrix by reducing to Echelon and normal forms. Finding the inverse of a non-singular square matrix using row/ column transformations (Gauss- Jordan method). Consistency of system of linear equations (homogeneous and non- homogeneous) using the rank of a matrix. Solving *m* x *n and n* x *n l*inear system of equations by Gauss elimination.

Cayley-Hamilton Theorem (without proof) – Verification. Finding inverse of a matrix and powers of a matrix by Cayley-Hamilton theorem, Linear dependence and Independence of Vectors. Linear Transformation – Orthogonal Transformation. Eigen values and eigen vectors of a matrix. Properties of eigen values and eigen vectors of real and complex matrices. Finding linearly independent eigen vectors of a matrix when the eigen values of the matrix are repeated.

Diagonalization of matrix – Quadratic forms up to three variables. Rank – Positive definite, negative definite, semi definite, index, signature of quadratic forms. Reduction of a quadratic form to canonical form.

UNIT – II

Differential calculus methods. Rolle's Mean value Theorem – Lagrange's Mean Value Theorem – Cauchy's mean value Theorem – (all theorems without proof but with geometrical interpretations), verification of the Theorems and testing the applicability of these theorem to the given function.

Functions of several variables: Functional dependence- Jacobian- Maxima and Minima of functions of two variables without constraints and with constraints-Method of Lagrange multipliers.

UNIT – III

Improper integration, Multiple integration & applications: Gamma and Beta Functions –Relation between them, their properties – evaluation of improper integrals using Gamma / Beta functions

Multiple integrals – double and triple integrals – change of order of integration- change of variables (polar, cylindrical and spherical) Finding the area of a region using double integration and volume of a region using triple integration.

UNIT – IV

Differential equations and applications Overview of differential equations- exact, linear and Bernoulli (NOT TO BE EXAMINED). Applications of first order differential equations – Newton's Law of cooling, Law of natural growth and decay, orthogonal trajectories.

Linear differential equations of second and higher order with constant coefficients, Non-homogeneous term of the type $f(X) = e^{ax}$, Sin ax, Cos ax, and x^n, $e^{ax}V(x)$, $x^n V(x)$, method of variation of parameters. Applications to bending of beams, Electrical circuits and simple harmonic motion.

UNIT – V

Laplace transform and its applications to Ordinary differential equations Definition of Integral transform, Domain of the function and Kernel for the Laplace transforms. Existence of Laplace transform. Laplace transform of standard functions, first shifting Theorem, Laplace transform of functions when they are multiplied or divided by "t". Laplace transforms of derivatives and integrals of functions. – Unit step function – second shifting theorem – Dirac's delta function, Periodic function – Inverse Laplace transform by Partial fractions(Heaviside method) Inverse Laplace transforms of functions when they are multiplied or divided by "s", Inverse Laplace Transforms of derivatives and integrals of functions, Convolution theorem –- Solving ordinary differential equations by Laplace transforms.

TEXT BOOKS:

1. Advanced engineering Mathematics by Kreyszig, John Wiley & Sons Publishers.
2. Higher Engineering Mathematics by B.S. Grewal, Khanna Publishers.

REFERENCES:

1. Advanced Engineering Mathematics by R.K. Jain & S.R.K. Iyengar, 3rd edition, Narosa Publishing House, Delhi.
2. Engineering Mathematics – I by T.K. V. Iyengar, B. Krishna Gandhi & Others, S. Chand.
3. Engineering Mathematics – I by D. S. Chandrasekhar, Prison Books Pvt. Ltd.
4. Engineering Mathematics – I by G. Shanker Rao & Others I.K. International Publications.
5. Advanced Engineering Mathematics with MATLAB, Dean G. Duffy, 3rd Edi, CRC Press Taylor & Francis Group.
6. Mathematics for Engineers and Scientists, Alan Jeffrey, 6ht Edi, 2013, Chapman & Hall/ CRC
7. Advanced Engineering Mathematics, Michael Greenberg, Second Edition. Pearson Education.

Outcome:

- After learning the contents of this Unit the student is able to write the matrix representation of a set of linear equations and to analyze solutions of system of equations.
- The student will be able to understand the methods of differential calculus to optimize single and multivariable functions.
- The student is able to evaluate the multiple integrals and can apply the concepts to find the Areas, Volumes, Moment of Inertia etc., of regions on a plane or in space.
- The student is able to identify the type of differential equation and uses the right method to solve the differential equation. Also able to apply the theory of differential equations to the real world problems.
- The student is able to solve certain differential equations using Laplace Transform. Also able to transform functions on time domain to frequency domain using Laplace transforms.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

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ENGINEERING MECHANICS

UNIT – I

Introduction to Engineering Mechanics – Basic Concepts. **Resultants of Force System:** Parallelogram law **–**Forces and components- Resultant of coplanar Concurrent Forces – Components of forces in Space – Moment of Force - principle of moments – Coplanar Applications – Couples - Resultant of any Force System.

Equilibrium of Force Systems : Free Body Diagrams, Equations of Equilibrium - Equilibrium of planar Systems - Equilibrium of Spatial Systems.

UNIT – II

FRICTION: Introduction **–** Theory of Friction – Angle of friction - Laws of Friction – Static and Dynamic Frictions – Motion of Bodies: Wedge, Screw, Screw-jack, and Differential Screw-jack.

Transmission of Power: Flat Belt Drives - Types of Flat Belt Drives – Length of Belt, tensions, Tight side, Slack Side, Initial and Centrifugal – Power Transmitted and Condition for Max. Power.

UNIT – III

Centroids and Centers of Gravity: Introduction – Centroids and Centre of gravity of simple figures (from basic principles) – Centroids of Composite Figures - Theorem of Pappus – Center of gravity of bodies and centroids of volumes.

Moments of Inertia : Definition – Polar Moment of Inertia –Radius of gyration - Transfer formula for moment of inertia - Moments of Inertia for Composite areas - Products of Inertia, Transfer Formula for Product of Inertia.

Mass Moment of Inertia : Moment of Inertia of Masses- Transfer Formula for Mass Moments of Inertia - mass moment of inertia of composite bodies.

UNIT – IV

Kinematics of a Particle: Motion of a particle – Rectilinear motion – motion curves – Rectangular components of curvilinear motion– Kinematics of Rigid Body - Types of rigid body motion -Angular motion - Fixed Axis Rotation

Kinetics of particles: Translation -Analysis as a Particle and Analysis as a Rigid Body in Translation – Equations of plane motion - Angular motion - Fixed Axis Rotation – Rolling Bodies.

UNIT – V

Work – Energy Method: Work energy Equations for Translation - Work-Energy Applications to Particle Motion – Work energy applied to Connected Systems - Work energy applied to Fixed Axis Rotation and Plane Motion. Impulse and momentum.

Mechanical Vibrations : Definitions and Concepts – Simple Harmonic Motion – Free vibrations, simple and Compound Pendulums – Torsion Pendulum – Free vibrations without damping: General cases.

TEXT BOOKS:

1. Engineering Mechanics - Statics and Dynamics by Ferdinand.L. Singer / Harper International Edition.
2. Engineering Mechanics/ S. Timoshenko and D.H. Young, Mc Graw Hill Book Compan.

REFERENCES:

1. Engineering Mechanics / Irving Shames / Prentice Hall
2. A text of Engineering Mechanics /YVD Rao/ K. Govinda Rajulu/ M. Manzoor Hussain, Academic Publishing Company
3. Engg. Mechanics / M.V. Seshagiri Rao & D Rama Durgaiah/ Universities Press
4. Engineering Mechanics, Umesh Regl / Tayal.
5. Engg. Mechanics / KL Kumar / Tata McGraw Hill.
6. Engg. Mechanics / S.S. Bhavikati & K.G. Rajasekharappa

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

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ENGINEERING PHYSICS

Objectives:

It gives

- to the students basic understanding of bonding in solids, crystal structures and technique to characterize crystals
- to understand the behavior of electron in a solid and thereby one can determine the conductivity and specific heat values of the solids
- to study applications in Engineering like memory devices, transformer core and Electromagnetic machinery
- to help the student to design powerful light sources for various Engineering Applications and also enable them to develop communication systems using Fiber Technology
- to understand the working of Electronic devices, how to design acoustic proof halls and understand the behavior of the materials at Nano scale

UNIT-I

Crystallography: Ionic Bond, Covalent Bond, Metallic Bond, Hydrogen Bond, Vander-Waal's Bond, Calculation of Cohesive Energy of diatomic molecule- Space Lattice**,** Unit Cell, Lattice Parameters, Crystal Systems, Bravais Lattices, Atomic Radius, Co-ordination Number and Packing Factor of SC, BCC, FCC, Miller Indices, Crystal Planes and Directions, Inter Planar Spacing of Orthogonal Crystal Systems, Structure of Diamond and NaCl.

X-ray Diffraction & Defects in Crystals: Bragg's Law, X-Ray diffraction method: Laue Method, Powder Method**:** Point Defects: Vacancies, Substitutional, Interstitial, Frenkel and Schottky Defects, line defects (Qualitative) & Burger's Vector.

UNIT-II

Principles of Quantum Mechanics: Waves and Particles, de Broglie Hypothesis , Matter Waves, Davisson and Germer' Experiment, Heisenberg's Uncertainty Principle, Schrödinger's Time Independent Wave Equation - Physical Significance of the Wave Function – Infinite square well potential, extension to three dimensions

Elements of Statistical Mechanics& Electron theory of Solids: Phase space, Ensembles, Micro Canonical , Canonical and Grand Canonical Ensembles **-** Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac Statistics (Qualitative Treatment), Concept of Electron Gas, , Density of States, Fermi Energy- Electron in a periodic Potential, Bloch Theorem, Kronig-Penny Model (Qualitative Treatment), E-K curve, Origin of Energy Band Formation in Solids, Concept of Effective Mass of an Electron, Classification of Materials into Conductors, Semi Conductors & Insulators.

UNIT-III

Dielectric Properties: Electric Dipole, Dipole Moment, Dielectric Constant, Polarizability, Electric Susceptibility, Displacement Vector, Electronic, Ionic and Orientation Polarizations and Calculation of Polarizabilities: Ionic and Electronic - Internal Fields in Solids, Clausius - Mossotti Equation, Piezo -electricity and Ferro- electricity.

Magnetic Properties & Superconducting Properties: Permeability, Field Intensity, Magnetic Field Induction, Magnetization, Magnetic Susceptibility, Origin of Magnetic Moment, Bohr Magneton, Classification of Dia, Para and Ferro Magnetic Materials on the basis of Magnetic Moment, Domain Theory of Ferro Magnetism on the basis of Hysteresis Curve, Soft and Hard Magnetic Materials, Properties of Anti-Ferro and Ferri Magnetic Materials and their Applications, Superconductivity, Meissner Effect, Effect of Magnetic field, Type-I & Type-II Superconductors, Applications of Superconductors

UNIT-IV

Optics: Interference-Interference in thin films(Reflected light), Newton rings experiment- Fraunhofer diffraction due to single slit, N-slits, Diffraction grating experiment , Double refraction-construction and working of Nicol's Prism

Lasers & Fiber Optics: Characteristics of Lasers, Spontaneous and Stimulated Emission of Radiation, Einstein's Coefficients and Relation between them, Population Inversion, Lasing Action, Ruby Laser, Helium-Neon Laser, Semiconductor Diode Laser, Applications of Lasers- Principle of Optical Fiber, Construction of fiber, Acceptance Angle and Acceptance Cone, Numerical Aperture, Types of Optical Fibers: Step Index and Graded Index Fibers, Attenuation in Optical Fibers, Application of Optical Fiber in communication systems.

UNIT-V:

Semiconductor Physics: Fermi Level in Intrinsic and Extrinsic Semiconductors, Calculation of carrier concentration in Intrinsic &, Extrinsic Semiconductors, Direct and Indirect Band gap semiconductors, Hall Effect-Formation of PN Junction, Open Circuit PN Junction, Energy Diagram of PN Diode, Diode Equation, I-V Characteristics of PN Junction diode, Solar cell, LED & Photo Diodes. **Acoustics of Buildings &** Acoustic Quieting:, 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 Remedies

Nanotechnology: Origin of Nanotechnology, Nano Scale, Surface to Volume Ratio, Quantum Confinement, Bottom-up Fabrication: Sol-gel, Top-down Fabrication: Chemical Vapour Deposition, Characterization by TEM.

TEXT BOOKS:

1. Engineering Physics,K. Malik, A. K. Singh, Tata Mc Graw Hill Book Publishers
2. Engineering Physics, V. Rajendran, Tata Mc Graw Hill Book Publishers

REFERENCES:

1. Fundamentals of Physics, David Halliday, Robert Resnick, Jearl Walker by John Wiley & Sons
2. Sears and Zemansky's University Physics (10th Edition) by Hugh D. Young Roger A. Freedman, T. R. Sandin, A. Lewis FordAddison-Wesley Publishers;
3. Applied Physics for Engineers – P. Madhusudana Rao (Academic Publishing company, 2013)
4. Solid State Physics – M. Armugam (Anuradha Publications).
5. Modern Physics – R. Murugeshan & K. Siva Prasath – S. Chand & Co. (for Statistical Mechanics).
6. A Text Book of Engg Physics – M. N. Avadhanulu & P. G. Khsirsagar– S. Chand & Co. (for acoustics).
7. Modern Physics by K. Vijaya Kumar, S. Chandralingam: S. Chand & Co.Ltd
8. Nanotechnology – M.Ratner & D. Ratner (Pearson Ed.).
9. Introduction to Solid State Physics – C. Kittel (Wiley Eastern).
10. Solid State Physics – A.J. Dekker (Macmillan).
11. Applied Physics – Mani Naidu Pearson Education

Outcomes:

- The student would be able to learn the fundamental concepts on behavior of crystalline solids.
- The knowledge on Fundamentals of Quantum Mechanics, Statistical Mechanics enables the student to apply to various systems like Communications Solar Cells, Photo Cells and so on.
- Design, Characterization and study of properties of materials help the student to prepare new materials for various Engineering applications.
- This course also helps the student exposed to non destructive testing methods.
- Finally, Engineering Physics Course helps the student to develop problem solving skills and analytical skills

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

I Year B.Tech. MME	**L**	**T/P/D**	**C**
	3	**-/-/-**	**6**

ENGINEERING CHEMISTRY

Objective:
An engineer is as someone who uses scientific, natural and physical principles to design something of use for people or other living creatures. Much of what any engineer does involves chemistry because everything in our environment has a molecular make up. Engineering requires the concepts of applied chemistry and the more chemistry an engineer understands, the more beneficial it is. In the future, global problems and issues will require an in-depth understanding of chemistry to have a global solution. This syllabus aims at bridging the concepts and theory of chemistry with examples from fields of practical application, thus reinforcing the connection between science and engineering. It deals with the basic principles of various branches of chemistry which are fundamental tools necessary for an accomplished engineer.

UNIT I:
Electrochemistry & Corrosion: Electro Chemistry – Conductance - Specific, Equivalent and Molar conductance and their Units; Applications of Conductance (Conductometric titrations). **EMF:** Galvanic Cells, types of Electrodes – (Calomel, Quinhydrone and glass electrodes); Nernst equation and its applications ; concept of concentration cells, electro chemical series, Potentiometric titrations, determination of P^H using glass electrode-Numerical problems.
Batteries: Primary cells (dry cells) and secondary cells (lead-Acid cell, Ni-Cd cell, Lithium cells). Applications of batteries. **Fuel cells** – Hydrogen – Oxygen fuel cell; methanol – oxygen fuel cell ; Advantages and Applications.
Corrosion and its control: Causes and effects of corrosion; Theories of corrosion – Chemical & Electrochemical corrosion; Types of corrosion (Galvanic, Water line, Pitting and Intergranular); Factors affecting rate of corrosion – Nature of metal and Nature of Enviornent – Corrosion control methods – Cathodic protection (sacrificial anodic and impressed current). Surface coatings: Metallic coatings & methods of application of metallic coatings - hot dipping (galvanization & tinning), Cementation, cladding, electroplating (copper plating) Electroless plating (Ni plating) - Organic coatings – Paints - constituents and their functions.

UNIT II:
Engineering Materials: Polymers: Types of Polymerization (Chain & Step growth).**Plastics:** Thermoplastic & Thermo setting resins; Compounding & fabrication of plastics (Compression and injection moulding).Preparation, properties, engineering applications of PVC, Teflon and Bakelite.
Fibers- Charcterstics of fibers – preparation, properties and uses of Nylon – 6,6 and Dacron – Fiber Reinforced Plastics (FRP) – applications. **Rubbers** – Natural rubber and its vulcanization. Elastomers – Buna-s, Butyl rubber and Thiokol rubber.
Conducting polymers: Polyacetylene, Polyaniline, Mechanism of Conduction, doping; applications of Conducting polymers. **Bio-degradable Polymers**- preparation and Applications of Poly vinyl acetate and Poly lactic acid - **Cement:** composition of Portland cement, setting & hardening of cement (reactions), **Lubricants:** Classification with examples- Characterstics of a good lubricant & mechanism of lubrication (thick film , thin film and extreme pressure) – properties of lubricants: viscosity , Cloud point, flash and fire points. **Refractories:** Classification, charactersitcs of a good refractory and applications.
Nanomaterials: Introduction, preparation by sol-gel & chemical vapour deposition methods. Applications of nanomaterials.

UNIT III:
Water and its Treatment: Hardness of Water: Causes of hardness, expression of hardness – units – types of hardness, estimation of temporary & permanent hardness of water by EDTA method - numerical problems. Boiler troubles – Scale & sludges, Priming and foaming, caustic enbrittlement and boiler corrosion; Treatment of boiler feed water – Internal treatment (Phosphate, Colloidal and calgon conditioning) – External treatment – Lime Soda process, Zeolite process and ion exchange process. Numerical Problems. **Potable Water**- Its Specifications – Steps involved in trtament of potable water – Disinfection of water by chlorination and ozonisation. Reverse osmosis & its significance.

Unit – IV :
Fuels & Combustion: Fuels – Classification – soild fuels : coal – analysis of coal - proximate and ultimate analysis and their significance. Liquid fuels – petroleum and its refining – cracking – types – fixed bed catalytic cracking. Knocking – octane and cetane rating, synthetic petrol, Bergius and Fischer-Tropsch's process: Gaseous fuels - constituents, characterstics and applications of natural gas, LPG and CNG. Analysis of flue gas by Orsat's apparatus – Numerical Problems.
Combustion – Definition, Calorific value of fuel – HCV , LCV; Determination of calorific value by Junker's gas calorimeter – theoretical calculation of Calorific value by Dulong's formula – Numerical problems on combustion.

UNIT V:

Phase Rule & Surface Chemistry : **Phase Rule:** Definition of terms : Phase, component, degree of freedom, phase rule equation. Phase diagrams – one component system- water system. Two component system Lead- Silver, cooling curves, heat treatment based on iron-carbon phase diagram - hardening, annealing and normalization.

Surface Chemistry: **Adsorption –** Types of Adsorption, Isotherms – Freundlich and Langmuir adsorption isotherm, applications of adsorption; **Colloids**: Classification of Colloids; Electrical & optical properties, micelles, applications of colloids in industry.

TEXT BOOKS:

1. Engineering Chemistry by R.P. Mani,K.N. Mishra, B. Rama Devi /CENGAGE learning.
2. Engineering Chemistry by P.C Jain & Monica Jain, Dhanpatrai Publishing Company (2008).

REFERENCE BOOKS

1. Engineering Chemistry by B. Siva Shankar Mc.Graw Hill Publishing Company Limited, New Delhi (2006)
2. Engineering Chemistry J.C. Kuriacase & J. Rajaram, Tata McGraw Hills Publishing Company Limited, New Delhi (2004).
3. Text Book of Engineering Chemistry by S.S. Dara & Mukkati S. Chand & Co Publishers, New Delhi(2006)
4. Chemistry of Engineering Materials by CV Agarwal,C.P Murthy, A.Naidu, BS Publications.

Outcome:

- Students will demonstrate a depth of knowledge and apply the methods of inquiry in a discipline of their choosing, and they will demonstrate a breadth of knowledge across their choice of varied disciplines.
- Students will demonstrate the ability to access and interpret information, respond and adapt to changing situations, make complex decisions, solve problems, and evaluate actions.
- Students will demonstrate awareness and understanding of the skills necessary to live and work in a diverse engineering world.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

I Year B.Tech. MME	**L**	**T/P/D**	**C**
	3	**-/-/-**	**6**

COMPUTER PROGRAMMING

Objectives:

- To understand the various steps in Program development.
- To understand the basic concepts in C Programming Language.
- To learn how to write modular and readable C Programs.
- To learn to write programs (using structured programming approach) in C to solve problems.
- To introduce the students to basic data structures such as lists, stacks and queues.
- To make the student understand simple sorting and searching methods.

UNIT - I

Introduction to Computers – Computer Systems, Computing Environments, Computer Languages, Creating and running programs, Program Development.

Introduction to the C Language – Background, C Programs, Identifiers, Types, Variables, Constants, Input / Output, Operators(Arithmetic, relational, logical, bitwise etc.), Expressions, Precedence and Associativity, Expression Evaluation, Type conversions, Statements- Selection Statements(making decisions) – if and switch statements, Repetition statements (loops)-while, for, do-while statements, Loop examples, other statements related to looping – break, continue, goto, Simple C Program examples.

UNIT - II

Functions-Designing Structured Programs, Functions, user defined functions, inter function communication, Standard functions, Scope, Storage classes-auto, register, static, extern, scope rules, type qualifiers, recursion- recursive functions, Limitations of recursion, example C programs, Preprocessor commands.

Arrays – Concepts, using arrays in C, inter function communication, array applications, two – dimensional arrays, multidimensional arrays, C program examples.

UNIT - III

Pointers – Introduction (Basic Concepts), Pointers for inter function communication, pointers to pointers, compatibility, Pointer Applications-Arrays and Pointers, Pointer Arithmetic and arrays, Passing an array to a function, memory allocation functions, array of pointers, programming applications, pointers to void, pointers to functions.

Strings – Concepts, C Strings, String Input / Output functions, arrays of strings, string manipulation functions, string / data conversion, C program examples.

UNIT - IV

Enumerated, Structure ,and Union Types– The Type Definition(typedef), Enumerated types, Structures –Declaration, initialization, accessing structures, operations on structures, Complex structures, structures and functions, Passing structures through pointers, self referential structures, unions, bit fields, C programming examples, command –line arguments,

Input and Output – Concept of a file, streams, text files and binary files, Differences between text and binary files, State of a file, Opening and Closing files, file input / output functions (standard library input / output functions for files), file status functions (error handling),Positioning functions, C program examples.

UNIT – V

Searching and Sorting – Sorting- selection sort, bubble sort, Searching-linear and binary search methods.

Lists- Linear list – singly linked list implementation, insertion, deletion and searching operations on linear list, Stacks-Push and Pop Operations, Queues- Enqueue and Dequeue operations.

TEXT BOOKS:

1. Computer Science: A Structured Programming Approach Using C, B.A.Forouzan and R.F. Gilberg, Third Edition, Cengage Learning.
2. Programming in C. P. Dey and M Ghosh , Oxford University Press.

REFERENCE BOOKS:

1. C& Data structures – P. Padmanabham, Third Edition, B.S. Publications.
2. C for All, S. Thamarai Selvi, R.Murugesan, Anuradha Publications.
3. Problem Solving and Program Design in C, J.R. Hanly and E.B. Koffman, 7th Edition, Pearson education.
4. Programming in C, Ajay Mittal, Pearson.
5. Programming with C, B.Gottfried, 3rd edition, Schaum's outlines, TMH.
6. Problem solving with C, M.T.Somasekhara, PHI

7. Programming with C, R.S.Bickar, Universities Press.
8. Computer Programming & Data Structures, E.Balagurusamy, 4th edition, TMH.
9. Programming in C – Stephen G. Kochan, III Edition, Pearson Education.
10. The C Programming Language, B.W. Kernighan and Dennis M.Ritchie, PHI.
11. C Programming with problem solving, J.A. Jones & K. Harrow,Dreamtech Press.

Outcomes:

- Demonstrate the basic knowledge of computer hardware and software.
- Ability to apply solving and logical skills to programming in C language and also in other languages.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

I Year B.Tech. MME	**L**	**T/P/D**	**C**
	3	**-/-/3**	**6**

ENGINEERING DRAWING

UNIT – I

Introduction to Engineering Drawing: Principles of Engineering Drawing/Graphics – Various Drawing Instruments – Conventions in Drawing – **Lettering practice** – BIS Conventions.

Curves: Constructions of Curves used in Engineering Practice:

a) Conic Sections including the Rectangular Hyperbola – General method only.

b) Cycloid, Epicycloid and Hypocycloid

c) Involute.

Scales: Construction of different types of Scales, Plain, Diagonal, Vernier scale.

UNIT – II

Orthographic Projections in First Angle

Projection: Principles of Orthographic Projections – Conventions – First and Third Angle projections.

Projections of Points. including Points in all four quadrants.

Projections of Lines - Parallel, perpendicular, inclined to one plan and inclined to both planes. True length and true angle of a line. Traces of a line.

Projections of Planes: Plane parallel, perpendicular and inclined to one reference plane. Plane inclined to both the reference planes.

UNIT – III

Projections of Solids: Projections of regular solids, cube, prisms, pyramids, tetrahedran, cylinder and cone, axis inclined to both planes.

Sections and Sectional Views: Right Regular Solids – Prism, Cylinder, Pyramid, Cone – use of Auxiliary views.

UNIT – IV

Development of Surfaces: Development of Surfaces of Right, Regular Solids – Prisms, Cylinder, Pyramids, Cone and their parts. frustum of solids.

Intersection of Solids:- Intersection of Cylinder Vs Cylinder, Cylinder Vs Prism, Cylinder Vs Cone.

UNIT – V

Isometric Projections : Principles of Isometric Projection – Isometric Scale – Isometric Views– Conventions – Plane Figures, Simple and Compound Solids – Isometric Projection of objects having non- isometric lines. Isometric Projection of parts with Spherical surface.

Transformation of Projections : Conversion of Isometric Views to Orthographic Views. Conversion of orthographic views to isometric views – simple objects.

Perspective Projections : Perspective View : Points, Lines and Plane Figures, Vanishing Point Methods (General Method only).

TEXT BOOKS

1.Engineering Drawing – Basant, Agrawal, TMH

2. Engineering Drawing, N.D. Bhatt

REFERENCES :

1. Engineering Graphics. P I Varghese Tata McGraw Hill Education Pvt. Ltd.
2. Engineering drawing – P.J. Shah .S.Chand Publishers.
3. Engineering Drawing- Johle/Tata Macgraw Hill Book Publishers.
4. Engineering Drawing – M.B. Shah and B.C. Rana, Pearson.
5 .Engineering Drawing by K.Venu Gopal& V.Prabu Raja New Age Publications.
6. Engineering Drawing By John. PHI Learning Publisher.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

I Year B.Tech. MME	**L**	**T/P/D**	**C**
	-	**-/3/-**	**4**

COMPUTER PROGRAMMING LAB

Objectives:

- To write programs in C to solve the problems.
- To implement linear data structures such as lists, stacks, queues.
- To implement simple searching and sorting methods.

Recommended Systems/Software Requirements:

- Intel based desktop PC
- ANSI C Compiler with Supporting Editors

Week I

a) Write a C program to find the sum of individual digits of a positive integer.

b) A Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first n terms of the sequence.

c) Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.

Week 2

a) Write a C program to calculate the following Sum:

Sum=1-x^2/2! +x^4/4!-x^6/6!+x^8/8!-x^{10}/10!

b) Write a C program to find the roots of a quadratic equation.

Week 3

a) The total distance travelled by vehicle in 't' seconds is given by distance s = ut+1/2at^2 where 'u' and 'a' are the initial velocity (m/sec.) and acceleration (m/sec^2). Write C program to find the distance travelled at regular intervals of time given the values of 'u' and 'a'. The program should provide the flexibility to the user to select his own time intervals and repeat the calculations for different values of 'u' and 'a'.

b) Write a C program, which takes two integer operands and one operator from the user, performs the operation and then prints the result. (Consider the operators +,-,*, /, % and use Switch Statement)

Week 4

a) Write C programs that use both recursive and non-recursive functions

i) To find the factorial of a given integer.

ii) To find the GCD (greatest common divisor) of two given integers.

Week 5

a) Write a C program to find the largest integer in a list of integers.

b) Write a C program that uses functions to perform the following:

i) Addition of Two Matrices

ii) Multiplication of Two Matrices

Week 6

a) Write a C program that uses functions to perform the following operations:

i) To insert a sub-string in to a given main string from a given position.

ii) To delete n Characters from a given position in a given string.

b) Write a C program to determine if the given string is a palindrome or not

Week 7

a) Write a C program that displays the position or index in the string S where the string T begins, or – 1 if S doesn't contain T.

b) Write a C program to count the lines, words and characters in a given text.

Week 8

a) Write a C program to generate Pascal's triangle.

b) Write a C program to construct a pyramid of numbers.

Week 9

Write a C program to read in two numbers, x and n, and then compute the sum of this geometric progression:

1+x+x^2+x^3+…….+x^n

For example: if n is 3 and x is 5, then the program computes 1+5+25+125.

Print x, n, the sum

Perform error checking. For example, the formula does not make sense for negative exponents – if n is less than 0. Have your program print an error message if n<0, then go back and read in the next pair of numbers of without computing the sum. Are any values of x also illegal? If so, test for them too.

Week 10

a) 2's complement of a number is obtained by scanning it from right to left and complementing all the bits after the first appearance of a 1. Thus 2's complement of 11100 is 00100. Write a C program to find the 2's complement of a binary number.
b) Write a C program to convert a Roman numeral to its decimal equivalent.

Week 11
Write a C program that uses functions to perform the following operations:
i) Reading a complex number
ii) Writing a complex number
iii) Addition of two complex numbers
iv) Multiplication of two complex numbers
(Note: represent complex number using a structure.)
Week 12
a) Write a C program which copies one file to another.
b) Write a C program to reverse the first n characters in a file.
(Note: The file name and n are specified on the command line.)
Week 13
a) Write a C program to display the contents of a file.
b) Write a C program to merge two files into a third file (i.e., the contents of the first file followed by those of the second are put in the third file)
Week 14
a) Write a C program that uses non recursive function to search for a Key value in a given list of integers using Linear search.
b) Write a C program that uses non recursive function to search for a Key value in a given sorted list of integers using Binary search.
Week 15
a) Write a C program that implements the Selection sort method to sort a given array of integers in ascending order.
b) Write a C program that implements the Bubble sort method to sort a given list of names in ascending order.
Week 16
Write a C program that uses functions to perform the following operations:
i) Create a singly linked list of integer elements.
ii) Traverse the above list and display the elements.
Week 17
Write a C program that implements stack (its operations) using a singly linked list to display a given list of integers in reverse order. Ex. input: 10 23 4 6 output: 6 4 23 10
Week 18
Write a C program that implements Queue (its operations) using a singly linked list to display a given list of integers in the same order. Ex. input: 10 23 4 6 output: 10 23 4 6
Week 19
Write a C program to implement the linear regression algorithm.
Week 20
Write a C program to implement the polynomial regression algorithm.
Week 21
Write a C program to implement the Lagrange interpolation.
Week 22
Write C program to implement the Newton- Gregory forward interpolation.
Week 23
Write a C program to implement Trapezoidal method.
Week 24
Write a C program to implement Simpson method.
TEXT BOOKS:
1. C programming and Data Structures, P. Padmanabham, Third Edition, BS Publications
2. Computer Programming in C, V. Rajaraman, PHI Publishers.
3. C Programming, E.Balagurusamy, 3rd edition, TMH Publishers.
4. C Programming, M.V.S.S.N.Prasad, ACME Learning Pvt. Ltd.
5. C and Data Structures, N.B.Venkateswarlu and E.V.Prasad,S.Chand Publishers
6. Mastering C, K.R. Venugopal and S.R. Prasad, TMH Publishers.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

I Year B.Tech. MME	**L**	**T/P/D**	**C**
	-	**-/3/-**	**4**

ENGINEERING PHYSICS / ENGINEERING CHEMISTRY LAB

ENGINEERING PHYSICS LAB
(Any TEN experiments compulsory)

Objectives

This course on Physics lab is designed with 13 experiments in an academic year. It is common to all branches of Engineering in B.Tech Ist year.

The objective of the course is that the student will have exposure to various experimental skills which is very essential for an Engineering student.

The experiments are selected from various area of Physics like Physical Optics, Lasers, Fiber Optics, Sound, Mechanics, Electricity & Magnetism and Basic Electronics.

Also the student is exposed to various tools like Screw gauge, Vernier Callipers, Physics Balance , Spectrometer and Microscope.

1. Dispersive power of the material of a prism – Spectrometer
2. Determination of wavelength of a source – Diffraction Grating.
3. Newton's Rings - Radius of curvature of plano convex lens.
4. Melde's experiment – Transverse and longitudinal modes.
5. Time constant of an R-C circuit.
6. L-C-R circuit.
7. Magnetic field along the axis of current carrying coil – Stewart and Gees method.
8. Study the characteristics of LED and LASER sources.
9. Bending losses of fibres & Evaluation of numerical aperture of a given fibre.
10. Energy gap of a material of p-n junction.
11. Torsional pendulum.
12. Wavelength of light –diffraction grating - using laser.
13. Characteristics of a solar cell

LABORATORY MANUAL:

1. Laboratory Manual of Engineering Physics by Dr.Y.Aparna & Dr.K.Venkateswara Rao (V.G.S Publishers)

Outcomes

The student is expected to learn from this laboratory course the concept of error and its analysis. It also allows the student to develop experimental skills to design new experiments in Engineering.

With the exposure to these experiments the student can compare the theory and correlate with experiment.

ENGINEERING CHEMISTRY LAB

List of Experiments (Any 12 of the following) :

Titrimetry:

1. Estimation of ferrous iron by dichrometry.
2. Estimation of hardness of water by EDTA method.

Mineral analysis:

3. Determination of percentage of copper in brass.
4. Estimation of manganese dioxide in pyrolusite.

Instrumental Methods:

Colorimetry:

5. Determination of ferrous iron in cement by colorimetric method
6. Estimation of copper by colorimetric method.

Conductometry:

7. Conductometric titration of strong acid vs strong base.
8. Conductometric titration of mixture of acids vs strong base.

Potentiometry:

9. Titration of strong acd vs strong base by potentiometry.
10. Titration of weak acid vs strong base by potentiometry.

Physical properties:

11. Determination of viscosity of sample oil by redwood / oswald's viscometer.
12. Determination of Surface tension of lubricants.

Preparations:

13. Preparation of Aspirin
14. Preparation of Thiokol rubber

Adsorption:

15. Adsorption of acetic acid on charcoal.

TEXT BOOKS:

1. Practical Engineering Chemistry by K. Mukkanti, etal, B.S. Publications, Hyderabad.
2. Inorganic quantitative analysis, Vogel.

REFERENCE BOOKS:

1. Text Book of engineering chemistry by R. N. Goyal and Harrmendra Goel, Ane Books Private Ltd.,
2. A text book on experiments and calculation Engg. S.S. Dara.
3. Instrumental methods of chemical analysis, Chatwal, Anand, Himalaya Publications.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

I Year B.Tech. MME	**L**	**T/P/D**	**C**
	-	**-/3/-**	**2**

ENGLISH LANGUAGE COMMUNICATION SKILLS LAB

The **Language Lab** focuses on the production and practice of sounds of language and familiarises the students with the use of English in everyday situations and contexts.

Objectives

- To facilitate computer-aided multi-media instruction enabling individualized and independent language learning
- To sensitise the students to the nuances of English speech sounds, word accent, intonation and rhythm
- To bring about a consistent accent and intelligibility in their pronunciation of English by providing an opportunity for practice in speaking
- To improve the fluency in spoken English and neutralize mother tongue influence
- To train students to use language appropriately for interviews, group discussion and public speaking

Syllabus: English Language Communication Skills Lab shall have two parts:

a. **Computer Assisted Language Learning (CALL) Lab**
b. **Interactive Communication Skills (ICS) Lab**

The following course content is prescribed for the **English Language Communication Skills Lab**

Exercise – I
CALL Lab: Introduction to Phonetics – Speech Sounds – Vowels and Consonants
ICS Lab: Ice-Breaking activity and JAM session
Articles, Prepositions, Word formation- Prefixes & Suffixes, Synonyms & Antonyms

Exercise – II
CALL Lab: Structure of Syllables - Past Tense Marker and Plural Marker – Weak Forms and Strong Forms - Consonant Clusters.
ICS Lab: Situational Dialogues – Role-Play- Expressions in Various Situations – Self-introduction and Introducing Others – Greetings – Apologies – Requests – Social and Professional Etiquette - Telephone Etiquette.
Concord (Subject in agreement with verb) and Words often misspelt- confused/misused

Exercise - III
CALL Lab: Minimal Pairs- Word accent and Stress Shifts- Listening Comprehension.
ICS Lab: Descriptions- Narrations- Giving Directions and guidelines.
Sequence of Tenses, Question Tags and One word substitutes.

Exercise – IV
CALL Lab: Intonation and Common errors in Pronunciation.
ICS Lab: Extempore- Public Speaking
Active and Passive Voice, –Common Errors in English, Idioms and Phrases

Exercise – V
CALL Lab: Neutralization of Mother Tongue Influence and Conversation Practice
ICS Lab: Information Transfer- Oral Presentation Skills
Reading Comprehension and Job Application with Resume preparation.

Minimum Requirement of infra structural facilities for ELCS Lab:

1. **Computer Assisted Language Learning (CALL) Lab:**
   The Computer aided Language Lab for 40 students with 40 systems, one master console, LAN facility and English language software for self- study by learners.

System Requirement (Hardware component):
Computer network with Lan with minimum 60 multimedia systems with the following specifications:

i) P – IV Processor
   a) Speed – 2.8 GHZ
   b) RAM – 512 MB Minimum
   c) Hard Disk – 80 GB
ii) Headphones of High quality

2. **Interactive Communication Skills (ICS) Lab :**
   The Interactive Communication Skills Lab: A Spacious room with movable chairs and audio-visual aids with a Public Address System, a T. V., a digital stereo –audio & video system and camcorder etc.

Books Suggested for English Language Lab Library (to be located within the lab in addition to the CDs of the text book which are loaded on the systems):

1. Suresh Kumar, E. & Sreehari, P. 2009. *A Handbook for English Language Laboratories.* New Delhi: Foundation
2. *Speaking English Effectively* 2nd Edition by Krishna Mohan and N. P. Singh, 2011. Macmillan Publishers India Ltd. Delhi.
3. Sasi Kumar, V & Dhamija, P.V. *How to Prepare for Group Discussion and Interviews.* Tata McGraw Hill
4. Hancock, M. 2009. *English Pronunciation in Use. Intermediate.* Cambridge: CUP
5. Spoken English: A Manual of Speech and Phonetics by R. K. Bansal & J. B. Harrison. 2013. Orient Blackswan. Hyderabad.
6. Hewings, M. 2009. *English Pronunciation in Use. Advanced.* Cambridge: CUP
7. Marks, J. 2009. *English Pronunciation in Use. Elementary.* Cambridge: CUP
8. Nambiar, K.C. 2011. *Speaking Accurately. A Course in International Communication.* New Delhi : Foundation
9. Soundararaj, Francis. 2012. *Basics of Communication in English. New Delhi: Macmillan*
10. **Spoken English** (CIEFL) in 3 volumes with 6 cassettes, OUP.
11. **English Pronouncing Dictionary** Daniel Jones Current Edition with CD.
12. **A textbook of English Phonetics for Indian Students** by T. Balasubramanian (Macmillan)
13. **Prescribed Lab Manual:** A Manual entitled "***English Language Communication Skills (ELCS) Lab Manual- cum- Work Book****"*, published by Cengage Learning India Pvt. Ltd, New Delhi. 2013

DISTRIBUTION AND WEIGHTAGE OF MARKS

English Language Laboratory Practical Examination:

1. The practical examinations for the English Language Laboratory shall be conducted as per the University norms prescribed for the core engineering practical sessions.
2. For the Language lab sessions, there shall be a continuous evaluation during the year for 25 sessional marks and 50 year-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 year- 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.

Outcomes:

1. Better Understanding of nuances of language through audio- visual experience and group activities
2. Neutralization of accent for intelligibility
3. Speaking with clarity and confidence thereby enhancing employability skills of the students

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

I Year B.Tech. MME	**L**	**T/P/D**	**C**
	-	**-/3/-**	**4**

IT WORKSHOP / ENGINEERING WORKSHOP

Objectives:
The IT Workshop for engineers is a training lab course spread over 54 hours. The modules include training on PC Hardware, Internet & World Wide Web and Productivity tools including Word, Excel and Power Point.

PC Hardware introduces the students to a personal computer and its basic peripherals, the process of assembling a personal computer, installation of system software like MS Windows, Linux and the required device drivers. In addition hardware and software level troubleshooting process, tips and tricks would be covered. **The students should work on working PC to disassemble and assemble to working condition and install Windows and Linux on the same PC. Students are suggested to work similar tasks in the Laptop scenario wherever possible.**

Internet & World Wide Web module introduces the different ways of hooking the PC on to the internet from home and workplace and effectively usage of the internet. Usage of web browsers, email, newsgroups and discussion forums would be covered. In addition, awareness of cyber hygiene, i.e., protecting the personal computer from getting infected with the viruses, worms and other cyber attacks would be introduced.

Productivity tools module would enable the students in crafting professional word documents, excel spread sheets and power point presentations using the Microsoft suite of office tools and LaTeX. (**Recommended to use Microsoft office 2007 in place of MS Office 2003)**

PC Hardware

Week 1 – Task 1 : Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor.

Week 2 – Task 2 : Every student should disassemble and assemble the PC back to working condition. Lab instructors should verify the work and follow it up with a Viva. Also students need to go through the video which shows the process of assembling a PC. A video would be given as part of the course content.

Week 3 – Task 3 : Every student should individually install MS windows on the personal computer. Lab instructor should verify the installation and follow it up with a Viva.

Week 4 – Task 4 : Every student should install Linux on the computer. This computer should have windows installed. The system should be configured as dual boot with both windows and Linux. Lab instructors should verify the installation and follow it up with a Viva

Week 5 – Task 5: Hardware Troubleshooting: Students have to be given a PC which does not boot due to improper assembly or defective peripherals. They should identify the problem and fix it to get the computer back to working condition. The work done should be verified by the instructor and followed up with a Viva

Week 6 – Task 6 : Software Troubleshooting : Students have to be given a malfunctioning CPU due to system software problems. They should identify the problem and fix it to get the computer back to working condition. The work done should be verified by the instructor and followed up with a Viva.

Internet & World Wide Web

Week 7 - Task 1 : **Orientation & Connectivity Boot Camp :** Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally students should demonstrate, to the instructor, how to access the websites and email. If there is no internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN.

Week 8 - Task 2 : Web Browsers, Surfing the Web : Students customize their web browsers with the LAN proxy settings, bookmarks, search toolbars and pop up blockers. Also, plug-ins like Macromedia Flash and JRE for applets should be configured.

Week 9 - Task 3 : **Search Engines & Netiquette :** Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google. This should be demonstrated to the instructors by the student.

Week 10 - Task 4: Cyber Hygiene: Students would be exposed to the various threats on the internet and would be asked to configure their computer to be safe on the internet. They need to first install antivirus software, configure their personal firewall and windows update on their computer. Then they need to customize their browsers to block pop ups, block active x downloads to avoid viruses and/or worms.

Week 11- Task 5: Develop your home page using HTML Consisting of your photo, name, address and education details as a table and your skill set as a list.

Productivity tools

LaTeX and Word

Week 12 – Word Orientation: The mentor needs to give an overview of LaTeX and Microsoft (MS) office 2007/ equivalent (FOSS) tool word: Importance of LaTeX and MS office 2007/ equivalent (FOSS) tool Word as word Processors, Details of the three tasks and features that would be covered in each, using LaTeX and word – Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter.

Task 1 : Using LaTeX and Word to create project certificate. Features to be covered:-Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option in both LaTeX and Word.

Week 13 - Task 2: Creating project abstract Features to be covered:-Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.

Week 14 - Task 3 : Creating a Newsletter : Features to be covered:- Table of Content, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes, Paragraphs and Mail Merge in word.

Excel

Week 15 - Excel Orientation: The mentor needs to tell the importance of MS office 2007/ equivalent (FOSS) tool Excel as a Spreadsheet tool, give the details of the two tasks and features that would be covered in each. Using Excel – Accessing, overview of toolbars, saving excel files, Using help and resources.

Task 1: Creating a Scheduler - Features to be covered:- Gridlines, Format Cells, Summation, auto fill, Formatting Text

Week 16 - Task 2 : Calculating GPA - .Features to be covered:- Cell Referencing, Formulae in excel – average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function, LOOKUP/VLOOKUP, Sorting, Conditional formatting

LaTeX and MS/equivalent (FOSS) tool Power Point

Week 17 - Task1: Students will be working on basic power point utilities and tools which help them create basic power point presentation. Topic covered during this week includes :- PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in both LaTeX and Power point. Students will be given model power point presentation which needs to be replicated (exactly how it's asked).

Week 18- Task 2: Second week helps students in making their presentations interactive. Topic covered during this week includes: Hyperlinks, Inserting –Images, Clip Art, Audio, Video, Objects, Tables and Charts

Week 19 - Task 3: Concentrating on the in and out of Microsoft power point and presentations in LaTeX. Helps them learn best practices in designing and preparing power point presentation. Topic covered during this week includes: - Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc), Inserting – Background, textures, Design Templates, Hidden slides.

REFERENCE BOOKS:

1. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education.
2. LaTeX Companion – Leslie Lamport, PHI/Pearson.

3. Introduction to Computers, Peter Norton, 6/e Mc Graw Hill Publishers.
4. Upgrading and Repairing, PC's 18th e, Scott Muller QUE, Pearson Education
5. Comdex Information Technology course tool kit Vikas Gupta, WILEY Dreamtech
6. IT Essentials PC Hardware and Software Companion Guide Third Edition by David Anfinson and Ken Quamme. – CISCO Press, Pearson Education.
7. PC Hardware and A+Handbook – Kate J. Chase PHI (Microsoft)

Outcomes:

- Apply knowledge for computer assembling and software installation.
- Ability how to solve the trouble shooting problems.
- Apply the tools for preparation of PPT, Documentation and budget sheet etc.

ENGINEERING WORKSHOP

1. TRADES FOR EXERCISES:

At least two exercises from each trade:

1. Carpentry
2. Fitting
3. Tin-Smithy and Development of jobs carried out and soldering.
4. Black Smithy
5. House-wiring
6. Foundry
7. Welding
8. Power tools in construction, wood working, electrical engineering and mechanical Engineering.

2. TRADES FOR DEMONSTRATION & EXPOSURE:

1. Plumbing
2. Machine Shop
3. Metal Cutting (Water Plasma)

TEXT BOOK:

1. Work shop Manual - P.Kannaiah/ K.L.Narayana/ Scitech Publishers.
2. Workshop Manual / Venkat Reddy/ BS Publications/Sixth Edition

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

II Year B.Tech. MME- I Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

MATHEMATICS – II

Objectives:

- The objective is to find the relation between the variables x and y out of the given data (x,y).
- This unit also aims to find such relationships which exactly pass through data or approximately satisfy the data under the condition of least sum of squares of errors.
- The aim of numerical methods is to provide systematic methods for solving problems in a numerical form using the given initial data.
- This topic deals with methods to find roots of an equation and solving a differential equation.
- The numerical methods are important because finding an analytical procedure to solve an equation may not be always available.
- In the diverse fields like electrical circuits, electronic communication, mechanical vibration and structural engineering, periodic functions naturally occur and hence their properties are very much required.
- Indeed, any periodic and non-periodic function can be best analyzed in one way by Fourier series and transforms methods.
- The unit aims at forming a partial differential equation (PDE) for a function with many variables and their solution methods. Two important methods for first order PDE's are learnt. While separation of variables technique is learnt for typical second order PDE's such as Wave, Heat and Laplace equations.
- In many Engineering fields the physical quantities involved are vector-valued functions.
- Hence the unit aims at the basic properties of vector-valued functions and their applications to line integrals, surface integrals and volume integrals.

UNIT – I

Vector Calculus: Vector Calculus: Scalar point function and vector point function, Gradient- Divergence- Curl and their related properties. Solenoidal and irrotational vectors – finding the Potential function. Laplacian operator. Line integral – work done – Surface integrals -Volume integral. Green's Theorem, Stoke's theorem and Gauss's Divergence Theorems (Statement & their Verification).

UNIT – II:

Fourier series and Fourier Transforms: Definition of periodic function. Fourier expansion of periodic functions in a given interval of length 2π . Determination of Fourier coefficients – Fourier series of even and odd functions – Fourier series in an arbitrary interval – even and odd periodic continuation – Half-range Fourier sine and cosine expansions.
Fourier integral theorem - Fourier sine and cosine integrals. Fourier transforms – Fourier sine and cosine transforms – properties – inverse transforms – Finite Fourier transforms.

UNIT – III:

Interpolation and Curve fitting

Interpolation: Introduction- Errors in Polynomial Interpolation – Finite differences- Forward Differences- Backward differences –Central differences – Symbolic relations of symbols. Difference expressions – Differences of a polynomial-Newton's formulae for interpolation - Gauss Central Difference Formulae –Interpolation with unevenly spaced points-Lagrange's Interpolation formula.
Curve fitting: Fitting a straight line –Second degree curve-exponential curve-power curve by method of least squares.

UNIT – IV : Numerical techniques

Solution of Algebraic and Transcendental Equations and Linear system of equations: Introduction – Graphical interpretation of solution of equations .The Bisection Method – The Method of False Position – The Iteration Method – Newton-Raphson Method .
Solving system of non-homogeneous equations by L-U Decomposition method (Crout's Method). Jacobi's and Gauss-Seidel iteration methods.

UNIT – V

Numerical Integration and Numerical solutions of differential equations:
Numerical integration - Trapezoidal rule, Simpson's $1/3^{rd}$ and 3/8 Rule , Gauss-Legendre one point, two point and three point formulas.

Numerical solution of Ordinary Differential equations: Picard's Method of successive approximations. Solution by Taylor's series method – Single step methods-Euler's Method-Euler's modified method, Runge-Kutta (second and classical fourth order) Methods.

Boundary values & Eigen value problems: Shooting method, Finite difference method and solving eigen values problems, power method

TEXT BOOKS:

1. Advanced Engineering Mathematics by Kreyszig, John Wiley & Sons.
2. Higher Engineering Mathematics by Dr. B.S. Grewal, Khanna Publishers.

REFERENCES:

1. Mathematical Methods by T.K.V. Iyengar, B.Krishna Gandhi & Others, S. Chand.
2. Introductory Methods by Numerical Analysis by S.S. Sastry, PHI Learning Pvt. Ltd.
3. Mathematical Methods by G.Shankar Rao, I.K. International Publications, N.Delhi
4. Advanced Engineering Mathematics with MATLAB, Dean G. Duffy, 3rd Edi, 2013, CRC Press Taylor & Francis Group.
5. Mathematics for Engineers and Scientists, Alan Jeffrey, 6ht Edi, 2013, Chapman & Hall/ CRC
6. Advanced Engineering Mathematics, Michael Greenberg, Second Edition. Person Education
7 Mathematics For Engineers By K.B.Datta And M.A S.Srinivas,Cengage Publications

Outcomes: From a given discrete data, one will be able to predict the value of the data at an intermediate point and by curve fitting, can find the most appropriate formula for a guessed relation of the data variables. This method of analysis data helps engineers to understand the system for better interpretation and decision making

- After studying this unit one will be able to find a root of a given equation and will be able to find a numerical solution for a given differential equation.
- Helps in describing the system by an ODE, if possible. Also, suggests to find the solution as a first approximation.
- One will be able to find the expansion of a given function by Fourier series and Fourier Transform of the function.
- Helps in phase transformation, Phase change and attenuation of coefficients in acoustics.
- After studying this unit, one will be able to find a corresponding Partial Differential Equation for an unknown function with many independent variables and to find their solution.
- Most of the problems in physical and engineering applications, problems are highly non-linear and hence expressing them as PDEs'. Hence understanding the nature of the equation and finding a suitable solution is very much essential.
- After studying this unit, one will be able to evaluate multiple integrals (line, surface, volume integrals) and convert line integrals to area integrals and surface integrals to volume integrals.
- It is an essential requirement for an engineer to understand the behavior of the physical system.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

II Year B.Tech. MME- I Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

ELECTRICAL ENGINEERING

Objective:
This course introduces the concepts of electrical DC and AC circuits, basic law's of electricity, instruments to measure the electrical quantities, different methods to solve the electrical networks, construction operational features of energy conversion devices i.e. DC machines, transformers, induction motors and synchronous machines.

UNIT I
Introduction: SI Unit's 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.
Electrical Instruments: Basic principles of indicating instruments – moving coil and moving iron instruments (Ammeters and voltmeters).

UNIT II
Single Phase AC Circuits: Generation of an alternating EMF – average and RMS values of alternating quantity – representation of alternating quantities by phasors – single phase series and parallel circuits (simple problems)– series and parallel resonance – three phase balanced systems – single and three phase power calculations.

UNIT III
DC Generators: Principle of operation of DC machines – EMF equation – types of generators – Magnetization and Load characteristics of DC generators
DC 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 IV
Transformers: Construction and principle of operation of single phase transformer –EMF equation O.C. & S.C. tests – efficiency and regulation.
Induction Motors: Principle and operation of three phase induction motors – types of motors, Squirrel cage and slip ring motor – slip torque characteristics.

UNIT V
Alternators: Principle and operation of alternators – O.C. & S.C. tests – regulation by synchronous impedance method.

TEXT BOOKS:
1. Basic concepts of Electrical Engineering, PS Subramanyam, BS Publications.
2. Basic Electrical Engineering, S.N. Singh, PHI.

REFERENCE BOOKS:
1. Basic Electrical Engineering, Abhijit Chakrabarthi, Sudipta nath, Chandrakumar Chanda, Tata-McGraw-Hill.
2. Principles of Electrical Engineering, V.K Mehta, Rohit Mehta, S.Chand Publications.
3. Basic Electrical Engineering, T.K.Nagasarkar and M.S. Sukhija, Oxford University Press.
4. Fundamentals of Electrical Engineering, RajendraPrasad, PHI.
5. Basic Electrical Engineering by D.P.Kothari , I.J. Nagrath, McGraw-Hill.

Outcome:
After going through this course the student gets a thorough knowledge on basic electrical circuits, parameters, and operation of the transformers in the energy conversion process, electromechanical energy conversion, construction operation characteristics different types applications of DC and AC machines and the constructional features and operation of measuring instruments like voltmeter, ammeter, wattmeter etc..., With which he/she can able to apply the above conceptual things to real-world electrical and electronics problems and applications.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

II Year B.Tech. MME- I Sem	**L**	**T/P/D**	**C**
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MECHANICS OF SOLIDS

UNIT – I

Simple Stresses & Strains : Elasticity and plasticity – Types of stresses & strains–Hooke's law– stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio & volumetric strain – Elastic moduli & the relationship between them – Bars of varying section – compositebars – 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 contra flexure – 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.

Shear Stresses: Derivation of formula – Shear stress distribution across various beams sections like rectangular, circular, triangular, I, T angle sections.

UNIT-IV

Principal Stresses and Strains: Introduction – Stresses on an inclined section of a bar under axial loading – compound stresses – Normal and tangential stresses on an inclined plane for biaxial stresses – Two perpendicular normal stresses accompanied by a state of simple shear – Mohr's circle of stresses – Principal stresses and strains – Analytical and graphical solutions.

Theories of Failure: Introduction – Various theories of failure - Maximum Principal Stress Theory, Maximum Principal Strain Theory, Strain Energy and Shear Strain Energy Theory (Von Mises Theory).

UNIT – V

Torsion of Circular Shafts : Theory of pure torsion – Derivation of Torsion equations : $T/J = q/r = N\theta/L$ – Assumptions made in the theory of pure torsion – Torsional moment of resistance – Polar section modulus – Power transmitted by shafts – Combined bending and torsion and end thrust – Design of shafts according to theories of failure.

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– Thin spherical shells.

TEXT BOOKS :

1. Strength of materials – R.S. Kurmi and Gupta.
2. Solid Mechanics, by Popov
3. Strength of Materials – Ryder. G.H.; Macmillan Long Man Pub.
4. Strength of Materials – W.A. Nash, TMH

REFERENCES :

1. Strength of Materials -By Jindal, Umesh Publications.
2. Analysis of structures by Vazirani and Ratwani.
3. Mechanics of Structures Vol –I by H.J.Shah and S.B.Junnarkar, Charotar Publishing House Pvt. Ltd.
4. Strength of Materials by D.S Prakash Rao, Universities Press Pvt. Ltd.
5. Strength of Materials by S.S.Rattan, Tata McGraw Hill Education Pvt. Ltd.
6. Fundamentals of Solid Mechancis by M.L.Gambhir, PHI Learning Pvt. Ltd
7. Strength of Materials by R.K Rajput, S.Chand & Company Ltd.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

II Year B.Tech. MME- I Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

OBJECT ORIENTED PROGRAMMING THROUGH JAVA

Learning Objectives:

- To understand object oriented programming concepts, and apply them in problem solving
- To learn the basics of java Console and GUI based programming

UNIT -I:

Object Oriented Thinking and Java Basics: Need for OOP Paradigm, Summary of OOP Concepts, Coping with Complexity, Abstraction Mechanisms, A Way of Viewing World – Agents, Responsibility, Messages, Methods, History of Java, Java Buzzwords, Data Types, Variables, Scope and Life Time of Variables, Arrays, Operators, Expressions, Control Statements, Type Conversion and Casting, Simple Java Program, Concepts of Classes, Objects, Constructors, Methods, Access Control, This Keyword, Garbage Collection, Overloading Methods and Constructors, Method Binding, Inheritance, Overriding and Exceptions, Parameter Passing, Recursion, Nested and Inner Classes, Exploring String Class.

UNIT -II:

Inheritance, Packages and Interfaces: Hierarchical Abstractions, Base Class Object, Subclass, Subtype, Substitutability, Forms of Inheritance- Specialization, Specification, Construction, Extension, Limitation, Combination, Benefits of Inheritance, Costs of Inheritance. Member Access Rules, Super Uses, Using Final with Inheritance, Polymorphism- Method Overriding, Abstract Classes, The Object Class.

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, Exploring Java.IO.

UNIT -III:

Exception Handling and Multithreading: Concepts of Exception Handling, Benefits of Exception Handling, Termination or Resumptive Models, Exception Hierarchy, Usage of Try, Catch, Throw, Throws and Finally, Built in Exceptions, Creating Own Exception Sub Classes.

String Handling, Exploring Java.Util, Differences between Multi-Threading and Multitasking, Thread Life Cycle, Creating Threads, Thread Priorities, Synchronizing Threads, Interthread Communication, Thread Groups, Daemon Threads.

Enumerations, Autoboxing, Annotations, Generics.

UNIT -IV:

Event Handling: Events, Event Sources, Event Classes, Event Listeners, Delegation Event Model, Handling Mouse and Keyboard Events, Adapter Classes.

The AWT Class Hierarchy, User Interface Components- Labels, Button, Canvas, Scrollbars, Text Components, Check Box, Check Box Groups, Choices, Lists Panels – Scrollpane, Dialogs, Menubar, Graphics, Layout Manager – Layout Manager Types – Border, Grid, Flow, Card and Grid Bag.

UNIT -V:

Applets: Concepts f Applets, Differences between Applets and Applications, Life Cycle of an Applet, Types of Applets, Creating Applets, Passing Parameters to Applets.

Swing: Introduction, Limitations of AWT, MVC Architecture, Components, Containers, Exploring Swing- Japplet, Jframe and Jcomponent, Icons and Labels, Text Fields, Buttons – The Jbutton Class, Check Boxes, Radio Buttons, Combo Boxes, Tabbed Panes, Scroll Panes, Trees, and Tables.

TEXT BOOKS:

1. Java the Complete Reference, 7th Editon, Herbert Schildt, TMH.
2. Understanding OOP with Java Updated Edition, T. Budd, Pearson Education.

REFERENCE BOOKS:

1. An Introduction to Programming and OO Design using Java, J.Nino and F.A. Hosch, John wiley & Sons.
2. An Introduction to OOP, Third Edition, T. Budd, Pearson Education.
3. Introduction to Java Programming, Y. Daniel Liang, Pearson Education.
4. An Introduction to Java Programming and Object Oriented Application Development, R.A. Johnson-Thomson.
5. Core Java 2, Vol 1, Fundamentals, Cay.S.Horstmann and Gary Cornell, Eighth Edition, Pearson Education.

6. Core Java 2, Vol 2, Advanced Features, Cay.S.Horstmann and Gary Cornell, eighth Edition, Pearson Education

Expected Outcome:

The student is expected to have

- Understanding of OOP concepts and basics of java programming (Console and GUI based)
- The skills to apply OOP and Java programming in problem solving
- Should have the ability to extend his knowledge of Java programming further on his/her own.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

II Year B.Tech. MME- I Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

PHYSICAL METALLURGY

Objective:
The Prime objective of this course is to make the student understand the interrelation between microstructure and characteristics of Metals and Alloys. The course also critically focuses on the crystallography, phase transformations that occur in several ferrous and nonferrous metallurgical systems as a function of temperature and composition through phase equilibrium diagrams.

UNIT – I
Crystal structure: Crystallography: space lattice, unit cell, lattice parameter, coordination number, atomic radius, packing factor, density calculations. Miller's indices. Relation between crystal structure and ductility. Solidification: homogeneous and heterogeneous nucleation. Polymorphism.

UNIT – II
Microstructures: Grains and grain boundaries. ASTM Grain Size. Grain size dependence of strength. Strain hardening, Recrystallization, and grain growth. Solid solutions - substitutional and interstitial solid solutions.

UNIT – III
Binary Phase diagrams: Construction. Isomorphous and eutectic systems-Specific examples: Cu-Ni, Pb-Sn, Al-Cu. Structure evolution. Phase rule. Lever rule. Hume-Rothery rules. Importance of electron-to-atom ratio. Intermediate phases, Intermetallic compounds. Application of phase diagrams. Precipitation hardening.

UNIT – IV
Iron-Carbon Phase Diagram: Phase Transformations. Microstructures and quantitative phase evaluation of the Fe-C Alloys. Effect of alloying elements on the phase diagram.

UNIT – V
Isothermal transformation diagrams: Construction and interpretation. Effect of alloying elements on kinetics of transformation. Pearlitic, Bainitic, and Martensitic transformations.

TEXT BOOKS:
1. Introduction to Physical Metallurgy – Sidney H. Avner, Published October 1st 1974 by McGraw-Hill Companies
2. Materials Science and Engineering, An introduction - WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007

REFERENCES:

1. Engineering Physical Metallurgy and Heat treatment – Yuri Lakhtin
2. C. Suryanarayana, Experimental Techniques in Mechanics and Materials, John Wiley, 2006
3. Foundations of Materials Science and Engineering – William Fortune Smith, Javad Hashemi McGraw-Hill Higher Education, 01-July-2003
4. Metallographic Laboratory Practice – George Louis Kehl McGraw-Hill, 1939
5. Essentials of Materials Science Engineering-Donald R. Askeland, Pradeep P. Phule, Cengage learning.
6. Materials Science and Metallurgy- C. Daniel Yesudian, D. G. Harris Samuel, Scitech Publications.
7. Engineering Materials-V.S.R Murthy, A.K. Jena, TataMcGraw Hill
8. Engineering Materials and Metallurgy-R. Srininasan, TataMcGraw Hill

Outcome:
At the conclusion of this course, the student will be able to appreciate and establish the crystal structure of metals, structure-property correlation in metals, importance of phase equilibrium diagrams of ferrous (in particular Iron-Carbon System) and nonferrous metallurgical systems and their significance as a tool for alloy design. The student will also be able to determine the quantity of phases present, ASTM Grain Size, kinetics of solidification of alloys.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

II Year B.Tech. MME- I Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

THERMODYNAMICS AND KINETICS

Objective:
This course is designed to emphasize clear cut understanding of the laws of thermodynamics, calculation of work in various thermodynamic processes, Free Energy Functions, their significance in determining the feasibility of metallurgical processes, and derivations associated with it. To obviate the shortcoming of Thermodynamics, Kinetic aspects of Chemical reactions with necessary equations is also dealt in detail.

UNIT-I
Fundamentals and basic laws of thermodynamics: Objectives and limitations to thermodynamics, concepts of system and state, thermodynamic variables, thermodynamic equilibrium. Reversible and irreversible processes, Zeroth law of thermodynamics
First Law of thermodynamics: Nature of first law, relationship between heat and work, internal energy, calculations of work in reversible adiabatic processes, reversible isothermal, and enthalpy change with temperature (Kirchoff's Equation)

UNIT-II
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.
Third law of thermodynamics: Background of third law deductions from third law, applications of third law, and other methods of obtaining ΔS^0 for a reaction,

UNIT-III
Free energy functions: Definition of Helmholtz and Gibbs free energy functions, meaning of thermodynamically possible process, determination of ΔG from thermal data useful relationships between free energies and other thermodynamic functions, Maxwell's equation and Gibbs-Helmholtz equation. Fugacity, activity and equilibrium constant, variation of the equilibrium constant with temperature,

UNIT-IV
Derivation of Gibb's phase rule, Application of phase rule to unary, binary and multicomponent systems, Claussius – Clapeyron equation: Introduction, derivation of the Claussius – Clapeyron equation for single substance, Duhriges rule for the estimation of the vapour pressures of an element, Intergarion of Claussius – Clapeyron equation

UNIT-V
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, consecutives and simultaneous reactions, catalysis in chemical reactions.

TEXT BOOKS:

1. Introduction to Metallurgical Thermodynamics – D.R. Gaskel
2. Physical chemistry of metals-L. S. Darken & Gurry

REFERENCES:

1. Physical chemistry for Metallurgists – J. Mackowick
2. Thermodynamics of solids-R.S.Swalin
3. Text Book of Materials and Metallurgical Thermodynamics: Ahindra Ghosh (PHI)
4. De Hoff, Robert, Thermodynamics in Materials Science, Second edition, CRC Press, 2006.
5. Lee, H. G., Chemical Thermodynamics for Metals and Materials, Imperial College Press, 2001.
6. Fundamentals of thermodynamics - Sonntaget al

Outcome:
The student will be thorough in establishing the feasibility of metallurgical reactions via determination of free energy change as a function of temperature. He will be able to solve the numerical problems on determination of equilibrium constant, vapour pressure of an element, order of a chemical reaction.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

II Year B.Tech. MME- I Sem	**L**	**T/P/D**	**C**
	-	**-/3/-**	**2**

JAVA PROGRAMMING LAB

Objectives: To introduce java compiler and eclipse platform
To impart hand on experience with java programming

Note:

1. **Use Linux and MySQL for the Lab Experiments. Though not mandatory, encourage the use of Eclipse platform**
2. **The list suggests the minimum program set. Hence, the concerned staff is requested to add more problems to the list as needed**

1) Use Eclipse or Netbean platform and acquaint with the various menus. Create a test project, add a test class and run it. See how you can use auto suggestions, auto fill. Try code formatter and code refactoring like renaming variables, methods and classes. Try debug step by step with a small program of about 10 to 15 lines which contains at least one if else condition and a for loop.
2) Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -,*, % operations. Add a text field to display the result. Handle any possible exceptions like divided by zero
3 a) Develop an applet in Java that displays a simple message.
b) Develop an applet in Java that receives an integer in one text field, and computes its factorial Value and returns it in another text field, when the button named “Compute” is clicked.
4 Write a Java program that creates a user interface to perform integer divisions. The user enters two numbers in the text fields, Num1 and Num2. The division of Num1 and Num2 is displayed in the Result field when the Divide button is clicked. If Num1 or Num2 were not an integer, the program would throw a Number Format Exception. If Num2 were Zero, the program would throw an Arithmetic Exception. Display the exception in a message dialog box.
5 Write a Java program that implements a multi-thread application that has three threads. First thread generates random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.
6 Write a Java program that connects to a database using JDBC and does add, delete, modify and retrieve operations.
7 Write a Java program that simulates a traffic light. The program lets the user select one of three lights: red, yellow, or green with radio buttons. On selecting a button, an appropriate message with “Stop” or “Ready” or “Go” should appear above the buttons in selected color. Initially, there is no message shown.
8 Write a Java program to create an abstract class named Shape that contains two integers and an empty method named printArea(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method printArea () that prints the area of the given shape.
9 Suppose that a table named Table.txt is stored in a text file. The first line in the file is the header, and the remaining lines correspond to rows in the table. The elements are separated by commas. Write a java program to display the table using Labels in Grid Layout.
10 Write a Java program that handles all mouse events and shows the event name at the center of the window when a mouse event is fired (Use Adapter classes).
11 Write a Java program that loads names and phone numbers from a text file where the data is organized as one line per record and each field in a record are separated by a tab (\t). It takes a name or phone number as input and prints the corresponding other value from the hash table (hint: use hash tables).
12 Implement the above program with database instead of a text file.
13 Write a Java program that takes tab separated data (one record per line) from a text file and inserts them into a database.
14 Write a java program that prints the meta-data of a given table

TEXT BOOK:

1. Java Fundamentals – A comprehensive Introduction, Herbert Schildt and Dale Skrien, TMH.

REFERENCE BOOKS:

1. Java for Programmers, P.J.Deitel and H.M.Deitel, Pearson education (OR) Java: How to Program P.J.Deitel and H.M.Deitel, PHI.
2. Object Oriented Programming through Java, P.Radha Krishna, Universities Press.
3. Thinking in Java, Bruce Eckel, Pearson Education
4. Programming in Java, S.Malhotra and S.Choudhary, Oxford Univ. Press.

Outcomes: The student is expected to have hands on experience with the following:

- Basics of java programming, multi-threaded programs and Exception handling
- The skills to apply OOP in Java programming in problem solving
- Ability to access data from a DB with Java programs
- Use of GUI components (Console and GUI based)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

II Year B.Tech. MME- I Sem	**L**	**T/P/D**	**C**
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PHYSICAL METALLURGY LAB

Objective:
This course essentially aims at making the students gain hands on experience on the equipment used for metallographic specimen preparation, optical microscopy and image analysis. The course would also have some study practices where in the construction of basic crystal structure models, phase diagrams are included.

1. Preparation of precise crystal structure models and study of their structural parameters, calculation of packing factor.
2. Preparation of specimen for metallographic examination.
3. Study of principle, construction and salient features of different classes of metallurgical microscopes.
4. Calculation of Grain Size and ASTM Grainsize number and determination and inclusion content in the given materials.

Microstructural analysis of ferrous alloys

5. Identification and analysis of microstructure of hypoeutectoid, eutectoid, and hypereutectoid steels.
6. Identification and analysis of microstructure of Alloy steels.
7. Identification and analysis of microstructure of different classes of cast irons.

Microstructural analysis of ferrous alloys

8. Identification and analysis of microstructure of various nonferrous alloys viz.,
   - Aluminum base
   - Copper base and
   - Titanium base alloys

Construction of phase equilibrium diagrams

9. Construction of graphical representation of ismorphous phase equilibrium diagram and study of phases, invariant points, and invariant reactions.
10. Construction of graphical representation of eutectic phase equilibrium diagrams and study of phases, invariant points, and invariant reactions.
11. Construction of graphical representation of Iron-Iron Carbide phase equilibrium diagram and study of phases, invariant points, and invariant reactions.

Outcome:
The student will be able to identify and analyze the microstructural features of the given ferrous/nonferrous metallic sample. He would also have thorough theoretical approach in construction of phase diagrams.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

II Year B.Tech. MME-II Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

MATHEMATICS – III

Objectives: To learn

- Transforming the given variable coefficient equation (Cauchy's and Lagrange's) into the one with constant coefficients.
- Identifying ordinary points, singular points and regular singular points for the given ODE.
- Finding the series solution around a regular singular point.
- Solve the given ODE with variable coefficients by Frobenius method and test the convergence of its series solution.
- Series solutions for Legendre and Bessel differential equations, analyzing the properties of Legendre and Bessel polynomials.
- Differentiation and Integration of complex valued functions.
- Evaluation of integrals using Cahchy's integral formula.
- Taylor's series, Maclaurin's series and Laurent's series expansions of complex functions
- Evaluation of integrals using residue theorem.
- Transform a given function from z - plane to w – plane.
- Identify the transformations like translation, magnification, rotation and reflection and inversion.
- Properties of bilinear transformations.

UNIT – I:
Linear ODE with variable coefficients and series solutions(second order only): Equations reducible to constant coefficients-Cauchy's and Lagrange's differential equations. Motivation for series solutions, Ordinary point and Regular singular point of a differential equation , Transformation of non-zero singular point to zero singular point. Series solutions to differential equations around zero, Frobenius Method about zero.

Unit-II
Special Functions : Legendre's Differential equation, General solution of Legendre's equation, Legendre polynomials Properties: Rodrigue's formula – Recurrence relations, Generating function of Legendre's polynomials – Orthogonality. Bessel's Differential equation, Bessel functions properties: – Recurrence relations, Orthogonality, Generating function , Trigonometric expansions involving Bessel functions.

UNIT-III:
Complex Functions –Differentiation and Integration : Complex functions and its representation on Argand plane, Concepts of limit Continuity, Differentiability, Analyticity, Cauchy-Riemann conditions, Harmonic functions – Milne – Thompson method. Line integral – Evaluation along a path and by indefinite integration – Cauchy's integral theorem – Cauchy's integral formula – Generalized integral formula.

UNIT-IV:
Power series expansions of complex functions and contour Integration: 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. 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) $\int_{c}^{c+2\pi} f(\cos\theta, \sin\theta)d\theta$

UNIT-V:
Conformal mapping: Transformation of z-plane to w-plane by a function, Conformal transformation. Standard transformations- Translation; Magnification and rotation; inversion and reflection,Transformations like e^z, log z, z^2, and Bilinear transformation. Properties of Bilinear transformation, determination of bilinear transformation when mappings of 3 points are given .

TEXT BOOKS:
1. Advanced Engineering Mathematics by Kreyszig, John Wiley & Sons.
2. Higher Engineering Mathematics by Dr. B.S. Grewal, Khanna Publishers.

REFERENCES:

1) Complex Variables Principles And Problem Sessions By A.K.Kapoor, World Scientific Publishers
2) Engineering Mathematics-3 By T.K.V.Iyengar andB.Krishna Gandhi Etc
3) A Text Book Of Engineering Mathematics By N P Bali, Manesh Goyal
4) Mathematics for Engineers and Scientists, Alan Jeffrey, 6th Edit. 2013, Chapman & Hall/CRC
5) Advanced Engineering Mathematics, Michael Greenberg, Second Edition. Person Education
6) Mathematics For Engineers By K.B.Datta And M.A S.Srinivas,Cengage Publications

Outcome: After going through this course the student will be able to:

- Apply the Frobenius method to obtain a series solution for the given linear 2nd ODE.
- Identify Bessel equation and Legendre equation and solve them under special conditions with the help of series solutions method. Also recurrence relations and orthogonality properties of Bessel and Legendre polynomials.

After going to through this course the student will be able to

a. analyze the complex functions with reference to their analyticity, Integration using Cauchy's integral theorem,
b. Find the Taylor's and Laurent series expansion of complex functions
c. The conformal transformations of complex functions can be dealt with ease.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

II Year B.Tech. MME-II Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

MECHANICS OF FLUIDS

Aim & Objectives:
The student will gain insight into a number of potentially useful phenomena involving movement of fluids. He/she will learn to do elementary calculations for engineering application of fluid motion. This course also prepares the student for more advanced courses such as Aerodynamics- I & -II.

UNIT I
Fluid Properties: Density, specific weight , specific gravity, surface tension & capillarity, Newton's law of viscosity, incompressible & compressible fluid, numerical problems.
Hydrostatic forces on submerged bodies: Pressure at a point, Pascal's law, pressure variation with temperature and height, Center of pressure on vertical, inclined and curved surfaces.
Manometers- simple and differential manometers, inverted manometers, micro manometers, Pressure gauges and numerical problems. **Buoyancy**- Archimedes's Principle, Metacenter, meta centric height calculations.

UNIT II
Fluid Kinematics: Stream line, path line, streak line, stream surface, stream tube, classification of flows: steady, unsteady, uniform, non uniform, laminar, turbulent flows. One dimensional approximation, examples of real 1-D flows, two dimensional approximation, 2-D flow in wind tunnel, continuity equations for 1-D and 2-D flows both compressible and incompressible, stream function for two dimensional incompressible flows. Vorticity, irrotational flow, Velocity potential function.

UNIT III
Fluid Dynamics: Surface & body forces, substantive derivative, local derivative and convective derivative, momentum equation, Euler equation, Bernoulli's equation, .Phenomenological basis of Navier-Stokes equation, Introduction to vortex flows.
Statement of Buckingham's π-theorem, Similarity parameters: Reynolds number, Froude number, Concepts of geometric, kinematic and dynamic similarity, Reynolds number as a very approximate measure of ratio of Inertia Force and Viscous Force, flow measurements : pressure, velocity and mass flow rate, viscosity , Pitot-static tube, venturi meter and orifice meter, viscometers, .

UNIT IV
Boundary Layer: Introductory concepts of boundary layer, Large Reynolds number flows and Prandtl's boundary layer hypothesis, Qualitative description of Boundary layer thickness and velocity profile on a flat plate and flow around submerged objects. Pressure drag and skin friction drag.

UNIT V
Pipe flow: Reynolds experiment, Darcy's equation, major and minor losses in pipes and numerical problems.
Exact solutions of Navier stokes equations, flow between parallel plates, flow through long tubes, Fully developed flow, turbulent flow, variation of friction factor with Reynolds number, Moody's chart.

TEXT BOOKS:
1. Engineering Fluid mechanics – K.L . Kumar, S.Chand & Co.
2. Introduction to Fluid Mechanics and Fluid machines – S.K. Som and G. Biswas

REFERENCES:
1. Fluid Mechanics – Frank M and White, Mc-Grawhill.
2. Fluid Mechanics- Fox and Mc Donald
3. Fluid Mechanics – E. Rathakrishnan

Outcome:
It makes the student ready to understand advance Aero dynamics.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

II Year B.Tech. MME-II Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

ENVIRONMENTAL STUDIES

Objectives:

1. Understanding the importance of ecological balance for sustainable development.
2. Understanding the impacts of developmental activities and mitigation measures.
3. Understanding the environmental policies and regulations

UNIT-I :

Ecosystems: Definition, Scope and Importance of ecosystem. Classification, structure and function of an ecosystem, Food chains, food webs and ecological pyramids. Flow of energy, Biogeochemical cycles, Bioaccumulation, Biomagnification, ecosystem value, services and carrying capacity, Field visits.

UNIT-II:

Natural Resources: Classification of Resources: Living and Non-Living resources, **water resources:** use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problems. **Mineral resources:** use and exploitation, environmental effects of extracting and using mineral resources, **Land resources:** Forest resources, **Energy resources:** growing energy needs, renewable and non renewable energy sources, use of alternate energy source, case studies.

UNIT-III:

Biodiversity and Biotic Resources: Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity; consumptive use, productive use, social, ethical, aesthetic and optional values. India as a mega diversity nation, Hot spots of biodiversity. Field visit. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; conservation of biodiversity: In-Situ and Ex-situ conservation. National Biodiversity act.

UNIT-IV:

Environmental Pollution and Control Technologies: Environmental Pollution: Classification of pollution, **Air Pollution:** Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards. **Water pollution:** Sources and types of pollution, drinking water quality standards. **Soil Pollution:** Sources and types, Impacts of modern agriculture, degradation of soil. **Noise Pollution:** Sources and Health hazards, standards, **Solid waste:** Municipal Solid Waste management, composition and characteristics of e-Waste and its management. **Pollution control technologies:** Wastewater Treatment methods: Primary, secondary and Tertiary.
Overview of air pollution control technologies, Concepts of bioremediation. **Global Environmental Problems and Global Efforts: C**limate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS). Deforestation and desertification. International conventions / Protocols: Earth summit, Kyoto protocol and Montréal Protocol.

UNIT-V:

Environmental Policy, Legislation & EIA: Environmental Protection act, Legal aspects Air Act- 1981, Water Act, Forest Act, Wild life Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. EIA: EIA structure, methods of baseline data acquisition. Overview on Impacts of air, water, biological and Socio-economical aspects. Strategies for risk assessment, Concepts of Environmental Management Plan (EMP). **Towards Sustainable Future:** Concept of Sustainable Development, Population and its explosion, Crazy Consumerism, Environmental Education, Urban Sprawl, Human health, Environmental Ethics, Concept of Green Building, Ecological Foot Print, Life Cycle assessment (LCA), Low carbon life style.

SUGGESTED TEXT BOOKS:

1 Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.
2 Environmental Studies by R. Rajagopalan, Oxford University Press.

REFERENCE BOOKS:

1. Environmental Science: towards a sustainable future by Richard T.Wright. 2008 PHL Learning Private Ltd. New Delhi.
2. Environmental Engineering and science by Gilbert M.Masters and Wendell P. Ela .2008 PHI Learning Pvt. Ltd.
3. Environmental Science by Daniel B.Botkin & Edward A.Keller, Wiley INDIA edition.
4. Environmental Studies by Anubha Kaushik, 4th Edition, New age international publishers.
5. Text book of Environmental Science and Technology - Dr. M. Anji Reddy 2007, BS Publications.

Outcomes:
Based on this course, the Engineering graduate will understand /evaluate / develop technologies on the basis of ecological principles and environmental regulations which inturn helps in sustainable development

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

II Year B.Tech. MME-II Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

FUELS, FURNACES AND REFRACTORIES

Objective:
This course is mainly intended to describe the importance and characterization of conventional and unconventional fuels that are employed in metallurgical processes; construction, salient features and heat transfer of various furnaces; measurement of temperature through pyrometers. The characterization, manufacture, testing and applications of refractories are also dealt as an integral part of the course.

UNIT- I
Introduction to Fuels, Classification of fuels. Principles of Carbonization, Manufacture of Metallurgical coke Properties of Metallurgical Coke Testing of Coke.
Principles of production of fuel oils from crude. Manufacture, properties and uses of Producer gas, Water gas, Blast furnace gas, and Coke Oven gas.
Nuclear Fuels: Introduction; Comparison between conventional Fuels and Nuclear Fuels;
Classification – Fissile and Fertile fuels; Fission and Fusion, Energy Release and Chain reaction.

UNIT- II
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-III
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-IV
Pyrometry: Thermo electric pyrometry - peltier and Thomas EMFs. Thermo-electric power of thermocouples. Required properties of thermocouples. Noble and base metal thermocouples. Thermo-piles. Measurement of e.m.f by Milli-voltmeters and potentiometers.Thermometer; optical and radiation pyrometers.

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

TEXT BOOK:
1. Furnaces, Fuels and refractories: O. P. Gupta, Khanna Publishers.
2. Fuels, Furnaces, Refractories & Pyrometry- A. V. K.Surya Narayana.

REFERENCES:
1. Elements of fuel technology -HIMUS
2. Refractories by Norton
3. Refractories - R. Chisti.
4. Furances - J. D. Gilchrist
5. Pyrometry - W. P. Wood & J.M. Corck
6. Elements of heat transfer - Jakob & Hawikns.
7. Elements of thermodynamics& heat transfer - Obert & Young.
8. Control systems & Instrumentation: S. Bhasker.

Outcome:
On understanding the technology of fuels, furnaces and refractories, the student will be able to select suitable furnace/refractories to meet the industrial requirements.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

II Year B.Tech. MME-II Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

METALLURGICAL THERMODYNAMICS

Objective:
The prime aim of this course is to apply thermodynamics and kinetics to various metallurgical aspects like Solutions, Phase diagrams, Diffusion, and Ellingham Diagrams. The course is also intended to correlate electrochemical principles with thermodynamics.

UNIT-I
Diffusion In Solids: Fick's law of diffusion and its application, Kirkendal effect, Darken's equations, the Metano method, Determination of intrinsic diffusivities, Diffusion Mechanisms in metals, self-diffusion in pure metals, diffusion along the grain boundaries and surfaces, Temperature dependence of the diffusion coefficient.

UNIT-II
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 Richardson's diagrams.

UNIT III
Solutions: Composition, partial molal quantities, Gibb's - Duhem equation, integration of Gibbs' - Duhem equation, Ideal dilute solutions, Ideal solutions, (Raoults Law), Non-ideal solutions (Henry's Law), Excess thermodynamics quantities, Sieverts law.

UNIT IV
Application to Phase Diagrams:
Concept of chemical potential, Equality of chemical potentials in equilibrated phases, Calculation of solidus and liquids lines for an ideal solution, Calculation of liquidus line for eutectic systems.

UNIT V
Reversible Cells
Electro-chemical cells, galvanic cells, chemical and electrical energy, thermodynamics of Electro-chemical cells, Standard electrode potentials, application of Gibbs-Helmholtz equation to Galvanic cells, Concentration cells.

TEXT BOOKS:
1. Physical Metallurgy for Metallurgists - J. Mackowick
2. Thermodynamics of solids-R A Swalin

REFERENCES:
1. Physical Chemistry of Metals- L S Darken and Gurry
2. Physical Metallurgy Principles-R H Reddhill
3. Text Book of Materials and Metallurgical Thermodynamics- A Ghosh

Outcome:
The student will be able to establish a thermodynamic perception with Metallurgical processes and solve the problems associated with.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

II Year B.Tech. MME-II Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

MINERAL PROCESSING

Objective:
The prime objective of this course is to build a solid foundation on Principles, equipment of various mineral beneficiation procedures that would facilitate metal extraction. It also focuses on mathematical derivations that are associated with concentration processes.

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.
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 law, Kick's law and Bond's law.

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

UNIT III
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. Magnetic separation processes and electrostatic separation process

UNIT IV
Jigging: Theory of jigging. Jigging machines: harz jig, baum jig, and Hancock jig. Design considerations in a jig. Tabling: -study of stratification on a table. Shaking tables, wilfley table. Humphrey's spiral classifier.

UNIT V
Flotation: Principles of flotation. Factors affecting flotation. Classification of collectors, frothers and regulators. Factors affecting their efficiency. Flotation machines: Pneumatic and mechanical flotation cells. Application of flotation process for Cu, Pb and Zn ores.

TEXT BOOKS:
1. Principles of Mineral Dressing - A.M. Gaudin.
2. Mineral processing technology-B. A. Wills

REFERENCES:
1. Elements of Ore Dressing - A. F. Taggart
2. Ore dressing practices - S. K. Jain.

Outcome:
The student will be able to judge the concentration process for a particular mineral. He will also have complete understanding on principles, construction, and working of the equipment for concentration and classification.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

II Year B.Tech. MME-II Sem	**L**	**T/P/D**	**C**
	-	**-/3/-**	**2**

FUELS, FURNACES AND REFRACTORIES LAB

Objective:
This laboratory course critically deals with the characterization of fuels, refractories and measurement of temperature. Apart from this, it also concerns the flow properties of lubricants and their variation with temperature.

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

Equipment:
1. Muffle Furnace (1000^0 c) – 2 No’s
2. Pensky Martins Apparatus
3. Abels Flash Point Apparatus
4. Red – wood – I Viscometer
5. Red – wood – II Viscometer
5. Say bolt Viscometer
6. Bomb Calorimeter
7. Junkers Gas Calorimeter
8. Compression testing Machine
9. Digital Electronic Balance

Outcome:
The student will gain hands-on experience on the equipment that facilitates property evaluation of fuels, lubricants and refractories. This would provide the student to choose the fuels and refractories for specific use in construction of different furnaces.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

II Year B.Tech. MME-II Sem	**L**	**T/P/D**	**C**
	-	**-/3/-**	**2**

MINERAL PROCESSING LAB

Objective:
This course is mainly designed to make the student to understand and determine the process variables in various mineral beneficiation treatments employed. The characteristics of mineral particles like size, size distribution etc. are also evaluated.

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 Stokes 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 comminution. (study)
9. Determination of the efficiency of a magnetic separator.
10. Determination of the efficiency of a jig. (study)
11. Study of the particle separation by fluid flow using Wilfley table. (study)
12. To study the concentration of metallic and non-metallic ores by Froth-Flotation process. (study)

Equipment:
1. Riffle Sampler
2. Sieve Shaker with Sieves
3. Stokes' Apparatus
4. Jaw Crusher
5. Roll Crusher
6. Ball Mill
7. Grindability Index Apparatus
8. Magnetic Separator
9. Jig
10. Wilfley Table
11. Froth – Floatation Equipment
12. Balances

Outcome:
The student will be able to choose the appropriate equipment and regulate the process parameters for the required mineral beneficiation technique.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

III Year B.Tech. MME-I Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

BASIC ELECTRONICS

Objectives:

- Understands the principle of P-N junction diode characteristics and special diodes.
- Usage of filter diode in the applications of rectifiers and redifiers with filters.
- Understands the principle of operation of BJTs and their characteristics in different configurations.
- Understands the principle of operation, characteristics of SCR, applications of SCR and principle of Diac and Triac.
- Understands the two – port small signal analysis of BJT and frequency response characteristics of CE, CB & CC amplifiers and feedback amplifier and various oscillators.
- Understand Timer circuits & welding, heating circuits.

UNIT I

Semiconductor Materials and Junction Diodes: 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: Bipolar Junction Transistor(BJT) structure, principle of operation of npn and pnp transistor, Transistor configurations CB, CE, CC. Relation between I_C, I_B and I_E currents – Input and output characteristics of BJT.
Single Stage Amplifiers: Review, Small Signal Analysis of Junction Transistor, Frequency response of Common Emitter Amplifier, Common Base Amplifier, Common Collector Amplifier.

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 Ri, Ro, Av and AI of an amplifier.
Oscillators: Classification of oscillators, principle of feedback oscillator, Barkhausen's criterion, RC phase shift oscillator, Hartley and Collpits oscillators.

UNIT V

Basic Timer Circuits, Applications, welding control, Resistance welding, Energy storage welding.
Induction and Dielectric heating, Ultrasonic generators and applications.

TEXT BOOKS:

1. E.D.C – Mohommad. H. Rashid, Cengage, 2013
2. Industrial Electronics – G. K. Mithal, Khanna Publications, 19th Edn., 2003.

REFERENCES:

1. Electronic Devices and Circuits – J. Millman and C.C. Halkias, TMH, 1998
2. Basic Electronics – Sedha and Mithal, S. Chand & Co.
3. Electronic Devices and Circuits – K. Lal Kishore, B.S. Publications, 2nd edition, 2005.
4. Thyristors and Applications – M. Ram Murthy, East-West Press, 1977.
5. 8085 Microprocessors and Interfacing – R.S. Goankar.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

III Year B.Tech. MME-I Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

NONFERROUS EXTRACTIVE METALLURGY

Objective:
The basic objective of this course is to deliver various types of extraction methods of well-known and industrially applied nonferrous metals.

UNIT I
Copper: Principle Ores 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: Principle Ores and Minerals, General Principles; Roasting, Horizontal and vertical retort processes; Production by imperial smelting; Leaching purification; Electrolysis, Refining.
Lead: Principle Ores and Minerals Smelting –Reduction process, Roast Reaction process, direct smelting reduction process – Air flash smelting, oxygen flash, oxygen slip bath smelting, QSL process, refining of lead bullion. Pyro and electrolytic refining.
TIN: Principle Ores and Minerals-

UNIT III
Aluminium: Principle Ores and Minerals, Production of pure Al_2O_3, Bayer's process, Devillepechiney Process, Hall - Heroult cell, electrolyte, electrode reactions, Current efficiency, Cell Voltage, Anode effect; Refining of Aluminum, Alternative processes of aluminium production.

UNIT IV
Magnesium; Principle Ores and Minerals, Production of a hydrous Magnesium chloride from sea water and magnesite. Electro-winning practice and problem, refining, Pidgeon and Hansgrig processes.
Titanium: Principle Ores and Minerals, Upgrading of ilmenite, chlorination of titania, Kroll's process. Refining.

UNIT V
Uranium: Principle Ores and Minerals, Acid and alkali processes for digestion of uranium ores, Purification of crude salt, Production of reactor grade UO2 and uranium.
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. Non Ferrous Extractive Metallurgy – G B Gill John Wiley & Sons 1980

REFERENCES:
1. Hand Book of Extractive Metallurgy Vol. 2 & 3, Fathi Habashi Wiley – PCH 1997
2. Extractive Metallurgy of Copper - WGL Davln Port, U King, M Schelesinger and A.K. Biswas, Elsevier Science 2002
3. Metallurgy of Non-Ferrous Metals - WH Dennis.
4. Nuclear Chemical Engineering - Manstion Bendict and Thomas H. Pigfort

Outcome:
The student will be able to ascertain the method of extraction for a particular metal. He would also be able to understand the importance of recovery of precious metallic byproduct values during extraction.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

III Year B.Tech. MME-I Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

MECHANICAL METALLURGY

Objective:
This course is primarily designed to develop the fundamental aspects of mechanics of deformation of metals, Destructive testing, and Fractography.

UNIT- I
Plastic deformation in metals and alloys: Critical resolved shear stress. Defects in crystalline materials: Point and line defects. The concept of dislocations - Edge and screw dislocations, Interaction between dislocations, Energy of a dislocation, dislocation climb, Jogs, Forces on dislocations. Frank Reed source, slip and twinning.

UNIT- II
Fracture: Elementary theories of fracture, Griffiths theory of brittle fracture; Ductile Fracture, Notch sensitivity.
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
Tension Test: Engineering stress and Engineering strain, True stress and True strain and their relations, True stress-strain curve tension test and tensile properties, conditions for necking, effect of temperature and strain rate on tensile properties.
Compression Test: Elastic and in-elastic action in compression. Compression Test.
Impact Test; Notched bar impact test and its significance, Charpy and Izod Tests, significance of transition temperature curve, Metallurgical factors affecting on transition temperature, temper embrittlement. DBTT curve and its importance. Fracture toughness testing - COD and CTOD tests

UNIT-IV
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 life. Low cycle fatigue and High cycle fatigue.

UNIT –V
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 BOOKS:
1. Mechanical Metallurgy - GE Dieter
2. Mechanical behavior of material-A. H. Courteny

REFERENCES:
1. Engineering Materials Science - CW Richards
2. Testing of materials A.V. K. Suryanarayana
3. Mechanical behavior - Ed.Wulf.
4. Mechanical Metallurgy, White and LeMay.

Outcome:
At the end of the course, the student will be able to identify and analyze the fundamentals of deformation mechanism of metals and alloys so that the metal forming operations can be easily understood.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

III Year B.Tech. MME-I Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

HEAT TREATMENT TECHNOLOGY

Objective:
This course is mainly designed to develop knowledge among the students about basic principles and process variables of heat treatment. Thermomechanical treatment, Surface hardening techniques, heat treatment of steels, cast irons, nonferrous alloys are also dealt in detail.

UNIT-I
Principles of Heat Treatment, Annealing, Normalizing, Hardening and Tempering. Mechanism of heat removal during quenching, quenching media, size and mass effect,

UNIT-II
Time Temperature Transformation (TTT) Curves, CCT Curves, Effect of cooling on transformation of Austenitic, perarlitic, bainite, and martensite.

UNIT-III
Effect of alloying elements on T-T-T Diagrams, hardenability. Factors affecting hardenability and its determination

UNIT-IV
Thermo-mechanical treatments, Austempering, Martempering, Patenting, Spheoridizing, Ausforming, Subzero treatment, Isoforming, Cryoforming

UNIT-V
Surface Hardening: Carburizing, Nitriding, Cyaniding, Carbonitriding, Induction and Flame Hardening, Post heat treatment processes. Heat treatment of Cast Irons, Carbon Steels, Alloy steels, Maraging Steels, and Al- Alloys.

TEXT BOOKS:
1. Heat Treatment Principle and Techniques - Rajan & Sharma
2. Heat Treatment of Metals – Zakharov, Mir publishers, Moscow
3. Introduction to Physical Metallurgy – SH Avner, TATA Mc GRAW HILL ,1997

REFERENCES:
1. Engineering physical metallurgy and heat treatment by Yu. Lakhtin
2. Physical Metallurgy - Clark and Varney
3. ASM Metals Hand Book Volume 4
4. Physical Metallurgy-Raghavan

Outcome:
The student will be able to identify and list out various conventional and advanced heat treatment technologies and also be able to select a suitable heat treatment technology for modifying the structure and properties of an alloy of known composition. The student will also be able to design a heat treatment cycle to solve the industry oriented problems with respect to improvement of mechanical properties.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

III Year B.Tech. MME-I Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

IRON PRODUCTION

Objective:
This course is mainly included to provide full picture of production of pig iron in Blast Furnace, Physical Chemistry involved, advancements, and alternate routes of iron making. Sponge Iron production is also included as an integral part.

UNIT-I
History of Iron making; Types of iron ores and their classification. Principles of Iron making – Reduction, Smelting, Direct Reduction, Smelt Reduction; Raw materials for Iron making, their distribution, occurrence in India and in the world. Factors affecting valuation of iron ores.
Preparation of iron ores; Agglomeration of Iron ore fines, **Sintering;** Principles, Factors affecting sintering, sintering bonds, sintering machines;
Pelletisation; Theory of pellatisation, Water-particles system. Production of green pellets; disk and drum pelletisers, Induartion of pellets; Shaft, traveling grate.

UNIT-II
Blast Furnace profile and design considerations. Furnace lining. Furnace cooling system. Hoisting equipment. Blast Furnace Stoves. Blast Furnace gas cleaning system and gas uses. Blast furnace operations and difficulties.

UNIT-III
Physical chemistry of Iron making; Blast furnace reactions; Physical and chemical factors affecting reduction of ores; Relevant CO/CO_2 and H_2/H_2O diagram. Control of C, Si, S and P in iron and slags. Types of Pig Irons and Blast furnace Slags.

UNIT-IV
Modern trends in Blast Furnace. Alternate routes of iron making. Principles of Sponge Iron Making, Degree of Metallization, Percentage Reduction, Classification of Sponge Iron making methods.
Sponge Iron Production - Using gases reducing agent **a.** Midrex process **b**. HYL, **c**. Krupp-Renn; and using solid reducing agent such as SL/RN process

UNIT-V
Smelt Reduction Methods, Classification. Advantages of COREX, INRED, ELRED Processes, Plasma Smelting.

TEXT BOOKS:
1. Principles of Blast furnace Iron making – A.K Biswas
2. Beyond Blast furnace – Amit Chaterjee – CRC Press

REFERENCES:
1. Modern Iron Making – Dr. R. H. Tupkary
2. Iron making and Steel making – Ahindra Ghosh & Amit Chaterjee, PHI Pvt. Ltd. 2008
3. Hand Book of Extractive Metallurgy – Fathi Habhashi Vol. 1 Metals Industry Ferrous Metals
4. Hot metal Production by Smelting Reduction of Iron Oxides – Amit chaterjee, PHI Publications 2010

Outcome:
The student will be able to understand the technology of iron production in detail there by he/she would be in a position of regulating the process variables to enhance the thermal efficiency of Blast Furnace.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

III Year B.Tech. MME-I Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

METAL JOINING TECHNOLOGY

Objective:
The basic objective of this course is to provide in depth knowledge about various metal joining techniques, the thermal, residual, and transformational stresses associated with, the equipment used, their modern developments, and defects and defectoscopy of weldments.

UNIT I
Broad classification of welding processes. Principles, advantages disadvantages and fields of application of the following welding processes. Gas Welding, Arc Welding, Resistance Welding. Other metal joining techniques: Brazing, Soldeing and Adhesive bonding

UNIT II
Advanced Metal Joining Techniques: Plasma Arc Welding, **E**lectron Beam welding; Laser welding, diffusion welding.

UNIT-III
Microstructure of fusion and heat affected zone, Thermal and Residual stresses, pre and post treatments. Mechanical properties of weldments.

UNIT-IV
Welding of structural steel, cast iron, stainless steel and HSLA steels. Welding of copper and its alloys, welding of aluminum and its alloys, joining of dissimilar metals.

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UNIT V
Quality Testing of Weldments by Dye Penetrant and Radiography Testing, Welding defects and remedies

TEXT BOOKS:
1. Welding Technology - R.S.Parmar
2. Welding Technology – O.P. Kanna

REFERENCES:
1. JF Lancaster; Welding Metallurgy
2. Little; Welding and Welding Technology
3. Agarwal Manghmani; Welding Engineering
4. BE Rossi; Welding Engineering
5. Welding and Metal Fabrication-Larry Jeffres-Yesdee Publishing Pvt. Ltd., 2012

Outcome:
The student will be able to apply various metal joining techniques for various ferrous and nonferrous alloys, fixing of process parameters to obtain a sound welding, precautionary measures to be taken to avoid weld defects, and advancements in Metal Joining technologies.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

III Year B.Tech. MME-I Sem	**L**	**T/P/D**	**C**
	-	**/3/-**	**2**

MECHANICAL METALLURGY LAB

Objective:
This laboratory course is mainly designed to know the various testing methods for evaluation of mechanical properties of metals.

1. **Hardness Test**: To determine the Brinell Hardness Values of values of ferrous and non-ferrous samples.
2. To determine the **Rockwell hardness** values of ferrous and nonferrous materials
3. To find the hardness of given materials by using V**ickers hardness tester.**
4. **Tension Test:** To determine the elastic modulus, yield strength ultimate tensile strength, fracture stress, percentage Elongation, percentage reduction in area of the given ferrous and non-ferrous alloys.
5. **Impact Testing:** To determine the Charpy and Izod (V Groove notch) values of a given material at room temperature.
6. **Torsion Test**: To determine the modulus of rigidity of given material.
7. **Fatigue Test:** To determine the fatigue strength of a given material at a given stress.
8. To determine the formability of given materials by **Erichson Cup Test**
9. To manufacture washer components using Fly Press (progressive dies/ Compound dies).
10. **Deep drawing** of a cup with /without blank holder by Hydraulic press.
11. To determine the friction factor by **Ring compression test**
12. Determination of strain hardening exponent ‘n’ and strength coefficient ‘k’.

Outcome:
The student will be able to have hands-on practice on testing of materials for assessing mechanical properties and will be in a position to analyze them.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

III Year B.Tech. MME-I Sem	**L**	**T/P/D**	**C**
	-	**-/3/-**	**2**

HEAT TREATMENT TECHNOLOGY LAB

Objective:
This Laboratory course provides a knowledge of various types of heat treatments and surface hardening treatments for both ferrous and nonferrous metals and alloys.

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 hardened steel.
5. Study of age hardening phenomenon in an aluminum alloy
6. Spheroidizing of high carbon steel
7. Determination of hardenability of a steel using Jominy end Quench Test
8. Re-crystallization studies on cold worked copper or Cu - alloys

Equipment:
1. Muffle Furnaces 1200 ^{0}C
2. Hardenability Apparatus
3. Microscopes
4. Rockwell Hardness Tester

Outcome:
The student will be able to gain hands-on practice about industrial heat treatment processes and structure-property correlation of various\ metals and alloys.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

III Year B.Tech. MME-II Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

Objectives:
To enable the student to understand and appreciate, with a practical insight, the importance of certain basic issues governing the business operations namely: demand and supply, production function, cost analysis, markets, forms of business organisations, capital budgeting and financial accounting and financial analysis.

Unit I
Introduction & Demand Analysis*:* Definition, Nature and Scope of Managerial Economics. Demand Analysis: Demand Determinants, Law of Demand and its exceptions. *Elasticity of Demand*: Definition, Types, Measurement and Significance of Elasticity of Demand. *Demand Forecasting,* Factors governing demand forecasting, methods of demand forecasting.

Unit II
Production & Cost Analysis: *Production Function* – Isoquants and Isocosts, MRTS, Least Cost Combination of Inputs, Cobb-Douglas Production function, Laws of Returns, Internal and External Economies of Scale. *Cost Analysis***:** Cost concepts. Break-even Analysis (BEA)-Determination of Break-Even Point (simple problems) - Managerial Significance.

Unit III
Markets & New Economic Environment: Types of competition and Markets, Features of Perfect competition, Monopoly and Monopolistic Competition. Price-Output Determination in case of Perfect Competition and Monopoly. *Pricing*: Objectives and Policies of Pricing. Methods of Pricing. *Business:* Features and evaluation of different forms of Business Organisation: Sole Proprietorship, Partnership, Joint Stock Company, Public Enterprises and their types, *New Economic Environment*: Changing Business Environment in Post-liberalization scenario.

Unit IV
Capital Budgeting: Capital and its significance, Types of Capital, Estimation of Fixed and Working capital requirements, Methods and sources of raising capital - Trading Forecast, Capital Budget, Cash Budget. 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 V
Introduction to Financial Accounting & Financial Analysis: Accounting concepts and Conventions - Introduction IFRS - Double-Entry Book Keeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments). *Financial Analysis***:** Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability ratios. Du Pont Chart.

TEXT BOOKS:

1. Varshney & Maheswari: Managerial Economics, Sultan Chand, 2009.
2. S.A. Siddiqui & A.S. Siddiqui, Managerial Economics and Financial Analysis, New Age international Publishers, Hyderabad 2013.
3. M. Kasi Reddy & Saraswathi, Managerial Economics and Financial Analysis, PHI New Delhi, 2012.

REFERENCES:

1. Ambrish Gupta, Financial Accounting for Management, Pearson Education, New Delhi.2012.
2. H. Craig Peterson & W. Cris Lewis, Managerial Economics, Pearson, 2012.
3. Lipsey & Chrystel, Economics, Oxford University Press, 2012
4. Domnick Salvatore: Managerial Economics in a Global Economy, Thomson, 2012.
5. Narayanaswamy: Financial Accounting—A Managerial Perspective, Pearson, 2012.
6. S.N.Maheswari & S.K. Maheswari, Financial Accounting, Vikas, 2012.
7. Truet and Truet: Managerial Economics: Analysis, Problems and Cases, Wiley, 2012.
8. Dwivedi: Managerial Economics, Vikas, 2012.
9. Shailaja & Usha : MEFA, University Press, 2012.
10. Aryasri: Managerial Economics and Financial Analysis, TMH, 2012.
11. Vijay Kumar & Appa Rao, Managerial Economics & Financial Analysis, Cengage 2011.
12. J. V. Prabhakar Rao & P.V. Rao, Managerial Economics & Financial Analysis, Maruthi Publishers, 2011.

Outcomes:

At the end of the course, the student will

- Understand the market dynamics namely, demand and supply, demand forecasting , elasticity of demand and supply, pricing methods and pricing in different market structures.
- Gain an insight into how production function is carried out to achieve least cost combination of inputs and cost analysis
- Develop an understanding of
- Analyse how capital budgeting decisions are carried out
- Understand the framework for both manual and computerised accounting process
- Know how to analyse and interpret the financial statements through ratio analysis.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

III Year B.Tech. MME-II Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

MECHANICAL WORKING OF METALS

Objective:
This course is mainly designed to provide knowledge about various metal forming operations, their process parameters, and mathematical equations associated with the process.

UNIT I
Stress and Strain Relationship for Elastic Behaviour: Description of stress at a point. State of stress in two dimensions. Mohrs circle of stress in two dimensions, state of stress in three dimensions. Mohrs 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.
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.

UNIT IV
Rolling of Metals: Classification of rolling process, rolling mills. Hot rolling, cold rolling, rolling of bars and shapes, forging and geometrical relationships in rolling. 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 V
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.
Drawing of Rods, Wires and Tube: Rod and wire drawing, tube drawing processes, deep drawing, residual stresses in rod, wire and tubes.

TEXT BOOKS:
1. Mechanical Metallurgy by GE Dieter (3rd edition)
2. Technology of metal forms processes – Surender Kumar PHI 2008

REFERENCES:
1. Mechanical working of metals-Avitzur.
2. Engineering Metallurgy-PartII-Higgins.
3. Mechanical behavior of Materials- A.H. Cortney
4. Mechanical Working of Metals- Sur Jhomes
5. Mechanical Metallurgy- White and Lemay

Outcome:
The student will be able to solve problems on calculation of required stress, extent of deformation in metal forming techniques.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

III Year B.Tech. MME-II Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

FOUNDRY TECHNOLOGY

UNIT I

Introduction to 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.

UNIT II

Moulding Processes: Green and dry sand moulding; shell moulding, CO_2 moulding. Core making. Plaster moulding, Gating Risering and their design.

Casting Defects and Remedial Measures: Casting defects arising due to moulding, cores, melting and pouring practice. Inspection and Testing of castings.

UNIT III:

Casting Methods: Permanent mould casting, pressure die-casting, Gravity die casting, Vacuum die casting, centrifugal casting, Investment Casting, Squeeze casting and Composite Casting.

UNIT IV:

Melting and Solidification: Cupola and Induction Melting. Nucleation and growth. Freezing of metals and alloys. Dendritic freezing. Progressive and Directional Solidification. Melting of Gray iron in cupola.

UNIT V:

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.

TEXT BOOKS:

1. Principles of Metal casting by Heine - Loper and Rosenthal, Tata Mc Graw Hill, 2nd Edition.
2. Metal Casting: Principles and practice – T.V. Ramana Rao, New Age International, 2007

REFERENCES:

1. Metals Handbook Vol. 5 published by ASM, Ohio.
2. Foundry Technology – Dharmendra kumar & S.K.Jain, CBS Publisher, 2007.
3. Manufacturing Technology – Vol.I: Foundry, Forming and Welding, P.N. Rao, Mc Graw Hill 3rd Edition.
4. Casting Technology and Cast Alloys-A K Chakrabarti-PHI 2011 Edition.
5. Castings-John Campbell-Second Edition-Elsevier.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

III Year B.Tech. MME-II Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

POWDER METALLURGY

Objective:
The objective of this course is to establish the powder technology applied to metals as an unconventional mean of fabrication of metals. It is also intended to explain the process variables in powder metallurgy technology and significant applications.

UNIT – I
Introduction: Emergence and importance of powder metallurgy. Comparison of powder metallurgy with other manufacturing techniques. It's scope and limitations.
Characterization of Powders: Importance. Determining powder characteristics; particle shape, size, size distribution, specific surface area, apparent and tap density, angle of repose, compressibility / compactbility.

UNIT – II
Methods of Powder Production; chemical reduction (tungsten, iron), carbonyl decomposition (iron, nickel), atomization (pure metal and multicomponent alloy powders), milling (oxides), electrolysis (elemental powders). Influence of the manufacturing process on powder characteristics.

UNIT – III
Consolidation of Metal Powders:
Compaction: Isostatic pressing and die compaction. Theory of consolidation: Pressure transmission in powders. Pressure dependence of densification. Green strength.
Sintering: Mechanisms of solid state and liquid phase sintering. Effect of powder characteristics on compaction and sintering. Hot isostatic pressing. Spark Plasma Sintering. Properties of P/M parts.

UNIT – IV
P/M Products: I. Porous Parts - Filters, Self-lubricating bearings (**(**CuSn). II. **Dispersion strengthened materials:** (Cu-Al_2O_3, Ni-ThO_2). **III. Electrical materials -** Tungsten lamp filaments, Thoriated tungsten welding electrodes, tungsten automobile electrical contacts.

UNIT – V
P/M Products: **IV. Magnetic materials;** Fe-Ni soft magnets, ALNICO and $SmCo_5$ permanent magnets. **V. Cutting Tools:** Cemented carbides (WC-Co). **VI. Special Products;** Heavy alloys (W-Ni-Fe).

TEXT BOOKS:
1. Powder Metallurgy Science- Randall M German , Metal Powder Industries Federation, 1994 - Technology & Engineering ,USA,1994
2. Powder Metallurgy-Science, Technology and Materials-Anish Upadhyaya, G S Upadhyaya

REFERENCES:
1. Introduction to powder metallurgy – J.S. Hirshhorn American ***Powder Metallurgy*** Institute, Princeton NJ, 1969
2. Powder metallurgy – Anil Kumar Sinha, Dhanpat Rai & Sons, Nai Sarak, 110006, 1981
3. Powder Metallurgy principles – Fritz V. Lenel , Princeton, 1986
4. ASM Handbook on Powder Metallurgy, Metals Park, Ohio, USA

Outcome:
The student will be able to understand the significance, process, and applications of this unconventional fabrication technology in detail.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

III Year B.Tech. MME-II Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

STEEL MAKING

Objective:
This course is mainly included to provide full picture of production of steel in various furnaces/converters, Physical Chemistry involved, advancements, Continuous Casting, and secondary steel making processes.

UNIT-I
Introduction and Principles of Steel Making**,** Classification of Steel making Processes. Early steel making processes; Cementation and crucible processes. Raw materials for steel making. Factors affecting efficiency of steel making. Decarburization, desiliconization. Dephosphorisation and desulphurisation. Principles of deoxidation, Types of deoxidation;-Precipitation, diffusion and treatment with synthetic slags, Molecular and ionic theory of slags.

UNIT-II
Construction and process details of Bessemer convertors and Open Hearth Furnace, Electric Arc Furnace , Induction Furnace, their modifications and improvements. Casting Pit Practice.

UNIT-III
Construction and process details of LD, LD-AC, Kaldo and Rotor processes. Oxygen Bottom blown process. Hybrid Process: LD-AD, LEB, and LD-OD.

UNIT-IV
Solidification of steels. Ingot defects and remedies. Continuous Casting of Steel and its defects and remedies,

UNIT-V
Secondary Steel making-Types, Advantages. A brief description of vacuum treatment of steel, Powder injection. VAR and ESR Processes. VOD and AOD Processes.

TEXT BOOKS:
1. Steel Making – A. K. chakrabarthi (PHI) 2007
2. Iron Making & Steel Making Theory and Practice - Ahindra Ghosh & Amit chatterjee

REFERENCES:
1. Modern Steelmaking – Dr. R.H. Tupkary and V.H. Tupkary
2. Steel Making – V. a. Kudrin
3. Fundamentals of Steel Making practice - Brahma Deo & Rob Boom
4. Secondary Steel Making; Principles and applications – Ahindra Ghosh
5. Physical Chemistry of Iron & Steel by Boodsworth

Outcome:
The student will be able to understand the technology of steel production in detail there by he/she would be in a position of regulating the process variables to enhance the thermal efficiency, and yield of steel making process.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

III Year B.Tech. MME-II Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

HUMAN VALUES AND PROFESSIONAL ETHICS
(Open Elective)

Objectives : This introductory course input is intended

- To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- To facilitate the development of a Holistic perspective among students towards life, profession and happiness, based on a correct understanding of the Human reality and the rest of Existence. Such a holistic perspective forms the basis of Value based living in a natural way.
- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually satisfying human behavior and mutually enriching interaction with Nature.

Unit I:
Course Introduction - Need, Basic Guidelines, Content and Process for Value Education: Understanding the need, basic guidelines, content and process for Value Education. Self Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self exploration. Continuous Happiness and Prosperity- A look at basic Human Aspirations. Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario. Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

Unit II:
Understanding Harmony in the Human Being - Harmony in Myself! : Understanding human being as a co-existence of the sentient 'I' and the material 'Body'. Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer). Understanding the characteristics and activities of 'I' and harmony in 'I'. Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail. Programs to ensure Sanyam and Swasthya.

Unit III:
Understanding Harmony in the Family and Society- Harmony in Human - Human Relationship : Understanding harmony in the Family- the basic unit of human interaction. Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; **Trust (Vishwas) and Respect (Samman) as the foundational values of relationship.** Understanding the meaning of Vishwas; Difference between intention and competence. Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship. Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals. Visualizing a universal harmonious order in society- Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha)- from family to world family!

Unit IV:
Understanding Harmony in the Nature and Existence - Whole existence as Co-existence : Understanding the harmony in the Nature. Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature. Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space. Holistic perception of harmony at all levels of existence.

Unit V:
Implications of the above Holistic Understanding of Harmony on Professional Ethics : Natural acceptance of human values. Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in professional ethics:

a) Ability to utilize the professional competence for augmenting universal human order,
b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems,
c) Ability to identify and develop appropriate technologies and management patterns for above production systems.

Case studies of typical holistic technologies, management models and production systems. Strategy for transition from the present state to Universal Human Order:

a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers
b) At the level of society: as mutually enriching institutions and organizations

TEXT BOOK

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.
2. Prof. KV Subba Raju, 2013, Success Secrets for Engineering Students, Smart Student Publications,3rd Edition.

REFERENCE BOOKS

1. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and HarperCollins, USA
2. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
3. A Nagraj, 1998, Jeevan Vidya ek Parichay, Divya Path Sansthan, Amarkantak.
4. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
5. PL Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Purblishers.
6. A.N. Tripathy, 2003, Human Values, New Age International Publishers.
7. Subhas Palekar, 2000, How to practice Natural Farming, Pracheen(Vaidik) Krishi Tantra Shodh, Amravati.
8. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
9. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press
10. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethichs (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.

Relevant CDs, Movies, Documentaries & Other Literature:

1. Value Education website, http://www.uptu.ac.in
2. Story of Stuff, http://www.storyofstuff.com
3. Al Gore, An Inconvenient Truth, Paramount Classics, USA
4. Charlie Chaplin, Modern Times, United Artists, USA
5. IIT Delhi, Modern Technology – the Untold Story

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

III Year B.Tech. MME-II Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

DISASTER MANAGEMENT
(Open Elective)

Unit-I

Environmental Hazards & Disasters: Meaning of Environmental hazards, Environmental Disasters and Environmental stress. Concept of Environmental Hazards, Environmental stress & Environmental Disasters. Different approaches & relation with human Ecology - Landscape Approach - Ecosystem Approach - Perception approach - Human ecology & its application in geographical researches.

Unit –II

Types of Environmental hazards & Disasters: Natural hazards and Disasters - Man induced hazards & Disasters - Natural Hazards- Planetary Hazards/ Disasters - Extra Planetary Hazards/ disasters - Planetary Hazards- Endogenous Hazards - Exogenous Hazards –

Unit –III

Endogenous Hazards - Volcanic Eruption – Earthquakes – Landslides - Volcanic Hazards/ Disasters - Causes and distribution of Volcanoes - Hazardous effects of volcanic eruptions - Environmental impacts of volcanic eruptions - Earthquake Hazards/ disasters - Causes of Earthquakes - Distribution of earthquakes - Hazardous effects of - earthquakes - - Earthquake Hazards in India - - Human adjustment, perception & mitigation of earthquake.

Unit –IV

Exogenous hazards/ disasters - Infrequent events- Cumulative atmospheric hazards/ disasters
Infrequent events: Cyclones – Lightning – Hailstorms
Cyclones: Tropical cyclones & Local storms - Destruction by tropical cyclones & local storms (causes , distribution human adjustment, perception & mitigation) Cumulative atmospheric hazards/ disasters : - Floods- Droughts- Cold waves- Heat waves Floods:- Causes of floods- Flood hazards India- Flood control measures (Human adjustment, perception & mitigation) Droughts:- Impacts of droughts- Drought hazards in India- Drought control measures- Extra Palnetary Hazards/ Disasters- Man induced Hazards /Disasters- Physical hazards/ Disasters-Soil Erosion
Soil Erosion:-- Mechanics & forms of Soil Erosion- Factors & causes of Soil Erosion- Conservation measures of Soil Erosion
Chemical hazards/ disasters:-- Release of toxic chemicals, nuclear explosion- Sedimentation processes Sedimentation processes:- Global Sedimentation problems- Regional Sedimentation problems- Sedimentation & Environmental problems- Corrective measures of Erosion & Sedimentation
Biological hazards/ disasters:- Population Explosion.

Unit –V

Emerging approaches in Disaster Management- Three Stages
1. Pre- disaster stage (preparedness)
2. Emergency Stage
3. Post Disaster stage-Rehabilitation

TEXT BOOKS:

1. Disaster Mitigation: Experiences And Reflections by Pardeep Sahni
2. Natural Hazards & Disasters by Donald Hyndman & David Hyndman – Cengage Learning

REFERENCES

1. R.B.Singh (Ed) Environmental Geography, Heritage Publishers New Delhi,1990
2. Savinder Singh Environmental Geography, Prayag Pustak Bhawan, 1997
3. Kates,B.I & White, G.F The Environment as Hazards, oxford, New York, 1978
4. R.B. Singh (Ed) Disaster Management, Rawat Publication, New Delhi, 2000
5. H.K. Gupta (Ed) Disaster Management, Universiters Press, India, 2003
6. R.B. Singh, Space Technology for Disaster Mitigation in India (INCED), University of Tokyo, 1994
7. Dr. Satender , Disaster Management t in Hills, Concept Publishing Co., New Delhi, 2003
8. A.S. Arya Action Plan For Earthquake,Disaster, Mitigation in V.K. Sharma (Ed) Disaster Management IIPA Publication New Delhi, 1994
9. R.K. Bhandani An overview on Natural & Man made Disaster & their Reduction,CSIR, New Delhi
10. M.C. Gupta Manuals on Natural Disaster management in India, National Centre for Disaster Management,IIPA, New Delhi, 2001

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

III Year B.Tech. MME-II Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

INTELLECTUAL PROPERTY RIGHTS
(Open Elective)

UNIT – I
Introduction to Intellectual property: Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

UNIT – II
Trade Marks : Purpose and function of trade marks, acquisition of trade mark rights, protectable matter, selecting and evaluating trade mark, trade mark registration processes.

UNIT – III
Law of copy rights : Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law.
Law of patents : Foundation of patent law, patent searching process, ownership rights and transfer

UNIT – IV
Trade Secrets : Trade secrete law, determination of trade secrete status, liability for misappropriations of trade secrets, protection for submission, trade secrete litigation.
Unfair competition : Misappropriation right of publicity, False advertising.

UNIT – V
New development of intellectual property: new developments in trade mark law ; copy right law, patent law, intellectual property audits.
International overview on intellectual property, international – trade mark law, copy right law, international patent law, international development in trade secrets law.

TEXT BOOKS & REFERENCES:

1. Intellectual property right, Deborah. E. Bouchoux, cengage learing.
2. Intellectual property right – Unleashing the knowledge economy, prabuddha ganguli, Tate Mc Graw Hill Publishing company ltd.,

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

III Year B.Tech. MME-II Sem	**L**	**T/P/D**	**C**
	-	**-/3/-**	**2**

FOUNDRY TECHNOLOGY LAB

Objective:
This laboratory course is mainly aimed at giving a practical look at some of the moulding processes, characterization of moulding sand, and pouring practice.

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 additives in sands.
6. Determination of clay content in sand.
7. Determination of the shatter index of green sand.
8. Melting of Al and Cu alloys in a pit furnace and casting into light components.
9. Study of Charge calculations and melting practice of cast iron in cupola.
10. Preparation of a shell-by-shell moulding process.
11. Non-destructive testing of few cast iron components.

Equipment;
1. Mould Boxes, Patterns, Core Boxes, Tool Boxes.
2. Rotap Sieve Shaker with Sieves
3. Permeability Apparatus.
4. Universal Sand testing Machine with Accessories.
5. Sand Hardness tester.
6. Clay Content Apparatus
7. Shatter Index test.
8. Melting: Pit Furnace; Electric Furnace
9. Shell Moulding Machine
10. Centrifugal Casting Machine
11. Ultra Sonic Tester
12. Ladles, Crucibles and other Accessories
13. Muffle Furnace 1000^0c

Outcome:
After concluding the Laboratory Course, the student will be able to gain hands-on experience on moulding processes, and pouring practice.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

III Year B.Tech. MME-II Sem	**L**	**T/P/D**	**C**
	-	**-/3/-**	**2**

ADVANCED COMMUNICATION SKILLS (ACS) LAB

Introduction

The introduction of the Advanced Communication Skills Lab is considered essential at 3rd year level. At this stage, the students need to prepare themselves for their careers which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalised context.

The proposed course should be a laboratory course to enable students to use 'good' English and perform the following:

- Gathering ideas and information to organise ideas relevantly and coherently.
- Engaging in debates.
- Participating in group discussions.
- Facing interviews.
- Writing project/research reports/technical reports.
- Making oral presentations.
- Writing formal letters.
- Transferring information from non-verbal to verbal texts and vice-versa.
- Taking part in social and professional communication.

Objectives:

This Lab focuses on using multi-media instruction for language development to meet the following targets:

- To improve the students' fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and professional contexts.
- Further, they would be required to communicate their ideas relevantly and coherently in writing.
- To prepare all the students for their placements.

Syllabus:

The following course content to conduct the activities is prescribed for the Advanced Communication Skills (ACS) Lab:

1. **Activities on Fundamentals of Inter-personal Communication and Building Vocabulary** - Starting a conversation – responding appropriately and relevantly – using the right body language – Role Play in different situations & Discourse Skills- using visuals - Synonyms and antonyms, word roots, one-word substitutes, prefixes and suffixes, study of word origin, business vocabulary, analogy, idioms and phrases, collocations & usage of vocabulary.
2. **Activities on Reading Comprehension** –General Vs Local comprehension, reading for facts, guessing meanings from context, scanning, skimming, inferring meaning, critical reading & effective googling.
3. **Activities on Writing Skills** – Structure and presentation of different types of writing – *letter writing/Resume writing/ e-correspondence/ Technical report writing/ Portfolio writing* – planning for writing – improving one's writing.
4. **Activities on Presentation Skills** – Oral presentations (individual and group) through JAM sessions/seminars/**PPTs** and written presentations through posters/projects/reports/ e-mails/assignments etc.
5. **Activities on Group Discussion and Interview Skills** – Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and organization of ideas and rubrics for evaluation- Concept and process, pre-interview planning, opening strategies, answering strategies, interview through tele-conference & video-conference and Mock Interviews.

Minimum Requirement:

The Advanced Communication Skills (ACS) Laboratory shall have the following infra-structural facilities to accommodate at least 35 students in the lab:

- **Spacious room with appropriate acoustics.**
- **Round Tables with movable chairs**
- **Audio-visual aids**
- **LCD Projector**
- **Public Address system**
- **P – IV Processor, Hard Disk – 80 GB, RAM–512 MB Minimum, Speed – 2.8 GHZ**
- **T. V, a digital stereo & Camcorder**

- **Headphones of High quality**

Prescribed Lab Manual: A book titled ***A Course Book of Advanced Communication Skills (ACS) Lab*** published by Universities Press, Hyderabad.

Suggested Software:

The software consisting of the prescribed topics elaborated above should be procured and used.

- **Oxford Advanced Learner's Compass**, 7th Edition
- **DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice.**
- **Lingua TOEFL CBT Insider**, by Dreamtech
- **TOEFL & GRE**(KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
- **The following software from 'train2success.com'**
  - **Preparing for being Interviewed**
  - **Positive Thinking**
  - **Interviewing Skills**
  - **Telephone Skills**
  - **Time Management**

Books Recommended:

1. Technical Communication by Meenakshi Raman & Sangeeta Sharma, Oxford University Press 2009.
2. Advanced Communication Skills Laboratory Manual by Sudha Rani, D, Pearson Education 2011.
3. Technical Communication by Paul V. Anderson. 2007. Cengage Learning pvt. Ltd. New Delhi.
4. Business and Professional Communication: Keys for Workplace Excellence. Kelly M. Quintanilla & Shawn T. Wahl. Sage South Asia Edition. Sage Publications. 2011.
5. The Basics of Communication: A Relational Perspective. Steve Duck & David T. McMahan. Sage South Asia Edition. Sage Publications. 2012.
6. English Vocabulary in Use series, Cambridge University Press 2008.
7. Management Shapers Series by Universities Press(India)Pvt Ltd., Himayatnagar, Hyderabad 2008.
8. Handbook for Technical Communication by David A. McMurrey & Joanne Buckley. 2012. Cengage Learning.
9. Communication Skills by Leena Sen, PHI Learning Pvt Ltd., New Delhi, 2009.
10. Handbook for Technical Writing by David A McMurrey & Joanne Buckely CENGAGE Learning 2008.
11. Job Hunting by Colm Downes, Cambridge University Press 2008.
12. Master Public Speaking by Anne Nicholls, JAICO Publishing House, 2006.
13. English for Technical Communication for Engineering Students, Aysha Vishwamohan, Tata Mc Graw-Hil 2009.
14. Books on TOEFL/GRE/GMAT/CAT/ IELTS by Barron's/DELTA/ Cambridge University Press.
15. International English for Call Centres by Barry Tomalin and Suhashini Thomas, Macmillan Publishers, 2009.

DISTRIBUTION AND WEIGHTAGE OF MARKS:

Advanced Communication Skills Lab Practicals*:*

1. The practical examinations for the ACS 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 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, by inviting the External Examiner from outside. In case of the non-availability of the External Examiner, other teacher of the same department can act as the External Examiner.

Mini Project: As a part of Internal Evaluation

1. Seminar/ Professional Presentation

2. A Report on the same has to be prepared and presented.

**** Teachers may use their discretion to choose topics relevant and suitable to the needs of students.***

**** Not more than two students to work on each mini project.***

**** Students may be assessed by their performance both in oral presentation and written report.***

Outcomes

- Accomplishment of sound vocabulary and its proper use contextually.
- Flair in Writing and felicity in written expression.
- Enhanced job prospects.
- Effective Speaking Abilities

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. MME-I Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

MANAGEMENT SCIENCE

Objectives:
This course is intended to familiarise the students with the framework for the managers and leaders available for understanding and making decisions relating to issues related organisational structure, production operations, marketing, Human resource Management, product management and strategy.

UNIT -I:
Introduction to Management and Organisation: Concepts of Management and organization- nature, importance and Functions of Management, Systems Approach to Management - Taylor's Scientific Management Theory – Fayal's Principles of Management – Maslow's theory of Hierarchy of Human Needs – Douglas McGregor's Theory X and Theory Y – Hertzberg Two Factor Theory of Motivation - Leadership Styles, Social responsibilities of Management. Designing Organisational Structures: Basic concepts related to Organisation - Departmentation and Decentralisation, Types and Evaluation of mechanistic and organic structures of organisation and suitability.

UNIT -II:
Operations and Marketing 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 – Business Process Reengineering (BPR) - Statistical Quality Control: control charts for Variables and Attributes (simple Problems) and Acceptance Sampling, TQM, Six Sigma, Deming's contribution to quality. Objectives of Inventory control, EOQ, ABC Analysis, Purchase Procedure, Stores Management and Stores Records – JIT System, Supply Chain Management, Functions of Marketing, Marketing Mix, and Marketing Strategies based on Product Life Cycle, Channels of distribution.

UNIT -III:
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 – Capability Maturity Model (CMM) Levels – Performance Management System.

UNIT -IV:
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 -V:
Strategic Management and Contemporary Strategic Issues: 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. Bench Marking and Balanced Score Card as Contemporary Business Strategies.

TEXT BOOKS:
1. Stoner, Freeman, Gilbert, *Management*, 6th Ed, Pearson Education, New Delhi, 2004
2. P Vijaya Kumar, N. Appa Rao and Ashima B. Chhalill, Cengage Learning India, 2012.

REFERENCE BOOKS:
1. Kotler Philip and Keller Kevin Lane: Marketing Management, Pearson, 2012.
2. Koontz and Weihrich: Essentials of Management, McGraw Hill, 2012.
3. Thomas N.Duening and John M.Ivancevich Management—Principles and
1. Guidelines, Biztantra, 2012.
4. Kanishka Bedi, Production and Operations Management, Oxford University
2. Press, 2012.
5. Samuel C.Certo: Modern Management, 2012.
6. Schermerhorn, Capling, Poole and Wiesner: Management, Wiley, 2012.
7. Parnell: Strategic Management, Cengage,2012.
8. Lawrence R Jauch, R.Gupta andWilliam F.Glueck: Business Policy and Strategic Management, Frank Bros.2012.
9. Aryasri: Management Science, McGraw Hill, 2012

outcomes: By the end of the course, the student will be in a position to

- Plan an organisational structure for a given context in the organisation
- carry out production operations through Work study
- understand the markets, customers and competition better and price the given products appropriately.
- ensure quality for a given product or service
- plan and control the HR function better
- plan, schedule and control projects through PERT and CPM
- evolve a strategy for a business or service organisation

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. MME-I Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

ELECTROMETALLURGY AND CORROSION

Objective:
This course is mainly designed to revive the fundamental aspects of electrochemistry and its application for metal extractions. It also focuses on various forms of corrosion, and their impact on life of metallurgical components, means and ways to engineer corrosion.

UNIT- I
Review of electrochemical Principles. –Faradays laws-Electrode potentials – Cathodic and anodic reactions-polarization over voltage. Current efficiency, throwing power and its evolution, electro plating of Cu, Ni, Cr, Zn and alloy Plating. Structure and properties of electrodeposits, Testing methods of electro deposits

UNIT -II
Electrochemical aspects of Corrosion, Corrosion Cells/Electrochemical Cells, Concentration Cells, Temperature Cells; Determination of electrode potential, Thermodynamic aspects, Nernst equation, Principles of Corrosion, Exchange Potential Theory, Pourbauix Diagram, Passivity diagrams, Polarization resistance, Linear Polarization Technique, Tafel and Nyquist Plots.

UNIT-III
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, Intergrannular corrosion, weld decay, Knife-line attack, Erosion corrosion, frettling corrosion

UNIT-IV
Corrosion protection methods; selection of materials for corrosion services, selection of environment-use of inhibitors, surface protection methods including painting, metallic coating. Cathodic protection, sacrificial anode.

UNIT-V
High Temperature Corrosion, Oxidation, Pilling Bed-worth Ratio; practical examples of high temperature oxidation-oxidation resistant materials and coatings.

TEXT BOOKS:
1. Principles of Electroplating and Electroforming - William Blum
2. Corrosion Engineering-Mars G. Fontana

REFERENCES:
1. Material science- Van Vlack
2. Electroplating Basic principles and practice - Kanan. N (Elsevier) 2004
3. Elements of Physical Metallurgy – a. guy
4. Corrosion and Protection – Einaravrdet (Spinger) 2004

Outcome:
At the end of this course, the student will be able to control the process variables like current efficiency, current density to obtain an efficient electrodeposition. Also, the student will have fullest understanding on the corrosion aspects which will enable them to engineer corrosion.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. MME-I Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

MATERIAL CHARACTERIZATION TECHNIQUES

Objective:
The primary objective of this course is to facilitate the students with various materials characterization techniques, their principles, procedural steps involved and applications.

UNIT – I
Optical Microscopy: Principle, Image formation, resolving power, Numerical aperture, magnification, Depth of focus, components of microscope, important lens defects and their corrections, Resolving power and Magnification, principle of phase contrast, interference and polarized light microscopy, Elements of quantitative Metallography and image processing.

UNIT – II
Scanning Electron Microscopy: Principle, Interaction of electron beams with matter; Construction and working principle of SEM, Working Distance, Depth of Field, Depth of Focus, and Spot Size. Specimen preparation for SEM, Different types of modes used in SEM (SE and BSE) and their applications, Advantages, limitations and applications of SEM.
Transmission Electron Microscopy: Principle, Construction and working principle of TEM, Resolving power and Magnification; Depth of field and depth of focus, Bright and dark field, Specimen preparation for the TEM: SAD, Applications of TEM, Advantage and limitations of TEM

UNIT – III
X-Ray Diffraction: Introduction, Production and properties of X-rays, Bragg's law of diffraction, Experimental Methods of Diffraction, Intensity of Diffracted beams – Scattering by an electron, by an atom, by a unit cell, structure-factor calculations; factors affecting Diffraction intensities.

UNIT – IV
Application of XRD: Orientation of single crystals, Effect of plastic deformation; the structure of polycrystalline Aggregates; Determination of crystal structure; Precise lattice parameter measurements; Phase-diagram determination, Order-disorder transformation; Chemical analysis by Diffraction; Stress measurement.

UNIT – V
Spectroscopy: Basics of spectroscopy, The Electromagnetic Spectrum, UV-Visible Absorption Spectra, equipment used for spectroscopy.
Infrared spectroscopy: Principle, Vibrational Spectroscopy, study of Infrared spectroscopic pattern, Group Frequencies, FTIR.
Raman spectroscopy: Principle, study of Raman spectroscopic pattern,
Nuclear Magnetic Resonance Spectroscopy: Principle, Study of NMR Patterns
Differential Thermal Analysis, Differential Scanning Calorimetry, Thermogravimetric Aanalysis

TEXT BOOKS:

1. Material Characterization: Introduction to Microscopic and Spectroscopic Methods **-**Yang Leng, John Wiley & Sons (Asia) Pvt. Ltd., 2008.
2. Fundamentals of Molecular Spectroscopy - IV edition - Colin Neville Banwell and Elaine M. McCash, Tata McGraw-Hill, 2008.

REFERENCES:

1. Microstructural Characterization of Materials- David Brandon, Wayne D. Kaplan, John Wiley & Sons Ltd., 2008
2. The Principles of Metallographic Laboratory and Practice (Metallurgy) **-** Kehl, George L, McGraw-Hill, 1949
3. Experimental Techniques in Materials and Mechanics - C Suryanarayana, CRC Press, Taylor & Francis Group, 2011,
4. Molecular spectroscopy**-** Ira N. Levine, Wiley, 1975 - Science
5. Metallography: Principles and Practices **-** George F. Vander Voort, ASM International, 1984 - TECHNOLOGY & ENGINEERING
6. Elements of X-ray diffraction - Bernard Dennis Cullity & Stuart R. Stock, Prentice Hall, 2001 - Science

Outcome:
This course would definitely construct a path for the students to choose/prefer characterization method for a particular system. This would also provide the students with an opportunity to conduct their final year project smooth and efficient

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. MME-I Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

NON-DESTRUCTIVE TESTING

Objective:
The prime aim of this course is to introduce and explain various nondestructive tests and their applications to metallurgical structures in detail.

UNIT-I
Introduction; Visual Methods: Optical aids, In-situ metallography, Optical holographic methods, Dynamic inspection. OTHER METHODS: Acoustic emission methods, Acoustic methods; Leak detection; Thermal inspection

UNIT-II
Flaw Detection: Principles, Process, and Penetrant systems; Liquid penetrant materials; Emulsifiers; cleaners developers, sensitivity; Advantages, Limitations, Applications.
MAGNETIC METHODS**:** Advantages, Limitations, Methods of generating fields; magnetic particles and suspending liquids Magnetography, field sensitive probes; applications. Measurement of metal properties.

UNIT-III
Radiographic Methods: Limitations; Principles of radiography; sources of radiation, Ionising radiation - X-rays sources, gama-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
Electromagnetic Testing: Magnetism; Magnetic domains; Magnetization curves; Magnetic Hysteresis; Hysteresis-loop tests; comparator - bridge tests Absolute single-coil system; applications.
Electrical Methods: Eddy current methods; potential-drop methods, applications.

TEXT BOOKS:
1. Non-Destructive Testing by P. Halmshaw
2. Testing of Materials by A.V.K.Suryanarayana

REFERENCES:

1. Metals Handbook Vol.II, Nondestructive inspection and quality control
2. Ultrosonic Testing of Metals; J Krantkramer and H. Krantkramer, spinger Vekg, 1987
3. R.C. McManter Ed., Non-destructive Testing Hand Bood Vol. I & II, Ronald Press
4. J.F. Himsley, Non-destructive Testing, Macdonald and Evans, London

Outcome:
The student will be able to judge/certify the nondestructive testing method to be suited to a particular metallurgical structure.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. MME-I Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

CERAMIC SCIENCE AND TECHNOLOGY
(Elective I)

Objective:
The basic objective of this course is to provide in depth knowledge on ceramic materials including structure, properties, phase transformations, applications, and fabrication methods of ceramics.

UNIT - I
Introduction and Crystal structures; Definition – Classification of Ceramics – Traditional Ceramics – Structural Ceramics – Ceramic super conductors. Crystal structures in Ceramics– Grouping of ions and Pouling's rules – Oxide structures – Silicate structures – Glass formation – Models of glass structure Types of glasses.

UNIT – II
Ceramic Phase - Equilibrium Diagrams; Two component systems like Al_2O_3 – SiO_2 and BaO – TiO_2; and Three component systems MgO – Al_2O_3 – SiO_2

UNIT – III
Development of Ceramic, microstructure, mechanical, Thermal, electrical, optical, magnetic, and chemical properties of ceramic materials

UNIT –IV
Powder Preparation Techniques; Sol-gel technology – Precipitation, Coprecipitation and Hydrothermal precipitation.
Preparation of Ceramic Powders; Preparation of Al_2O_3, ZrO_2, SiC, Si_3N_4 , BN & B_4C

UNIT – V
Ceramic Processing Techniques: Hot Pressing – Hot Isostatic Pressing - (HIP). Spark Plasma sintering. Sintering – Sinter / HIP - Injection moulding - Slip casting - Tape casting – Gel casting – Extrusion

TEXT BOOKS:
1. Introduction to Ceramics – W.D. Kingery et al – John Wikey
2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007

REFERENCES:
1. FINCER proceedings of workshop on fine ceramics synthesis, properties and applications – T.R. Rammohan et al.
2. Hand Book of Fibre-reinforced composite materials - Ed. Lubin.
3. Fundamentals of Ceramics – M W Barsoum
4. Ceramics – Mechanical Properties, Failure Behaviour, Material Selection – D. Munz & T. Fett
5. Ceramic Science and Technology – Vol. 2 Material Selection and Properties Ed., Ralf Riedel and I –Wei Chen, Wiely –VCH

Outcome:
Through this course, the student will be able to compare ceramics and understand their superiority over metals in some specific and critical applications. He would also be benefited as he might be choosing this class of materials during his higher education.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. MME-I Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

X-RAY DIFFRACTION
(Elective I)

Objective:
The prime aim of this course is to explain the students the significance of X-ray diffraction and its application in determination of crystal structure, lattice parameter, chemical analysis and stress measurement of the given system.

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. X-ray diffractometer, Components, XRD pattern and interpretation of XRD Peaks.

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; Determination of crystal structure, precise lattice parameter measurements. .

UNIT-V
Phase-diagram determination; Order-disorder transformation; Chemical analysis by Diffraction. Qualitative analysis, quantitative analysis, Stress measurement.

TEXT BOOKS:
1. Elements of X-ray diffraction by BD Cullity
2. X-Ray diffraction: a practical approach by C. Suryanarayana, M. Grant Norton

REFERENCES:

1. Structure of Metals - GS Barrett and TB Masallski. 2nd Edition
2. Basics of X-ray Diffraction and its Applications – K. Ramakanth Hebbar
3. X-ray diffraction methods - EW Nuffield.
4. X-ray diffraction B.E. Warren

Outcome:
At the end of this course, the student will acquire knowledge on various experimental methods of X-ray diffraction so that he/she can conduct his/her project work which may include characterization through X-ray Diffraction.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. MME-I Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

LIGHT METALS AND ALLOYS
(Elective I)

Objective:
This course is mainly intended to deal with Physical Metallurgy of various nonferrous metals having low density and their alloys in detail.

Unit I
Aluminium alloys: Classification, Heat treatment of cast and wrought Al alloys, Applications, Properties and Physical Metallurgy of Al-Cu alloys, Al-Mg alloys, Al-Si alloys, and Al-Li alloys.

Unit II
Magnesium Alloys: Wrought and Cast Mg alloys, Heat treatment of Mg and its alloys, Precipitation hardening in Magnesium base alloys,

Unit III
Titanium and its properties, Wrought and Cast Titanium alloys, Strengthening mechanisms of Titanium alloys. Alpha, Beta and Alpha-Beta Titanium alloys-Microstructure, Properties and Applications.

Unit IV
Zirconium and its alloys: Preparation, Physical metallurgy, properties and applications,

Unit V
Beryllium alloys: Preparation, properties and applications
Zinc and its alloys: Classification, properties and applications

TEXT BOOKS:
1. Heat treatment, structure and properties of Nonferrous alloys - Charlie Brooks, ASM Metals Park, Ohio, USA
2. Light alloys: Metallurgy of the light metals by I. J. Polmear.

REFERENCES:
1. Introduction to Physical Metallurgy – S.H. Avner
2. Engineering Physical Metallurgy – Lakhtin
3. ASM Metals Handbook Vol-1 & 2
4. Metallurgical abstracts on light metals and alloys, Keikinzoku Shōgakukai, Light Metal Educational Foundation, 1999

Outcome:
The student will have sound knowledge on Microstructure, properties, and applications of several reputed nonferrous alloys of low density and also he would be able to design a light alloy for a specific metallurgical application.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. MME-I Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

PROBABILITY AND STATISTICS
(Elective I)

Objectives: To learn

- Understand a random variable that describes randomness or an uncertainty in certain realistic situation. It can be of either discrete or continuous type.
- In the discrete case, study of the binomial and the Poisson random variables and the Normal random variable for the continuous case predominantly describe important probability distributions. Important statistical properties for these random variables provide very good insight and are essential for industrial applications.
- Most of the random situations are described as functions of many single random variables. In this unit, the objective is to learn functions of many random variables through joint distributions.
- The types of sampling, Sampling distribution of means ,Sampling distribution of variance,Estimations of statistical parameters, Testing of hypothesis of few unknown statistical parameters.
- The mechanism of queuing system ,The characteristics of queue,The mean arrival and service rates
- The expected queue length, The waiting line
- The random processes, The classification of random processes, Markov chain, Classification of states Stochastic matrix (transition probability matrix),Limiting probabilities, Applications of Markov chains

UNIT-I

Single Random variables and probability distributions: Random variables – Discrete and continuous. Probability distributions, mass function/ density function of a probability distribution . Mathematical Expectation, Moment about origin, Central moments Moment generating function of probability distribution.

Binomial, Poisson & normal distributions and their properties. Moment generating functions of the above three distributions, and hence finding the mean and variance.

UNIT-II

Multiple Random variables, Correlation & Regression: Joint probability distributions- Joint probability mass / density function, Marginal probability mass / density functions, Covariance of two random variables, Correlation - Coefficient of correlation, The rank correlation.

Regression- Regression Coefficient, The lines of regression and multiple correlation & regression.

UNIT-III

Sampling Distributions and Testing of Hypothesis

Sampling: Definitions of population, sampling, statistic, parameter. Types of sampling, Expected values of Sample mean and varience, sampling distribution, Standard error, Sampling distribution of means and sampling distribution of varience.

Parameter estimations – likelihood estimate, interval estimations.

Testing of hypothesis: Null hypothesis, Alternate hypothesis, type I, & type II errors – critical region, confidence interval, Level of significance. One sided test, two sided test,

Large sample tests:

(i) Test of Equality of means of two samples equality of sample mean and population mean (cases of known varience & unknown varience, equal and unequal variances)
(ii) Tests of significance of difference between sample S.D and population S.D.
(iii) Tests of significance difference between sample proportion and population proportion&difference between two sample proportions.

Small sample tests:

Student t-distribution,its properties; Test of significance difference between sample mean and population mean; difference between means of two small samples

Snedecor's F- distribution and it's properties. Test of equality of two population variences

Chi-square distribution , it's properties, Chi-square test of goodness of fit

UNIT-IV

Queuing Theory: Structure of a queuing system, Operating Characteristics of queuing system, Transient and steady states, Terminology of Queuing systems, Arrival and service processes- Pure Birth-Death process Deterministic queuing models- M/M/1 Model of infinite queue, M/M/1 model of finite queue .

UNIT-V

Stochastic processes: Introduction to Stochastic Processes –Classification of Random processes, Methods of description of random processes, Stationary and non-stationary random process, Average values of single random process and two or more random processes. Markov process, Markov chain, classification of states – Examples of Markov Chains, Stochastic Matrix.

TEXT BOOKS:

1) Higher Engineering Mathematics by Dr. B.S. Grewal, Khanna Publishers
2) Probability and Statistics for Engineers and Scientists by Sheldon M.Ross, Academic Press
3) Operations Research by S.D. Sarma,

REFERENCE BOOKS:

1. Mathematics for Engineers by K.B.Datta and M.A S.Srinivas,Cengage Publications
2. Probability and Statistics by T.K.V.Iyengar & B.Krishna Gandhi Et
3. Fundamentals of Mathematical Statistics by S C Gupta and V.K.Kapoor
4. Probability and Statistics for Engineers and Scientists by Jay l.Devore.

Outcomes:

- Students would be able to identify distribution in certain realistic situation. It is mainly useful for circuit as well as non-circuit branches of engineering. Also able to differentiate among many random variable involved in the probability models. It is quite useful for all branches of engineering.
- The student would be able to calculate mean and proportions (small and large sample) and to make important decisions from few samples which are taken out of unmanageably huge populations .It is Mainly useful for non-circuit branches of engineering.
- The students would be able to find the expected queue length, the ideal time, the traffic intensity and the waiting time. These are very useful tools in many engineering and data management problems in the industry. It is useful for all branches of engineering.
- The student would able to understand about the random process, Markov process and Markov chains which are essentially models of many time dependent processes such as signals in communications, time series analysis, queuing systems. The student would be able to find the limiting probabilities and the probabilities in n^{th} state. It is quite useful for all branches of engineering

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. MME-I Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

SEMI CONDUCTORS AND MAGNETIC MATERIALS
(Elective II)

Objective:
This course specifically deals with a class of materials, semiconductors and magnetic materials which have wide application in electronic and memory storage devices.

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
Semi conductors: Band structures, intrinsic semi conductors, Extrinsic semi conductors; Hall effect; Elemental and compound semi conductors and their application; Super conductivity; super conducting materials, structure and applications.

UNIT III
Ferromagnetism: Ferromagnetic domains; Hysterisis loops, magnetostriction and magnetoelectricity, origin of Hysterisis due to domain wall movement; soft magnetic alloys.
Ferrimagnetic material: Spiral structure: Theory of ferrimagnetism; magnetic structures of ferrites; permeability of ferrites; stress-induced anisotropy in ferrites; applications of soft ferrites.

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.
Amorphous ferromagnetic alloys and ferro fluids: preparation and structure of amorphous ferromagnetic and its application; ferro fluids.

UNIT V
Permanent magnetic materials: Energy product of permanent magnetic material; behavior of permanent magnets under dynamic or recoil conditions; alnicos; Fe-Co-Cr alloys.
Cu-Ni-Fe and Cu-Ni-Co alloys; Fe-Co-Mo Alloys, Pt-Co alloys; permanent magnets based on the inter metallic compound Sm_2 Ca_{12} coercivity mechanisms; Temperature dependence of magnetic properties of permanent magnets. Applications of permanent magnetic materials

TEXT/REFERENCE BOOKS:

1. R E Hummel: Electronic Properties of Materials
2. R A Macurie: Ferromagnetic materials structure and properties
3. An introduction to materials science-H L Mancini
4. Magnetic Materials-Fundamentals and Devices-Nicola Spaldin
5. Fundamentals of Semi Conductors-Physical and Materials Properties-Peter Y. Yu Manuer Cardona
6. Semi Conductors-Halbleiter. Ed. Annuelle

Outcome:
This course would benefit the student through giving the inputs on semiconductor and magnetic material technology which in turn allow them choose the stream Electronic Materials at their post graduation level.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. MME-I Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

METALLURGICAL PROBLEMS
(Elective II)

Objective:
This course essentially aims at solving metallurgical industry-oriented problems with the assistance of fundamental principles learnt.

UNIT-I
Stoichiometric calculations. Burden calculations for Blast Furnace Iron Making

UNIT-II
Mass balance and Energy balance calculations. Problems based on Principles of Thermodynamics Problems based on Kinetics of Metallurgical Processes

UNIT-III
Problems on Heat Transfer. Problems on theoretical flame temperature.

UNIT-IV
Problems on pyrometallurgy. Problems based on Electrometallurgical processes

UNIT-V
Problems of Hydrometallurgical processes.

TEXT BOOKS:
1. Metallurgical problems: Butts
2. Elements of Heat Transfer: Jakob & Hawkins

REFERENCES:
1. Non-Ferrous Extractive Metallurgy: Bray
2. Problems in metallurgy and physics of metals - Moscow (Russia).
3. Problems in Metallurgy: United States Naval Academy. Postgraduate School, 1929.

Outcome:
At the end of the Course, the student will be able to develop the required caliber to solve burden calculations, problems in thermodynamics in Metallurgical Industries.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. MME-I Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

POLYMERIC MATERIALS
(Elective II)

Objective:
The objective of this course is to make the students understand the significance, classification, structure, properties, and applications of different classes of polymers, plastics, and elastomers and their fabrication methods.

UNIT-I
Introduction to polymers: Concept of polymers, formation of polymers, types of polymer reactions, Polymerization methods and mechanisms. Structure and Properties of Polymers and comparison of polymers with other materials.

UNIT- II
Classification of polymers, raw materials for polymers and their sources. Brief study of structure and properties of polymers. 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 Polymers, Calendaring and Casting. Various additives used in Polymers and their functions.
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, Polytetra fluorethylene.

UNIT – IV
Thermosetting resins; Introduction of thermosetting polymers, methods of condensation polymerizatin, raw materials, manufacturing method, properties and uses of Phenol- Formaldehyde resin, Urea-formaldehyde resins, alkyl resins.

UNIT – V
Raw materials, manufacturing methods, properties and uses of the following plastics - Acetals, Nylons, Polymethyl, Methocrylate (PMMA), Saturated polysters – PETP and PC, Cellulose acetate and viscose rayon.
Introduction of natural rubbers and synthetic rubbers like Buna-S, Buna-N, Thiokol, Polyurethane rubber and Silicon rubber.

TEXT BOOKS:

1. Polymer science – Gowrikar
2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007

REFERENCES:

1. Polymer Science & Technology - Joel fried
2. Material Science –V. D. Kodgire.
3. Introduction to materials science & engineering - Courtny & Hall
4. Polymeric materials: new research by B. M. Caruta

Outcome:
The student will be able to appreciate this class of materials (polymers) at par with other materials. He would also be in a position to design and derive various polymer base composites to meet the applications with the background he has on polymers.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. MME-I Sem	**L**	**T/P/D**	**C**
	-	**-/3/-**	**2**

ELECTROMETALLURGY AND CORROSION LAB

Objective:
This laboratory course is mainly designed to conduct the practices like electrodeposition, verification of Farady's Laws, and evaluation of factors affecting corrosion.

LIST OF EXPERIMENTS:
1) Study the effect of concentration and temperature on conductivity of an aqueous electrolyte (Aq. NaCl)
2) Verification of Faraday's laws
3) Electroplating of copper on brass and to study the influence of current density on current efficiency.
4) Electroplating of Nickel using watt's bath and to study the influence of current density on current efficiency
5) Electroplating of chromium on mild steel and to study the influence of current density on current efficiency.
6) To anodise the given aluminium sample and to colour with a dye and to measure the thickness of the oxide film
7) To conduct electropolishing of stainless steel using Nitric acid batch
8) To Estimate the rate of corrosion by understanding the principles of Uniform corrosion of Fe in varying concentration of HCl.
9) To understand the principles in galvanic cell corrosion using "Ferroxyl" indicating test solution.
10) To study the Intergrannular Corrosion of Austenitic Stainless Steel.

Outcome:
Through this laboratory practice, the student will be able to judge the process variables like current efficiency, current density to obtain desired electrodeposition. Also, the student will lay hands on the equipment designed for evaluation of corrosion aspects.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. MME-I Sem	**L**	**T/P/D**	**C**
	-	**-/3/-**	**2**

METALLURGICAL COMPUTATIONS LAB

Objective:
This laboratory Course essentially aims at giving computerized solutions to various problems in metallurgy like crystal structure and lattice parameter determination, kinetics and feasibility of chemical reactions etc.

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 Risering
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 Publicatons)
2. Computer programming and Numerical methods – S. Saran

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

Outcome:
The student will be able to solve numerical problems in metallurgical engineering with the support of computer programming.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. MME-II Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

ADVANCED MATERIALS
(Elective III)

Objective:
This course has a prime objective of educating the students in such a way that the student will have an opportunity to study all significant materials under one umbrella. The classification, manufacture and applications of these materials are dealt in detail.

UNIT-I
Nano-materials: Introduction – Classification of Nanomaterials, synthesis methods.
Carbon – Carbon Composites: Introduction, Preparation of carbon fibers, Reinforcement performs, knitting, braiding, weaving, filament winding, helical winding, polar winding. Making of carbon–carbon composites Advantages and Disadvantages, Properties and Application

UNIT-II
Intermetallic Compounds: Introduction, Types of Intermetallic compounds, Ni-Al, Fe-Al, and Ti-Al system, Preparation, Properties and Application of Intermetallic compounds.

UNIT-III
Bio-materials: Properties of Bio materials, Metallic bio-materials: Stainless steels, Cobalt and Titanium based materials. Polymers and Ceramics**.**

UNIT-IV
Functionally Gradient Materials (FGM): Classification of FGMS, Preparations, Properties and Applications of different FGM system.
Shape Memory Alloys (SMA): Introduction. Shape memory effect. Classification of shape memory alloys, Composition, Properties and Application of SMAs.

UNIT-V
Cermets: Introduction. Classification. Fabrication techniques. Bonding and microstructure, Oxide cermets, Carbide and Carbonitride cermets, and Steel-bonded cermets: Properties and Applications.
Refractory Metals and Alloys: Introduction. Manufacturing, Preparations, Properties and Application of W, Mo, Nb, Ta, Re

TEXT BOOKS:
1. Materials Science and Technology – R W Cahn
2. Wiley Interscience: Book Home-Hand Book of Advanced Materials.

REFERENCES:
1. High Temperature Materials-I E Campbell
2. Advanced materials: Refractory fibres, fibrous metals, composites - Charles Zbigniew Carroll-Porczynski
3. ASM Metals Hand Book Vol. 1& Vol. 2
4. Handbook of advanced materials: enabling new designs- James K. Wessel

Outcome:
The student will be able to design an advanced system/component with the knowledge acquired through this course. This also would help the student to organize his project work smooth and effective which runs in the same duration.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. MME-II Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

NANO MATERIALS
(Elective III)

Objective:
This course is primarily intended to expose the students to the most happening materials of interdiscipline (nanomaterials). This would emphasize on the classification, synthesis and applications of these materials.

Unit – 1
Introduction: What is Nano – Why Nano – Properties at Nano Scale. Classification of Nanomaterials-0 Dimension, 1 Dimension, 2 Dimension, and 3 Dimension, Advantages & Disadvantages of nanomaterials. Top-Down and Bottom-Up approaches.
Nano Particles: Introduction – Synthesis procedures – wet chemical approach & physical vapor synthesis approach etc – size effect & shape change and their properties – examples of systems involved – characterization techniques – properties & their applications.

Unit – II
Nano Wires: Introduction – various synthesis procedures (template assisted method, VLS method and other synthesis methods) – properties of nano wires – characterization procedures & principles involved. Application of Nano wires.
Nano tubes: Introduction – Different systems involved in nano tubes – single walled, multi-walled, Carbon based, metal incorporated tubes. Synthesis procedures (Solid & gaseous carbon source based production techniques etc.) Growth mechanism of carbon nano tubes – properties of carbon nano tubes – characterization – applications.

Unit – III
Nano Composites: Introduction-Synthesis procedures-various systems (metal-polymer, metal-ceramics and polymer-Ceramics). Characterization – procedures – Applications.

Unit – IV
Micro/Nano Fabrication Techniques: Introduction-Basic fabrication techniques (lithography, thin film deposition and doping) MEMS fabrication techniques-Nano fabrication techniques (E-Beam nano-imprint fabrication, Epitaxy and strain engineering. Scanned probe techniques)

Unit – V
Nano Biomaterials: Derived from nature: bioactive inorganic nanomaterials-their synthesis and applications

TEXT BOOKS:
1. Text book of Nano Science and Technology, B S Murthy, CRC Publications.
2. Nano Essentials T Pradeep / TMH

REFERENCES:
1. Springer Handbook of Nanotechnology
2. The Guest for new materials Auther S.T.Lakshmi Kumar, Published by Vigyan Prasar.
3. Nano – The Essentials C – Pradeep (IIcue Professor), MC – Graw Hill
4. Nano Materials Synthesis, Properties and applications, 1996, Edlstein and Cammarate
5. Nano Materials A.K. Bandyopadyay/ New age Publications

Outcome:
The student will be able to design a component/material that would provide us a ‘better tomorrow’ via nanotechnology.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. MME-II Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

NUCLEAR METALLURGY
(Elective III)

Objective:
This course is mainly intended to give a broad view and understanding of the various unconventional (nuclear fuels), nuclear reactors, their constructional and operational details, their status in our country.

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: Rector components; Types of reactors; PWR, BWR, Graphite Moderator Reactor, Heavy water Reactor, Light Water moderator Reactor, Liquid metal coolant reactor.
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: 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. Construction of reactors.

UNIT – IV: 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 – V: Nuclear power production in India and its economics and safety measures.

TEXT BOOK:
1. Wright JC -Metallurgy in Nuclear Power Technology; Iliffe Book Ltd., 1962
2. Glasstone S and Snesonske A; Prncipales of Nuclear Reactor Engineering; Macmillan, London

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

Outcome:
The student will be able to apply the principles and structural aspects of nuclear reactions and reactors so that he /she can proceed on his/her own to create enormous amount of energy to serve the nation in a better way.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. MME-II Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

SUPERALLOYS
(Elective IV)

Objective:
The basic aim of this course is to expose the students to various superalloys through their physical metallurgy, heat treatment, and microstructural, mechanical characteristics.

UNIT -I
Introduction: Introduction to superalloys, Guide to selection of superalloys, Wrought superalloys, Heat Resistant alloys.
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 –II
Relationship of properties to Microstructure in superalloys. Fracture properties of superalloys.
High temperature corrosion and use of castings for protection.

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

UNIT- IV
Melting Process: Melting of Superalloys; Principles and practices of vacuum Induction Melting and Vacuum Arc melting.
Casting methods: Improving turbine blade performance by solidification control -the development of single crystal turbine blades.

UNIT -V
Forming Methods: Forming and Fabrication of superalloys; Recent developments in P/M of superalloys-Production of components by Hot-Isostatic Pressing.
Quality of super alloy castings: Heat Treating of Heat resistant alloys.

TEXT BOOKS:
1. Superalloys: Source book; Mathew J. Donachie. Jr. editor; 1984.
2. The superalloys: edited by Chester T. Sims and William C Haagel; 1972.

REFERENCES:
1. High temperature Materials, Campbell IE, John wiley and sons Inc.;1956
2. The superalloys: fundamentals and applications By Roger C. Reed
3. Superalloys: a technical guide - Elihu F. Bradley - 1988 - 280 pages
4. Superalloys A Technical Guide, Methew J. Donachie, Stephen J. Donachie

Outcome:
At the end of the course, the student will be able to select the required superalloy for a specific high temperature application. He would also be in a position to design the technology for enhancing the high temperature mechanical characteristics of the superalloy.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. MME-II Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

FERROALLOYS TECHNOLOGY
(Elective IV)

Objective:
The prime objective of the course is to make the students understand various ferroalloys applied in ferrous metallurgy. The furnaces used for production, and the present status and future scope of the ferroalloy industry in India are also dealt as an integral part of the course.

UNIT-I
Introduction: Types of Ferro alloys and their uses; Present status of ferroalloy industry in India. Future plans and developments.
Principles: Physicochemical aspects of Ferroalloys. Production by various methods.

UNIT-II
Types of Furnaces, its design and refractories. Mechanical equipment, auxiliaries, electric power in to heat. Furnace power supply. Working voltage, power factor and efficiency.

UNIT-III
Production: Production of ferrosilicon-Calcium, ferromanganese (high and low carbon). Ferro-chrome (high and low carbon)

UNIT-IV
Ferro-molybdenum. ferrotungsten, ferrotitanium, ferrovanadium.

UNIT-V
Lay out: Lay out of a ferroalloy plant and its production economics. Present status of ferroalloy Industry in India. Future plans and developments

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

Outcome:
Acquiring knowledge on the course, the student will be able to select the required ferroalloy for a specific ferrous alloy to bring out quality yield.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. MME-II Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

SELECTION OF MATERIALS FOR ENGINEERING APPLICATIONS
(Elective IV)

Objective:
The prime objective of the course is to provide necessary information for selecting a material for the required engineering application.

Unit I:
Materials selection process: Overview of materials selection process, Material property charts, Relationship between materials selection and processing, Use of failure analysis in material selection

Unit II:
Effect of Composition, Processing, and Structure on materials properties: Introduction. Structure - property relationship in engineering materials, Viz., steels, cast irons, non ferrous alloys, Ceramics, Glasses, Plastics, Composites

Unit III:
Properties versus Performance of Materials: Effect of surface treatments on material performance. Design for fatigue resistance, fracture toughness, Corrosion resistance and high temperature applications, Oxidation resistance, Wear resistance, and Property requirement for Electronic and magnetic applications. Design criteria for brittle materials, Plastics, Composites.

Unit IV:
Manufacturing Aspects of Design : Manufacture processes and their selection. Modeling of manufacture processes. Design for Casting, Deformation process, Powder metallurgy, Machining, Joining and Heat treatment, Control of residual Stress and Surface finish.

Unit V:
Manufacturing Aspects of Design: Design for processing of ceramics, plastics and composites processing of Nano-crystalline materials.

TEXT BOOKS:

1. M.F. Ashby, *Materials Selection in Mechanical Design,* Pergamon Press, 1992
2. G.E. Dieter, *Engineering Design, A Materials and Processing Approach,* 2nd ed., McGraw-Hill, 1991

REFERENCES:

1. Material Selection and Design, Vol 20, ASM Hand Book, ASM International
2. V. John, *Introduction to Engineering Materials,* 3rd ed., Industrial Press, 1992
3. T.H. Courtney, *Mechanical Behavior of Materials,* McGraw-Hill, 1990
4. J.R. Dixon and C. Poli, *Engineering Design and Design for Manufacturing,* Field Stone Publishers, 1995
5. Surface Engineering, Vol 5, *ASM Handbook,* ASM International, 1994
6. H.O. Fuchs and R.I. Stephens, *Metal Fatigue in Engineering,* John Wiley & Sons, 1980
7. S.T. Rolfe and J.M. Barsom, *Fracture and Fatigue Control in Structures,* 4th ed., Prentice-Hall, Inc., 1996

Outcome:
The student will be able to select the materials for a specified engineering application.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. MME-II Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

COMPOSITE MATERIALS

Objective:
The prime objective of this course is to introduce, classify, and process one type of novel and widely applied materials (composite materials). The applications of composite materials that would suit the requirements are also dealt in detail as an integral part.

UNIT –I
introduction: Definition – Classification of Composite materials. Advantages and applications of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT – II
Reinforcements: Preparation, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

UNIT – III
Manufacturing of Metal Matrix Composites; Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications.

UNIT –IV
Manufacturing of Ceramic Matrix Composites; Liquid Metal Infiltration – Liquid phase sintering.
Manufacturing of Carbon – Carbon composites; Knitting, Braiding, Weaving. Properties and applications.

UNIT –V
Manufacturing of Polymer Matrix Composites; Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

TEXT BOOKS:
1. Composite Materials – K.K.Chawla
2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007

REFERENCES:
1. Hand Book of Composite Materials-ed-Lubin
2. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany
3. Composite Materials Science and Applications – Deborah D.L. Chung
4. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi
5. Composite Materials science and Application –Deborah.D.L.Chung

Outcome:
The student will be able to apply the concepts learnt during the course to the design, synthesize, characterize, and apply a composite material to a specific application.

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IV Year B.Tech. MME-II Sem	**L**	**T/P/D**	**C**
	-	**-/-/-**	**2**

INDUSTRY ORIENTED MINI PROJECT

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. MME-II Sem	**L**	**T/P/D**	**C**
	-	**-/6/-**	**2**

SEMINAR

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. MME-II Sem	**L**	**T/P/D**	**C**
	-	**-/15/-**	**10**

PROJECT WORK

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IV Year B.Tech. MME-II Sem	**L**	**T/P/D**	**C**
	-	**-/-/-**	**2**

COMPREHENSIVE VIVA