MAHATMA GANDHI INSTITUTE OF TECHNOLOGY (Autonomous)

B.Tech. in Metallurgical and Materials Engineering

Scheme of Instruction and Examination for I and II Semester

(Choice Based Credit System)

Applicable from Academic Year 2022-23

I SEMESTER

S.No	Course Code	Course Title	Instruction			Examination			Credits
			Hours Per Week			Max. Marks		Duration of SEE in Hours	
			L	T	P/D	CIE	SEE	3	
1	MA101BS	Matrices and Calculus	3	1	0	40	60	3	4
2	PH101BS	Applied Physics	3	1	0	40	60	3	4
3	CS102ES	C Programming and Data Structures	3	0	0	40	60	3	3
4	EN101HS	English for Skill Enhancement	2	0	0	40	60	3	2
5	PH151BS	Applied Physics Laboratory	0	0	3	40	60	3	1.5
6	CS152ES	C Programming and Data Structures Laboratory	0	0	2	40	60	3	1
7	EN151HS	English Language and Communication Skills Laboratory	0	0	2	40	60	3	1
8	MM151PC	Elements of Metallurgical and Materials Engineering	0	0	2	50	-	-	1
9	ME151ES	Engineering Workshop	0	1	3	40	60	3	2.5
10		Induction Programme							
		Total Hours/Marks/Credits	**11**	**3**	**12**	**370**	**480**		**20**

II SEMESTER

S.No	Course Code	Course Title	Instruction			Examination			Credits
			Hours Per Week			Max. Marks		Duration of SEE in Hours	
			L	T	P/D	CIE	SEE	3	
1	MA201BS	Ordinary Differential Equations and Vector Calculus	3	1	0	40	60	3	4
2	CH201BS	Engineering Chemistry	3	1	0	40	60	3	4
3	ME201ES	Engineering Graphics	1	0	4	40	60	3	3
4	ME202ES	Engineering Mechanics	3	0	0	40	60	3	3
5	MM201PC	Principles of Materials Science and Engineering	2	0	0	40	60	3	2
6	CH251BS	Engineering Chemistry Laboratory	0	0	2	40	60	3	1
7	CS251ES	Python Programming Laboratory	0	1	2	40	60	3	2
8	MM251PC	Principles of Materials Science and Engineering Laboratory	0	0	2	40	60	3	1
9	MC201BS	Environmental Science	3	0	0	40	60	3	0
		Total Hours/Marks/Credits	**15**	**3**	**10**	**360**	**540**		**20**

L: Lecture T: Tutorial D:Drawing P:Practical

CIE: Continuous Internal EvaluationSEE: Semester End Examination

MAHATMA GANDHI INSTITUTE OF TECHNOLOGY (Autonomous)

B. Tech. in Metallurgical and Materials Engineering

Scheme of Instruction and Examination for III & IV Semester

(Choice Based Credit System)

Applicable from AY 2022-23 Batch

III SEMESTER

S. No.	Course Code	Course Title	Instruction Hours per week			Examination Max. Marks		Duration of SEE in hours	Credits
			L	T	P/D	CIE	SEE		
1.	MM301PC	Iron Making	3	0	0	40	60	3	3
2.	MM302PC	Mineral Processing	3	0	0	40	60	3	3
3.	MM303PC	Metallurgical Thermodynamics and Kinetics	3	1	0	40	60	3	4
4.	ME331ES	Mechanics of Solids and Fluids	3	0	0	40	60	3	3
5.	MM304PC	Physical Metallurgy	3	1	0	40	60	3	4
6.	MM351PC	Physical Metallurgy Lab	0	0	2	40	60	3	1
7.	MM352PC	Mineral Processing Lab	0	0	2	40	60	3	1
8.	MM353PC	Basic Metallurgical Computations Lab	0	0	2	40	60	3	1
9.	MC301HS	Constitution of India	3	0	0	40	60	3	0
Total Hours/Marks/Credits			**18**	**02**	**06**	**360**	**540**		**20**

IVSEMESTER

S. No.	Course Code	Course Title	Instruction Hours per week			Examination Max. Marks		Duration of SEE in hours	Credits
			L	T	P	CIE	SEE		
1.	EE431ES	Basic Electrical and Electronics Engineering	3	0	0	40	60	3	3
2.	MA403BS	Probability, Statistics and Complex Variables	3	1	0	40	60	3	4
3.	MM401PC	Mechanical Metallurgy	3	0	0	40	60	3	3
4.	MM402PC	Heat Treatment and Phase Transformations	3	0	0	40	60	3	3
5.	MM403PC	Steel Making	2	0	0	40	60	3	2
6.	EE461ES	Basic Electrical and Electronics Engineering Lab	0	0	2	40	60	3	1
7.	MM451PC	Mechanical Metallurgy Lab	0	0	2	40	60	3	1
8.	MM452PC	Heat Treatment and Phase Transformations Lab	0	0	2	40	60	3	1
9.	MM453PC	Real-time Research Project/ Field-Based Project	0	0	4	50	-	-	2
10.	MC451HS	Gender Sensitization Laboratory	0	0	2	40	60	3	0
Total Hours/Marks/Credits			**14**	**1**	**12**	**410**	**540**		**20**

L: Lecture T: Tutorial D: Drawing P: Practical CIE: Continuous Internal Evaluation SEE: Semester End Examination

B.Tech. I - Semester

L	T	P	C
3	1	0	4

MA101BS: Matrices and Calculus

(Common to all Branches)

Course Objectives

- Types of matrices and their properties, concept of a rank of the matrix and applying this concept to know the consistency and solving the system of linear equations.
- Concept of eigen values and eigen vectors and to reduce the quadratic form to canonical form.
- Geometrical approach to the mean value theorems and their application to the mathematical problems, evaluation of improper integrals using Beta and Gamma functions.
- Partial differentiation, concept of total derivative, finding maxima and minima of function of two and three variables.

Course Outcomes

- Write the matrix representation of a set of linear equations and to analyse the solution of the system of equations.
- Find the Eigen values and Eigen vectors, reduce the quadratic form to canonical form using orthogonal transformations.
- Solve the applications on the mean value theorems, evaluate the improper integrals using Beta and Gamma functions.
- Find the extreme values of functions of two variables with and without constraints.
- Evaluate the multiple integrals and apply the concept to find areas, volumes.

UNIT-I: Matrices

Rank of a matrix by Echelon form and Normal form, Inverse of Non-singular matrices by Gauss- Jordan method, System of linear equations: Solving system of Homogeneous and Non-Homogeneous equations, LU Decomposition method, Gauss elimination method and Gauss Seidel Iteration Method.

UNIT-II: Eigen values and Eigen vectors

Linear Transformation and Orthogonal Transformation: Eigen values, Eigen vectors, properties of Symmetric, Skew Symmetric, Orthogonal, Unitary, Hermitian and Skew Hermitian matrices with reference to Eigen values and Eigen vectors Diagonalization of a matrix, Cayley-Hamilton Theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton Theorem, Quadratic forms and Nature of the Quadratic Forms, Reduction of Quadratic form to canonical forms by Orthogonal Transformation.

UNIT-III: Calculus

Mean value theorems: Rolle"s theorem, Lagrange"s Mean value theorem with their Geometrical Interpretation and applications, Cauchy"s Mean value Theorem, Taylor"s Series. Definition of Improper Integral: Beta and Gamma functions and their

applications.

UNIT-IV: Multivariable Calculus (Partial Differentiation and applications)

Definitions of Limit and continuity, Partial Differentiation: Euler's Theorem, Total derivative, Jacobian, Functional dependence and independence. Applications: Maxima and minima of functions of two variables and three variables using method of Lagrange multipliers.

UNIT-V: Multivariable Calculus (Integration)

Evaluation of Double Integrals (Cartesian and polar coordinates), change of order of integration (only Cartesian form), Evaluation of Triple Integrals: Change of variables (Cartesian to polar) for double and (Cartesian to Spherical and Cylindrical polar coordinates) triple integrals.

Applications: Areas (by double integrals) and volumes (by double integrals and triple integrals).

Suggested Readings:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5th Editon, 2016.

Reference Books:

1. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9thEdition, Pearson, Reprint,2002.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications,Reprint, 2008.
4. H. K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, S Chand and Company Limited, New Delhi.

B.Tech I - Semester

L	T	P	C
3	1	0	4

PH101BS: Applied Physics

(Common to all branches)

Course Objectives: The objectives of this course for the student are to:

- Understand the basic principles of quantum physics.
- Understand the underlying mechanism involved in construction and working principles of various semiconductor devices.
- Study the fundamental concepts related to the dielectric and magnetic materials.
- Identify the importance of nanoscale, quantum confinement and various fabrication techniques.
- Study the characteristics of lasers and optical fibres.

Course Outcomes: At the end of the course the student will be able to:

- Understand physical world from fundamental point of view by the concepts of Quantum mechanics and visualize the difference between conductor, semiconductor and an insulator by classification of solids.
- Identify the role of semiconductor devices in science and engineering Applications.
- Explore the fundamental properties of dielectric and magnetic materials for their applications.
- Appreciate the features and applications of Nanomaterials.
- Understand various aspects of Lasers and Optical fiber and their applications in diverse fields.

UNIT - I: QUANTUM PHYSICS

Blackbody radiation – Planck"s radiation law - Wein"s law, Rayleigh-Jean"s law - Photoelectric effect – de Broglie"s Hypothesis, Davisson and Germer"s experiment – Heisenberg uncertainty principle with an illustration - Non-existence of electrons in nucleus - Time independent Schrodinger wave equation - Born interpretation of the wave function - Particle in one dimensional potential box.

UNIT - II: SEMICONDUCTORS AND DEVICES

Intrinsic and extrinsic semiconductors – Hall effect - Direct and indirect band gap semiconductors - Construction, principle of operation and characteristics of P-N Junction diode, Zener diode and Bipolar Junction Transistor (BJT) – LED, PIN diode, Avalanche Photo Diode (APD) and Solar cells: structure, materials, working principle and characteristics.

UNIT - III: DIELECTRIC AND MAGNETIC MATERIALS

Dielectric Materials: T ypes of polarizations – Electronic & Ionic polarizabilities - Internal field in Dielectrics and Clausius - Mossotti Relation – Ferroelectric -

Piezoelectric and Pyroelectric materials – Applications: liquid crystal displays (LCD) and crystal oscillators.

Magnetic Materials: Origin of magnetic moment - Classification of Magnetic materials - Weiss theory of ferromagnetism – Hysteresis curve – Soft and Hard magnetic materials – Applications: Bubble memory devices, magnetic field sensors.

UNIT - IV: NANOTECHNOLOGY

Nanoscale – Properties of Nanomaterials - Surface to volume ratio - Quantum confinement – Top- down fabrication: ball milling - Bottom-up fabrication: sol-gel, Physical Vapor Deposition (PVD) and Chemical Vapor Deposition (CVD) - Characterization techniques: XRD, SEM & TEM - Applications of nanomaterials.

B.Tech. I Sem.

L	T	P	C
3	0	0	3

CS102ES: C Programming and Data Structures

(Common to CIVIL, ECE, EEE, MCT, MECH, MME)

Course Objectives:

Introduce the importance of programming, C language constructs,program development, data structures, searching and sorting.

Course Outcomes:

- Understand the various steps in Program development.
- Explore the basic concepts in C Programming Language.
- Develop modular and readable C Programs
- Understand the basic concepts such as Abstract Data Types, Linear and Non-LinearData structures.
- Apply data structures such as stacks, queues in problem solving
- To understand and analyze various searching and sorting algorithms.

UNIT – I:

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

Introduction to C Language – Background, Simple C programs, Identifiers, Basic data types, Variables, Constants, Input / Output

Structure of a C Program – Operators, Bit-wise operators, Expressions, Precedence and Associatively, Expression Evaluation, Type conversions, Statements.

UNIT – II:

Statements – if and switch statements, Repetition statements – while, for, do-while statements, Loop examples, other statements related to looping – break, continue, go to, Recursion.

Designing Structured Programs- Functions, basics, user defined functions, inter function communication, standard functions.

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

UNIT – III:

Pointers – Introduction, Pointers for inter function communication, pointers to pointers, compatibility, **Pointer Applications** – Passing an array to a function, Memory allocation

functions, array of pointers **Strings** – Concepts, C Strings, String Input/Output functions, arrays of strings, string manipulation functions, string / data conversion.

UNIT – IV:

Derived types – The Typedef, enumerated types, Structures – Declaration, definition and initialization of structures, accessing structures, operations on structures, complex structures. Unions – Referencing unions, initializers, unions and structures.

Input and Output – Text vs Binary streams, standard library functions for files, converting file types, File programs – copy, merge files.

UNIT – V:

Sorting- selection sort, bubble sort, insertion sort,

Searching-linear and binary search methods.

Data Structures – Introduction to Data Structures, abstract data types, Linear list – singly linked list implementation, insertion, deletion and searching operations on linear list, Stacks- Operations, array and linked representations of stacks, stack applications, Queues-operations,array and linked representations.

TEXT BOOKS:

1. C Programming & Data Structures, B.A.Forouzan and R.F. Gilberg, Third Edition,Cengage Learning.
2. Problem Solving and Program Design in C, J.R. Hanly and E.B. Koffman, FifthEdition, Pearson Education.
3. The C Programming Language, B.W. Kernighan and Dennis M.Ritchie,PHI/Pearson Education

REFERENCE BOOKS:

1. C & Data structures – P. Padmanabham, 3rd Edition, B.S. Publications.
2. C Programming with problem solving, J.A. Jones & K. Harrow, Dreamtech Press
3 Programming in C – Stephen G. Kochan, III Edition, Pearson Education.
4. C for Engineers and Scientists, H. Cheng, McGraw-Hill International Edition
5. Data Structures using C – A. M. Tanenbaum, Y. Langsam, and M.J. Augenstein,Pearson Education / PHI
6. C Programming & Data Structures, E. Balagurusamy, TMH.
7. C Programming & Data Structures, P. Dey, M Ghosh R Thereja, Oxford University Press
8. C & Data structures – E V Prasad and N B Venkateswarlu, S. Chand & Co.

B. Tech. I Semester

L	T	P	C
2	0	0	2

EN101HS: English for Skill Enhancement

(Common to CE, ME, MCT, MME & ECE)

Course Objectives: This course will enable the students to:

- Improve the language proficiency in English with an emphasis on Vocabulary and improve their functional grammar.
- Enhance their Reading and Writing skills.
- Develop study skills and communication skills in various professional situations.
- Train in effective reading techniques for better comprehension of texts of various domains.
- Equip them to study Engineering subjects more effectively and critically using the theoretical and practical components of the syllabus.

Course Outcomes: Students will be able to:

- Choose appropriate vocabulary and sentence structures for their oral and written Communication.
- Demonstrate their understanding of the rules of functional grammar.
- Develop comprehension skills from the known and unknown passages.
- Take active part in drafting paragraphs, letters, essays, abstracts, précis and reports in various contexts.
- Acquire basic proficiency in reading and writing modules of English.

UNIT - I

Chapter entitled **Toasted English by R. K. Narayan** from **"English: Language, Context and Culture"** published by Orient BlackSwan, Hyderabad.

Vocabulary: The Concept of Word Formation -The Use of Prefixes and Suffixes - Acquaintance with Prefixes and Suffixes from Foreign Languages to form Derivatives - Synonyms and Antonyms

Grammar: Identifying Common Errors in Writing with Reference to Articles and Prepositions.

Reading: Reading and Its Importance- Techniques for Effective Reading.

Writing: Sentence Structures -Use of Phrases and Clauses in Sentences- Importance of Proper Punctuation- Techniques for Writing precisely – Paragraph Writing – Types, Structures and Features of a Paragraph - Creating Coherence-Organizing Principles of Paragraphs in Documents.

UNIT - II

Chapter entitled **Appro JRD by Sudha Murthy** from **"English: Language, Context and Culture" published** by Orient BlackSwan, Hyderabad.

Vocabulary: Words Often Misspelt - Homophones, Homonyms and Homographs

Grammar: Identifying Common Errors in Writing with Reference to Noun-pronoun Agreement and Subject-verb Agreement.

Reading: Sub-Skills of Reading – Skimming and Scanning – Exercises for Practice

Writing: Nature and Style of Writing- Defining /Describing People, Objects, Places and Events – Classifying- Providing Examples or Evidence.

UNIT - III

Chapter entitled **Lessons from Online Learning by F. Haider Alvi, Deborah Hurst et al** from **"English: Language, Context and Culture"** published by Orient BlackSwan, Hyderabad.

Vocabulary: Words Often Confused - Words from Foreign Languages and their Use in English.

Grammar: Identifying Common Errors in Writing with Reference to Misplaced Modifiers and Tenses.

Reading: Sub-Skills of Reading – Intensive Reading and Extensive Reading – Exercises for Practice – Barriers to Effective Reading.

Writing: Format of a Formal Letter-Writing Formal Letters E.g.., Letter of Complaint, Letter of Requisition, Email Etiquette, Job Application with CV/Resume.

UNIT - IV

Chapter entitled **Art and Literature by Abdul Kalam** from **"English: Language, Context and Culture"** published by Orient BlackSwan, Hyderabad.

Vocabulary: Standard Abbreviations in English – Idioms and Phrases
Grammar: Redundancies and Clichés in Oral and Written Communication.
Reading: Effective Steps to Reading - Survey, Question, Read, Recite and Review (SQ3R Method) - Exercises for Practice
Writing: Writing Practices- Essay Writing-Writing Introduction and Conclusion -Précis Writing.

UNIT - V

Chapter entitled **Go, Kiss the World by Subroto Bagchi** from **"English: Language, Context and Culture"** published by Orient BlackSwan, Hyderabad.
Vocabulary: Technical Vocabulary and their Usage
Grammar: Common Errors in English (Covering all the other aspects of grammar which were not covered in the previous units)
Reading: Reading Comprehension-Exercises for Practice
Writing: Technical Reports- Introduction – Characteristics of a Report – Categories of Reports Formats- Structure of Reports (Manuscript Format) -Types of Reports - Writing a Report.

Note: Listening and Speaking Skills which are given under Unit-6 in AICTE Model Curriculum are covered in the syllabus of ELCS Lab Course.

- **Note: 1**. As the syllabus of English given in AICTE Model Curriculum-2018 for B.Tech First Year is **Open-ended**, besides following the prescribed textbook, it is required to prepare teaching/learning materials **by the teachers collectively** in the form of handouts based on the needs of the students in their respective colleges for effective teaching/learning in the class.

- **Note**: **2**.Based on the recommendations of NEP2020, teachers are requested to be flexible to adopt Blended Learning in dealing with the course contents .They are advised to teach 40 percent of each topic from the syllabus in blended mode.

TEXTBOOK:

1. "English: Language, Context and Culture" by Orient BlackSwan Pvt. Ltd, Hyderabad. 2022. Print.

REFERENCE BOOKS:

1. Liss and Davis (2010) Effective Academic Writing, Oxford University Press.
2. Richards, Jack C. (2022) Interchange Series. Introduction, 1, 2, 3. Cambridge University Press
3. Wood, F.T. (2007). Remedial English Grammar. Macmillan.
4. Chaudhuri, Santanu Sinha. (2018). Learn English: A Fun Book of Functional Language, Grammar and Vocabulary. (2nd ed.,). Sage Publications India Pvt. Ltd.
5. Wiley (2019). Technical Communication. Wiley India Pvt. Ltd, Rupa Publications.
6. Vishwamohan, Aysha. (2013). English for Technical Communication for Engineering Students. Mc Graw-Hill Education India Pvt. Ltd.
7. Swan, Michael. (2016). Practical English Usage. Oxford University Press. Fourth Edition
8. Green, David (2015). Contemporary English Grammar Structure And Composition, Trinity Press (Imprint of Laxmi Publication Pvt Ltd)

B. Tech. I Semester

L	T	P	C
0	0	3	1.5

PH151BS:Applied Physics Laboratory

(Common to all branches)

Course Objectives: The objectives of this course for the student to

- Capable of handling instruments related to the Hall effect and photoelectric effect experiments and their measurements.
- Understand the characteristics of various devices such as PN junction diode, Zener diode, LED, solar cell, lasers and optical fiber and measurement of energy gap and resistivity of semiconductor materials.
- Able to measure the time constant of RC circuits.
- Study the variation of magnetic field along the axis of current carrying coil.
- Understanding the method of least squares fitting.

Course Outcomes: The students will be able to:

- Know the determination of the Planck's constant using Photo electric effect and identify the material whether it is n-type or p-type by Hall experiment.
- Appreciate quantum physics in semiconductor devices and optoelectronics.
- Gain the knowledge of applications of RC circuits.
- Understand the effect of magnetic field in different current carrying coils.
- Carried out data analysis.

LIST OF EXPERIMENTS:

1. Determination of work function and Planck's constant using photoelectric effect.
2. Determination of Hall co-efficient and carrier concentration of a given semiconductor.
3. Characteristics of series and parallel LCR circuits.
4. V-I characteristics of a p-n junction diode and Zener diode
5. V-I and P-I characteristics of light emitting diode (LED)
6. V-I Characteristics of solar cell
7. Determination of Energy gap of a semiconductor.
8. Determination of Acceptance Angle and Numerical Aperture of an optical fiber.
9. V-I characteristics of Laser diode.
10. Understanding the method of least squares – torsional pendulum as an example.
11. Determination of time constant using RC circuits
12. Determination of magnetic field of induction using Steewart-Gee's apparatus

Note: *Any 8 experiments are to be performed.*

REFERENCE BOOK:

1. S. Balasubramanian, M.N. Srinivasan "A Text book of Practical Physics"- S Chand Publishers, 2017.

B.Tech. I Sem.

L	T	P	C
0	0	2	1

CS152ES: C Programming and Data Structures Laboratory

(Common to CIVIL, ECE, EEE, MCT, MECH, MME)

Course Objectives:

- Introduce the importance of programming, C language constructs,program development, data structures, searching and sorting.

Course Outcomes:

- Develop modular and readable C Programs
- Solve problems using strings, functions
- Handle data in files
- Implement stacks, queues using arrays, linked lists.
- To understand and analyze various searching and sorting algorithms.

List of Experiments:

1. Write a C program to find the sum of individual digits of a positive integer.
2. Fibonacci sequence is defined as follows: the first and second terms in the sequenceare 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.
3. Write a C program to generate all the prime numbers between 1 and n, where n isa value supplied by the user.
4. Write a C program to find the roots of a quadratic equation.
5. Write a C program to find the factorial of a given integer.
6. Write a C program to find the GCD (greatest common divisor) of two given integers.
7. Write a C program to solve Towers of Hanoi problem.
8. 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)
9. Write a C program to find both the largest and smallest number in a list of integers.
10. Write a C program that uses functions to perform the following:
    i) Addition of Two Matrices
    ii) Multiplication of Two Matrices
11. 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.
12. Write a C program to determine if the given string is a palindrome or not
13. Write a C program that displays the position or index in the string S where the stringT begins, or – 1 if S doesn't contain T.
14. Write a C program to count the lines, words and characters in a given text.
15. Write a C program to generate Pascal's triangle.

16. Write a C program to construct a pyramid of numbers.

17. 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.)

18.

i. Write a C program which copies one file to another.
ii. Write a C program to reverse the first n characters ina file. (Note: The file name and n are specified on the command line.)

19.

i. Write a C program to display the contents of a file.
ii. 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)

20. Write a C program that uses functions to perform the following operations onsingly linked list.:

i) Creation ii) Insertion iii) Deletion iv) Traversal

21. Write C programs that implement stack (its operations) using

i) Arrays ii) Pointers

22. Write C programs that implement Queue (its operations) using

i) Arrays ii) Pointers

23. Write a C program that implements the following sorting methods to sort agiven list of integers in ascending order i) Bubble sortii) Selection sortiii)Insertion sort

24. Write C programs that use both recursive and non recursive functions to perform thefollowing searching operations for a Key value in a given list of integers:

i) Linear search ii) Binary search

TEXT BOOKS:

1. C Programming & Data Structures, B.A. Forouzan and R. F. Gilberg, Third Edition,Cengage Learning.
2. Let us C, Yeswanth Kanitkar
3. C Programming, Balaguruswamy.

B. Tech. I Semester

L	T	P	C
0	0	2	1

EN151HS: English Language and Communication Skills Laboratory

(Common to CE, ME, MCT, MME & ECE)

The **English Language and Communication Skills (ELCS) Lab** focuses on the production and practice of sounds of language and familiarizes the students with the use of English in everyday situations both in formal and informal contexts.

Course Objectives:

This course aims:

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

Course Outcomes: Students will be able to:

- Understand the nuances of English language through audio- visual experience and group Activities.
- Demonstrate their understanding of exact pronunciation of speech sounds.
- Acquire fluency in their language and neutralize their accent for intelligibility without Mother Tongue Interference (MTI).
- Speak with clarity and confidence which in turn enhances their employability skills.
- Develops their ability in presenting, arguing, summarizing and leading various communicative activities.

Syllabus: English Language and Communication Skills Lab (ELCS) shall have two parts:
a. Computer Assisted Language Learning (CALL) Lab

b. Interactive Communication Skills (ICS) Lab

Listening Skills:
Objectives
1. To enable students develop their listening skills so that they may appreciate the 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 recognize them and find the distinction between different sounds, to be able to mark stress and recognize 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 involve students in speaking activities in various contexts
2. To enable students express themselves fluently and appropriately in social and professional Contexts

• Oral practice
• Describing objects/situations/people
• Role play – Individual/Group activities
• Just A Minute (JAM) Sessions

The following course content is prescribed for the **English Language and Communication Skills Lab**.
Exercise – I
CALL Lab:
Understand: Listening Skill- Its importance – Purpose- Process- Types- Barriers- Effective Listening.
Practice: Introduction to Speech Sounds – Vowels and Consonants – Minimal Pairs-
Consonant Clusters- Past Tense Marker and Plural Marker- Testing Exercises
ICS Lab:
Understand: Spoken vs. Written language- Formal and Informal English.
Practice: Ice-Breaking Activity and JAM Session- Situational Dialogues – Greetings – Taking Leave – Introducing Oneself and Others.

Exercise – II
CALL Lab:
Understand: Structure of Syllables – Word Stress– Weak Forms and Strong Forms – Stress pattern in sentences – Intonation.
Practice: Basic Rules of Word Accent - Stress Shift - Weak Forms and Strong Forms- Stress pattern in sentences – Intonation - Testing Exercises
ICS Lab:
Understand: Features of Good Conversation – Strategies for Effective Communication.
Practice: Situational Dialogues – Role Play- Expressions in Various Situations –Making Requests and Seeking Permissions - Telephone Etiquette.

Exercise - III
CALL Lab:
Understand: Errors in Pronunciation-Neutralising Mother Tongue Interference (MTI).
Practice: Common Indian Variants in Pronunciation – Differences between British and American Pronunciation -Testing Exercises
ICS Lab:
Understand: Descriptions- Narrations- Giving Directions and Guidelines – Blog Writing
Practice: Giving Instructions – Seeking Clarifications – Asking for and Giving Directions – Thanking and Responding – Agreeing and Disagreeing – Seeking and Giving Advice – Making Suggestions.

Exercise – IV
CALL Lab:
Understand: Listening for General Details.
Practice: Listening Comprehension Tests - Testing Exercises
ICS Lab:
Understand: Public Speaking – Exposure to Structured Talks - Non-verbal Communication- Presentation Skills.
Practice: Making a Short Speech – Extempore- Making a Presentation.

Exercise – V
CALL Lab:

Understand: Listening for Specific Details.
Practice: Listening Comprehension Tests -Testing Exercises

ICS Lab:

Understand: Group Discussion – Introduction to Interview Skills
Practice: Group Discussion – Mock Interviews

Minimum Requirement of infrastructural facilities for ELCS Lab:

1. Computer Assisted Language Learning (CALL) Lab:

The Computer Assisted Language Learning Lab has to accommodate 40 students with 40 systems, with one Master Console, LAN facility and English language learning software for self- study by students.

System Requirement (Hardware component):

Computer network with LAN facility (minimum 40 systems with multimedia) with the following specifications:

i) Computers with Suitable Configuration

ii) High Fidelity Headphones

2. Interactive Communication Skills (ICS) Lab:

The Interactive Communication Skills Lab: A Spacious room with movable chairs and audiovisual aids with a Public Address System, a T. V. or LCD, a digital stereo –audio & video system and camcorder etc.

Source of Material (Master Copy):

- Exercises in Spoken English. Part 1, 2, 3. CIEFL and Oxford University Press

Note: Teachers are requested to make use of the master copy and get it tailor-made to suit the contents of the syllabus.

Suggested Software:

- Cambridge Advanced Learners' English Dictionary with CD.
- Grammar Made Easy by Darling Kindersley.
- Punctuation Made Easy by Darling Kindersley.
- Oxford Advanced Learner's Compass, 10th Edition.
- English in Mind (Series 1-4), Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge.
- English Pronunciation in Use (Elementary, Intermediate, Advanced) Cambridge University Press.
- English Vocabulary in Use (Elementary, Intermediate, Advanced) Cambridge University Press.
- TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS).
- Digital All
- Orell Digital Language Lab (Licensed Version)

REFERENCE BOOKS:

1. Kumar, Rajesh (2022). English Language Communication Skills – Lab Manual cum Workbook. Cengage Learning India Pvt. Ltd.
2. Shobha, KN & Rayen, J. Lourdes. (2019). Communicative English – A workbook. Cambridge University Press
3. Kumar, Sanjay & Lata, Pushp. (2019). Communication Skills: A Workbook. Oxford University Press
4. Board of Editors. (2016). ELCS Lab Manual: A Workbook for CALL and ICS Lab Activities. Orient Black Swan Pvt. Ltd.
5. Mishra, Veerendra et al. (2020). English Language Skills: A Practical Approach. Cambridge University Press.
6. Central Institute of English (2005). Exercises in Spoken English Vol. 1, 2 & 3, Oxford India, Hyderabad

B. Tech. I Semester

L	T	P	C
0	0	2	1

MM151PC: Elements of Metallurgical and Materials Engineering Laboratory

Course Objective:

- The objective of this course is to give an over of Metallurgical and Materials Engineering discipline

Course Outcomes:

By the end of the course student will be able to

- Get the basics of processes involved in extraction of Metals from their ores
- Gain understanding on Microstructure of metals and property measurements
- Understand fundamentals of Materials Processing
- Get basic knowledge on basic materials testing methods

List of Experiments:

1. Identification of various minerals and their sampling methods for mineral beneficiation
2. Leaching of Mineral through Hydrometallurgical Methods
3. Construction of electrolytic and electrochemical cells and understanding the principles of electrometallurgy
4. Study the constructional features of Metallurgical Microscope
5. Metallographic sample preparation of Ferrous and Non-Ferrous Metals
6. Hardness measurements of different materials using Rockwell and Vickers' Hardness.
7. Fundamentals of welding processes and preparation of Butt and Lap joints.
8. Fundamentals of Metal Casting and preparation of sand moulds and patterns.
9. Evaluation of compressive strength of Materials
10. Determination of porosity of Powder Metallurgy parts.

B. Tech. I Semester

L	T	P	C
0	1	3	2.5

ME151ES: ENGINEERING WORKSHOP

Pre-requisites: Practical skill

Course Objectives: At the end of this course students are expected to

- Study of different hand operated power tools, uses and their demonstration.
- Gain a good basic working knowledge required for the production of various engineering products.
- Provide hands on experience about use of different engineering materials, tools, equipment and processes those are common in the engineering field.
- Study commonly used Engineering trades like carpentry, fitting, tin smithy, foundry, house wiring, plumbing & black smithy and practical exposure to these trades.
- Study of various machining operations.

Course Outcomes: At the end of the course, the student will be able to

- Practice on various workshop trades including plumbing, fitting, carpentry, foundry, house wiring, tin smithy, black smithy and welding by using different tools.
- Identify and apply suitable tools for different trades of Engineering processes including drilling, material removing, measuring and chiseling.
- Apply basic electrical engineering knowledge for house wiring practice.
- Implement the knowledge of basic workshop processes under safety norms.
- Understand different metal joining techniques using arc welding process.

1. TRADES FOR EXERCISES:

At least two exercises from each trade:

I. Carpentry – (Bridle Joint, Half - Lap Joint, Mortise & Tenon Joint)
II. Fitting – (L- fit, V-Fit & Dovetail Fit)
III. Tin-Smithy – (Square Tin, Rectangular scoop & Rectangular tray)
IV. Foundry – (Preparation of Green Sand Mould using Single Piece and Split Pattern)
V. Welding Practice – (Arc Welding- Lap Joint, Butt Joint & T Joint)
VI. House-wiring – (Parallel & Series, Two-way Switch and Tube Light)
VII. Black Smithy – (Oval shape, S – Hook & Fan Hook)

2. TRADES FOR DEMONSTRATION & EXPOSURE:

Plumbing, Machine Shop, Metal Cutting (Water Plasma), Power tools used in construction and Wood Working operations.

Text Books:

1. Workshop Practice /B. L. Juneja / Cengage
2. Workshop Manual / K. Venugopal / Anuradha.

Reference Books:

1. Work shop Manual - P. Kannaiah/ K. L. Narayana/ SciTech
2. Workshop Manual / Venkat Reddy/ BSP

B. Tech. II Semester

L	T	P	C
3	1	0	4

MA201BS: Ordinary Differential Equations and Vector Calculus

(Common to all Branches)

Course Objectives

- Methods of solving the differential equations of first order.
- Methods of solving the differential equations of higher order.
- Concept, properties of Laplace transforms, solving ordinary differential equations using Laplace transforms techniques.
- The physical quantities involved in engineering field related to vector valued functions.
- The basic properties of vector valued functions and their applications to line, surface and volume integrals.

Course Outcomes

- Identify whether the given differential equation of first order is exact or not.
- Solve higher differential equation and apply the concept of differential equation to real world problems.
- Use the Laplace transforms techniques for solving ordinary differential equations.
- To analyse the physical quantities involved in engineering field related to vector valued functions.
- Evaluate the line, surface and volume integrals and converting them from one to another.

UNIT-I: First Order Ordinary Differential Equations

Exact differential equations, Equations reducible to exact differential equations, linear and Bernoulli's equations, Orthogonal Trajectories (only in Cartesian Coordinates). Applications: Newton's law of cooling, Law of natural growth and decay.

UNIT-II: Ordinary Differential Equations of Higher Order

Second order linear differential equations with constant coefficients: Non-Homogeneous terms of the type e^{ax}, sin ax, cos ax, polynomials in x, $e^{ax}V(x)$ and $x\,V(x)$, method of variation of parameters, Equations reducible to linear ordinary differential equations with constant coefficients: Legendre's equation, Cauchy-Euler equation. Applications: Electric Circuits.

UNIT-III: Laplace transforms

Laplace Transforms: Laplace Transform of standard functions, First shifting theorem, Second shifting theorem, Unit step function, Dirac delta function, Laplace transforms of functions when they are multiplied and divided by 't', Laplace transforms of derivatives and integrals of function, Evaluation of integrals by Laplace transforms, Laplace transform of periodic functions, Inverse Laplace transform by different methods, Convolution theorem (without proof). Applications: solving Initial value problems by Laplace Transform method.

UNIT-IV: Vector Differentiation

Vector point functions and scalar point functions, Gradient, Divergence and Curl, Directional derivatives, Tangent plane and normal line, Vector Identities, Scalar potential functions, Solenoidal and Irrotational vectors.

UNIT-V: Vector Integration

Line, Surface and Volume Integrals, Theorems of Green, Gauss and Stokes (without proofs) and their applications.

Suggested Readings:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications,

5th Edition, 2016.

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
3. H. K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, S Chand and Company Limited, New Delhi.
4. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications,Reprint, 2008.

B. Tech. II Semester

L	T	P	C
3	1	0	4

CH201BS: Engineering Chemistry

(Common to all branches)

Course Objectives:

To bring adaptability to the concepts of chemistry and to acquire the required skills to become a perfect engineer:

- To understand water quality for industrial and domestic usage, softening methods and related problems.
- To acquire the knowledge of Battery technology, corrosion and corrosion controlling techniques which are essential for the Engineers and applications in industries.
- To understand the preparation, properties and applications of polymeric materials.
- To get exposed to qualitative and quantitative parameters of fuels and to develop understanding of the combustion process.
- To understand the application of smart materials, lubricants, refractories and cement.

Course Outcomes:

After completing the course , the student will be able to acquire:

- Knowledge on the disadvantages of hard water for domestic and industrial purposes. The techniques of softening of hard water and treatment of potable water.
- Knowledge on storage of electrical energy in batteries, construction of batteries and fuel cells. Mechanism of corrosion of metals and alloys and corrosion control methods.
- Knowledge on the Preparation, properties and application of polymeric materials.
- Knowledge about the fuels, techniques of analysis for quality parameters of fuels, their combustion process and applications.
- Knowledge pertaining to the applications of smart materials, lubricants, refractories and cement.

UNIT - I: Water and its treatment: [8]

Introduction to hardness of water – Expression of hardness, Units and related numerical problems. Potable water and its specifications - Steps involved in the treatment of potable water - Disinfection of potable water by chlorination and breakpoint chlorination.

Boiler troubles: Sludge, Scale, Boiler corrosion and Caustic embrittlement. Internal treatment of Boiler feed water - Calgon conditioning - Phosphate conditioning - Colloidal conditioning. External treatment methods - Softening of water by ion- exchange processes. Desalination of water – Reverse osmosis.

UNIT – II Battery Chemistry & Corrosion [8]

Introduction - Classification of batteries - primary, secondary and reserve batteries with examples. Basic requirements for commercial batteries. Construction, working and applications of Zn-air and Lithium ion battery, Applications of Li-ion battery. Fuel Cells - Differences between battery and a fuel cell, Construction and applications of Methanol Oxygen fuel cell and Solid oxide fuel cell. Solar cells - Introduction and applications of Solar cells.

Corrosion: Causes and effects of corrosion – Theories of chemical and electrochemical

corrosion – mechanism of electrochemical corrosion. Types of corrosion: Galvanic, Water-line and Pitting corrosion. Factors affecting rate of corrosion. Corrosion control methods: Cathodic protection – Sacrificial anode and impressed current methods. Application of Metallic coatings - Electroplating

UNIT - III: Polymeric materials: [8]

Definition – Classification of polymers with examples – Types of polymerization – Addition and condensation polymerization with examples.

Plastics: Definition and characteristics - Thermoplastic and thermosetting plastics, Preparation, Properties and Engineering applications of PVC, Teflon and Bakelite.

Fibers: Preparation, Properties and Engineering applications of Nylon 6:6, and Terylene

Elastomers: Characteristics – Preparation – Properties and Applications of Buna-S, Butyl and Thiokolrubber.

Conducting polymers: Characteristics and Classification with examples - Mechanism of conduction in trans-polyacetylene and Applications of conducting polymers.

Biodegradable polymers: Concept and advantages - Polylactic acid and Polyvinyl alcohol and their applications.

UNIT - IV: Energy Sources: [8]

Introduction, Calorific value of fuel – HCV, LCV- Dulong's formula. Classification - solid fuels: Coal – Analysis of coal – Proximate and ultimate analysis and their significance. Liquid fuels – Petroleum and its refining, Cracking types – Moving bed catalytic cracking. Knocking – Octane and Cetane rating. Synthetic petrol - Fischer-Tropsch's process. Gaseous fuels – Composition and uses of Natural gas, LPG and CNG. Biodiesel – Transesterification, advantages.

UNIT - V: Engineering Materials: [8]

Smart materials and their engineering applications

Shape memory materials - Poly L- Lactic acid. Thermoresponse materials - Polyacryl amides, Poly vinylamides

Lubricants: Classification of lubricants with examples - Characteristics of a good lubricant. Properties of lubricants: Viscosity, Cloud point, Pour point, Flash point and Fire point.

Refractories: Definition, Classification, Characteristics of a good refractory. Application of refractories.

Cement: Portland cement - its composition, Setting and hardening

TEXT BOOKS:

1. Engineering Chemistry by P.C. Jain and M. Jain, Dhanpatrai Publishing Company, 2010
2. Engineering Chemistry by Rama Devi, Venkata Ramana Reddy and Rath, Cengage learning, 2016
3. A textbook of Engineering Chemistry by M. Thirumala Chary, E. Laxminarayana and K.Shashikala, Pearson Publications, 2021.
4. Textbook of Engineering Chemistry by Jaya Shree Anireddy, Wiley Publications.

REFERENCE BOOKS:

1. Engineering Chemistry by Shikha Agarwal, Cambridge University Press, Delhi (2015)
2. Engineering Chemistry by Shashi Chawla, Dhanpatrai and Company (P) Ltd. Delhi (2011)

B. Tech. II Semester

L	T	P	C
1	0	4	3

ME201ES: Engineering Graphics

Course Objectives:

- Recognize the standards of engineering graphics, learn to generate Geometric Constructions, Conic Sections and construct Engineering Scales.
- Understand the procedure to develop Orthographic projections of points, lines and planes.
- Learn the procedure to develop projection of solids and objects.
- Understand the procedure to generate the Sections and developments of Solids.
- Learn the procedure to develop Isometric projections, convert Orthographic views to Isometric views and vice versa using Graphics Instruments and AutoCAD.

Course Outcomes:

- Apply the fundamental principles of Engineering Graphics to create engineering drawings of various geometric constructions, conic sections and engineering scales adhering to BIS Standards.
- Generate Orthographic projections; Front View, top view and side views of points and lines.
- Draw the Orthographic projections of planes and solids
- Understand the Sections of solids and developments of surfaces.
- Develop Isometric projection convert Orthographic views to Isometric views and vice versa for practical engineering problems using AutoCAD.

UNIT – I:

Introduction to Engineering Graphics: Principles of Engineering Graphics and their Significance, Scales – Plain & Diagonal, Conic Sections-ellipse, parabola, hyperbola and Rectangular Hyperbola – General method only. Cycloid, Epicycloid and Hypocycloid. Introduction to Auto CAD software – Commands.

UNIT- II:

Orthographic Projections: Principles of Orthographic Projections – Conventions – Projections of Points and Lines, Projections of Plane regular geometric figures.

UNIT – III:

Projections of Regular Solids inclined to one plane, Sections and Sectional views of Right Regular Solids –Prism, Cylinder, Pyramid, and Cone

UNIT – IV:

Development of Surfaces of Right Regular Solids – Prism, Cylinder, Pyramid and Cone. Intersection of solids – cylinder vs cylinder.

UNIT – V:

Isometric Projections: Principles of Isometric Projection – Isometric Scale – Isometric Views – Conventions –Isometric Projection of solids. Conversion of Isometric Views to Orthographic Views and Vice-versa –Conventions.

Free hands Sketches of 2D, creation of 2D sketches. conversion of Isometric views to orthographic views using Auto CAD.

TEXT BOOKS:

1. Engineering Drawing N.D. Bhatt / Charotar
2. Engineering Drawing, Basant Agrawal and C M Agrawal, Third Edition McGraw Hill
3. Engineering Drawing and graphics Using AutoCAD Third Edition, T. Jeyapoovan, Vikas: S.Chand and company Ltd.

REFERENCE BOOKS:

1. Engineering Graphics and Design, WILEY, Edition 2020
2. Engineering Drawing, M. B. Shah, B.C. Rane / Pearson.
3. Engineering Drawing, N. S. Parthasarathy and Vela Murali, Oxford
4. Computer Aided Engineering Drawing – K Balaveera Reddy et al – CBS Publishers

Note: - Internal and External examinations are conducted in conventional mode.

B. Tech. II Semester

L	T	P	C
3	0	0	3

ME202ES: Engineering Mechanics

Course Objectives: The objectives of this course are to

- Explain the resolution of forces, compute the resultant of system of forces and solve problems using equations of equilibrium.
- Perform analysis of forces acting on bodies lying on rough surfaces.
- Locate the centroid and compute the area moment of inertia of standard and composite sections
- Locate centre of gravity and compute the mass moment of inertia of standard and composite bodies.
- Explain kinematics and kinetics of particles, curvilinear motion and rotation of rigid bodies.

Course Outcomes: At the end of the course, students will be able to

- Determine resultant of forces acting on a body and analyze equilibrium of a body subjected to system of forces.
- Solve problem of bodies subjected to friction.
- Find the location of centroid and calculate area moment of inertia of a given section.
- Find the centre of gravity and calculate the mass moment of inertia of given body.
- Solve problems using kinematic equations and also solve problems using principles of kinetics such as work-energy principle, Impulse-momentum principle

UNIT-I

Introduction to Engineering Mechanics - Basic concepts, System of Forces, Moment of Forces and its Application; Resultant of Force System, Free body diagrams, Equilibrium of System of Forces, Equations of Equilibrium of Coplanar Concurrent Force System; Spatial Systems - Components in Space, Resultant; Static Indeterminacy.

UNIT-II

Friction: Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, Wedge Friction, Screw jack;

UNIT-III

Centroid of Lines and Areas from first principles; Centroid of composite sections;
Centre of Gravity of simple bodies and composite bodies; Theorems of Pappus.

UNIT-IV

Moment of Inertia – Definition; Theorems of moment of inertia; Area Moment of inertia of plane sections from first principles, Area Moment of inertia of composite sections;

Mass Moment of Inertia - Transfer Formula, Mass moment of inertia of simple bodies and composite bodies.

UNIT-V

Kinematics - Rectilinear motion; Plane curvilinear motion;

Kinetics - D'Alembert's principle - its applications in translation and motion of connected bodies; Work Energy principle - its application in motion of connected bodies; Impulse-

momentum principle.

TEXT BOOKS:

1. K.Vijay Kumar Reddy and J.Suresh Kumar, Singer's Engineering Mechanics – Statics and Dynamics, BS Publications, 2011.
2. Irving H. Shames and G. Krishna Mohan Rao, Engineering Mechanics, Pearson Education, 2005.

REFERENCE BOOKS:

1. Timoshenko S.P and Young D.H., Engineering Mechanics, McGraw Hill International Edition, 1983.
2. Beer F.P & Johnston E.R Jr. Vector, Mechanics for Engineers, Tata McGraw Hill, 2004.
3. Hibbeler R.C & Ashok Gupta, Engineering Mechanics, Pearson Education, 2010.
4. Tayal A.K., Engineering Mechanics – Statics & Dynamics, Umesh Publications, 2011.
5. Basudeb Bhattacharyya, Engineering Mechanics, Oxford University Press, 2008.
6. Nelson A, Engineering Mechanics - Statics and Dynamics, McGraw Hill Education, 2017.

B. Tech. II Semester

L	T	P	C
2	0	0	2

MM201PC: Principles of Material Science and Engineering

Course Objective:

- This course is intended to give basic knowledge on classification, structure – Property relation of Materials

Course Outcomes:

At the end of the course, the student will be able to

- List various advanced materials and their need for building modern industry.
- Illustrate crystal systems and relevant calculations.
- Categorise imperfections in solids.
- Examine the types of solid solutions and their formation.
- Summarize properties of engineering materials

Unit - I: Introduction to Materials Engineering

Importance of Materials Science and Engineering, Classification of Materials, Advanced Materials, Modern Materials' Needs. Bonding in solids Metallic bond, ionic bond, covalent bond, van der Waals bond, mixed bond; forces between atoms/molecules.

Unit - II: The Structure of Crystalline Solids

Crystal Structures, Unit Cells, Metallic Crystal Structures, Polymorphism and Allotropy, classification of Crystal Systems; Crystallographic points, directions, and planes - Point Coordinates, Linear and Planar Density Computations. Crystalline and non-crystalline Materials – Single Crystals, Polycrystalline Materials, Anisotropy, Non-crystalline Solids. Comparative study of crystal structures in ceramics, polymers, and composites.

Unit - III: Imperfections in Solids

Point defects - Vacancies and Interstitials, cascades, Line Defects – Dislocations edge and screw dislocations; planarDefects, Volume Defects, Role of imperfections on properties of materials.

Unit - IV: Introduction to constitution of alloys

Definition, types of solid solutions, Hume Rothery's rules, compounds and conditions for their formation, Precipitation hardening and Dispersion hardening**.**

Unit - V: Properties of Materials

Physical, Mechanical, Thermal, Electrical, Magnetic, and Optical Properties.

Suggested Readings:

1. Materials Science and Engineering-An Introduction, William D. Callister, Jr., John Wiley & Sons, Inc., 2007, 7th Edition.
2. The Science and Engineering of Materials, Donald R. Askeland, Pradeep P. Phule, Thomson Learning, 2007, 5th Edition.
3. An introduction to materials engineering and science: for chemical and materials engineers, Brian S. Mitchell, John Wiley & Sons, Inc., 2004
4. Materials Science and Engineering – A First Course, V. Raghavan, Prentice Hall of India Private Limited, 2015, 6th Edition.
5. Materials Science and Engineering, G. S. Upadhyaya and Anish Upadhyaya, Viva Books Private Limited, 2006.

B. Tech. II Semester

0	0	2	1

CH251BS : Engineering Chemistry Laboratory

(Common to all branches)

Course Objectives:

The course consists of experiments related to the principles of chemistry required for an Engineering student and the student will learn the following:

- Estimation of hardness of water to check its suitability for industrial and drinking purpose and estimation procedures through volumetric analysis.
- Estimation procedures using conductometry and potentiometry.
- Preparation of polymers such as Bakelite and Polystyrene in the laboratory.
- Understand the lubricant properties such as saponification value and viscosity of oils.
- Understand the corrosion of metals in a corrosive medium.

Course Outcomes:

After completing the course, the student will gain practical knowledge on:

- Determination of parameters like hardness of water and estimations through volumetric analysis.
- Performance of experiments of conductometry and potentiometry and estimation procedures using them.
- Preparation of polymers like Bakelite and Polystyrene.
- Performing experiments related to estimation of saponification value and viscosity of lubricating oils.
- Performing experiments to know rate of corrosion of mild steel in various conditions.

List of Experiments:

I. **Volumetric Analysis:** Estimation of hardness of water by EDTA - Complexometry method.

II. **Volumetric Analysis:** Estimation of Fe^{+2} by Dichrometry.

III. **Conductometry:** Estimation of the concentration of an acid by Conductometry.

IV. **Potentiometry:** Estimation of the amount of Fe^{+2} by Potentiometry.

V. **Potentiometry:** Determination of an acid concentration using Potentiometer.

VI. **Preparations:**

1. Preparation of Bakelite.
2. Preparation Polystyrene

VII. **Lubricants:**

1. Estimation of acid value of given lubricating oil.
2. Estimation of viscosity of lubricating oil using Ostwald's Viscometer.

VIII. **Corrosion:** Determination of rate of corrosion of mild steel in the presence and absence of inhibitor

IX. **Virtual lab experiments**

a. Construction of Fuel cell and its working.

b. Smart materials for Biomedical applications

c. Batteries for Electrical vehicles.

d. Functioning of Solar cell and its applications.

REFERENCE BOOKS:

1. Lab manual for Engineering chemistry by B. Ramadevi and P. Aparna - S Chand Publications,New Delhi (2022)
2. Vogel's text book of practical organic chemistry - 5th edition
3. Inorganic Quantitative analysis by A.I. Vogel - ELBS Publications.
4. College Practical Chemistry by V.K. Ahluwalia - Narosa Publications Ltd., New Delhi (2007).

B. Tech. II Semester

L	T	P	C
0	1	2	2

CS251ES: Python Programming Laboratory

Course Objectives:

- To install and run the Python interpreter
- To learn control structures.
- To Understand Lists, Dictionaries in python
- To Handle Strings and Files in Python

Course Outcomes: After completion of the course, the student should be able to

- Develop the application specific codes using python.
- Understand Strings, Lists, Tuples and Dictionaries in Python
- Verify programs using modular approach, file I/O, Python standard library
- Implement Digital Systems using Python

Note: The lab experiments will be like the following experiment examples

Week -1:

1. i) Use a web browser to go to the Python website http://python.org. This page contains information about Python and links to Python-related pages, and it gives you the ability to search the Python documentation.

ii) Start the Python interpreter and type help() to start the online help utility.

2. Start a Python interpreter and use it as a Calculator.3.
   i) Write a program to calculate compound interest when principal, rate and number of periods aregiven.
   ii) Given coordinates (x1, y1), (x2, y2) find the distance between two points

4. Read name, address, email and phone number of a person through keyboard and print the details.

Week - 2:

1. Print the below triangle using for loop.5

4 4
3 3 3
2 2 2 2
1 1 1 1 1

2. Write a program to check whether the given input is digit or lowercase character or uppercasecharacter or a special character (use 'if-else-if' ladder)
3. Python Program to Print the Fibonacci sequence using while loop
4. Python program to print all prime numbers in a given interval (use break)

Week - 3:

1. i) Write a program to convert a list and tuple into arrays.

ii) Write a program to find common values between two arrays.

2. Write a function called gcd that takes parameters a and b and returns their greatest common divisor.
3. Write a function called palindrome that takes a string argument and returns True if it is a

palindromeand False otherwise. Remember that you can use the built-in function len to check the length of a string.

Week - 4:

1. Write a function called is_sorted that takes a list as a parameter and returns True if the list is sortedin ascending order and False otherwise.
2. Write a function called has_duplicates that takes a list and returns True if there is any element thatappears more than once. It should not modify the original list.

   i). Write a function called remove_duplicates that takes a list and returns a new list with only theunique elements from the original. Hint: they don‟t have to be in the same order.
   ii). The wordlist I provided, words.txt, doesn‟t contain single letter words. So you might want to add“I”, “a”, and the empty string.
   iii). Write a python code to read dictionary values from the user. Construct a function to invert itscontent. i.e., keys should be values and values should be keys.

3. i) Add a comma between the characters. If the given word is 'Apple', it should become 'A,p,p,l,e'
   ii) Remove the given word in all the places in a string?
   iii) Write a function that takes a sentence as an input parameter and replaces the first letter of every word with the corresponding upper case letter and the rest of the letters in the word by corresponding letters in lower case without using a built-in function?
4. Writes a recursive function that generates all binary strings of n-bit length

Week - 5:

1. i) Write a python program that defines a matrix and prints
   ii) Write a python program to perform addition of two square matrices
   iii) Write a python program to perform multiplication of two square matrices
2. How do you make a module? Give an example of construction of a module using different geometricalshapes and operations on them as its functions.
3. Use the structure of exception handling all general purpose exceptions.

Week-6:

1. a. Write a function called draw rectangle that takes a Canvas and a Rectangle as arguments and draws a representation of the Rectangle on the Canvas.
   b. Add an attribute named color to your Rectangle objects and modify draw_rectangle so that ituses the color attribute as the fill color.
   c. Write a function called draw point that takes a Canvas and a Point as arguments and draws arepresentation of the Point on the Canvas.
   d. Define a new class called Circle with appropriate attributes and instantiate a few Circle objects.Write a function called draw circle that draws circles on the canvas.
2. Write a Python program to demonstrate the usage of Method Resolution Order (MRO) in multiplelevels of Inheritances.
3. Write a python code to read a phone number and email-id from the user and validate it forCorrectness.

Week- 7

1. Write a Python code to merge two given file contents into a third file.

2. Write a Python code to open a given file and construct a function to check for given words present init and display on found.
3. Write a Python code to Read text from a text file, find the word with most number of occurrences
4. Write a function that reads a file *file1* and displays the number of words, number of vowels, blankspaces, lower case letters and uppercase letters.

Week - 8:

1. Import numpy, Plotpy and Scipy and explore their functionalities.
2. a) Install NumPy package with pip and explore it.
3. Write a program to implement Digital Logic Gates – AND, OR, NOT, EX-OR
4. Write a program to implement Half Adder, Full Adder, and Parallel Adder
5. Write a GUI program to create a window wizard having two text labels, two text fields and two buttons as Submit and Reset.

TEXT BOOKS:

1. Supercharged Python: Take your code to the next level, Overland
2. Learning Python, Mark Lutz, O'reilly

REFERENCE BOOKS:

1. Python Programming: A Modern Approach, Vamsi Kurama, Pearson
2. Python Programming A Modular Approach with Graphics, Database, Mobile, and W eb Applications, Sheetal Taneja, Naveen Kumar, Pearson
3. Programming with Python, A User‟s Book, Michael Dawson, Cengage Learning, India Edition
4. Think Python, Allen Downey, Green Tea Press
5. Core Python Programming, W. Chun, Pearson
6. Introduction to Python, Kenneth A. Lambert, Cengage

B. Tech. II Semester

L	T	P	C
0	0	2	1

MM251PC: Principles of Materials Science and Engineering Lab

Course Objective:

- The objective of this course is to give hands on experience on testing of material

Course Outcomes:

At the end of the course student will be able to

- Gain knowledge on atomic arrangements in different crystal
- Understand the testing procedure of various physical properties of materials
- Understand the testing procedure of various physical properties of Fuels
- CO4: Understand the testing procedure of various physical properties of Fuels

List of Experiments:

1. Construction of crystal structures – SC, BCC,
2. Construction of crystal structures FCC and HCP
3. Measurement of density of different materials using Archimedes Principle
4. Measurement of EMF of unknown cell with the Help of Potentiometer
5. Measurements of Temperatures using pyrometers
6. Determination of calorific values of solid and gaseous fuels
7. Determination of influence of temperature on viscosity of lubricating oils
8. Measurement of Specific Heat of different materials
9. Study of electrical properties of Materials
10. Study the optical properties of Materials

B. Tech. II Semester

L	T	P	C
3	0	0	0

MC201BS: Environmental Science

(Common to all branches)

Course Objectives:

- To understand the importance of ecosystem and ecological balance.
- To understand the natural resources and their conservation.
- To understand the importance of biodiversity and its values.
- To gain knowledge about environmental pollution, effects and controlling measures. To study about global environmental problems and global issues.
- To understand the environmental policies, regulations and sustainable development.

Course Outcomes:

After completing the course, the student will be able to:

- Get the information about ecosystem and their usage and conservation.
- Learn different types of natural resources and take up the measures to protect the resources.
- Get the information about biodiversity and their usage and conservation.
- Get the information about the types of pollution, understand their effects and controlling measures. Gain the knowledge about current global environmental issues and initiations to be taken to protect the environment.
- Gain the knowledge about environmental acts, EIA, sustainable development and follow the rules 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** and **Forest resources**. **Energy resources:** Growing energy needs, renewable and non-renewable energy resources, use of alternate energy resources. Case studies.

UNIT - III

Biodiversity and Biotic Resources: Introduction, definition, genetic, species and ecosystem diversity. Values 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. **Soil pollution:** Sources and types, impacts of modern agriculture, degradation of soil. **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 issues and Global efforts: Climate 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. NAPCC-GoI Initiatives.

UNIT - V

Environmental Policy, Legislation & EIA: Environmental Protection Act, legal aspects Air Act- 1981, Water Act, biomedical waste management and handling rules, hazardous waste management and handling rules.

EIA: EIA structure, methods of baseline data acquisition. Concepts of environmental management plan (EMP).

Towards Sustainable Future: Concept of sustainable development goals, population and its explosion. Crazy consumerism, Environmental education, Human health, Environmental ethics. Concept of green building, Principles of green chemistry, Ecological footprint, Life cycle assessment (LCA), Low carbon life style.

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.
6. Introduction to Environmental Science by Y. Anjaneyulu, BS Publications.

B. Tech. III Semester

L	T	P	C
3	0	0	3

MM301PC: Iron Making

Course objectives:

- Discuss the evolution of Iron making in chronological order.
- Illustrate the applications of thermodynamics and kinetics in production of pig iron andrefining it.
- Outline the techniques for production and primary processing in Blast furnace.
- Differentiate between past and present production methods and examine the modern trendsin iron production.
- Identify consists of and effect for blast furnace irregularities and their remedial measures.

Course outcomes: At the end of the course, the student will be able to

- Describe the developments of Iron making and recognize the importance of processing raw materials for Iron making keeping in view of economics, safety, and efficiency.
- Identify the required parameters and design of a blast furnace and illustrate ancillary equipment and measures to be taken for starting and troubleshooting of the Blast furnace process.
- Predict the physio-chemical phenomena taking place in blast furnace. Able to perform simple mass balance and complex problems.
- Identify and explain the modernization techniques to improve quantity, quality, and minimize waste.
- Able to predict the possible alternative processes to be followed suitable to the local conditions in view of energy, environmental and efficiency considerations.
- Able to undertake any technical assignment in R&D and production units with professional responsibility towards profession and society.

UNIT – I: Raw materials for Iron making. Occurrence and distribution of iron ores, fuels, and fluxes.Preparation of iron ores.

UNIT – II: Blast Furnace profile and design considerations. Furnace lining. Furnace cooling system. Blast Furnace stoves, BF gas cleaning system. Blast furnace operation and irregularities.

UNIT – **III**: Systems of importance in iron making blast furnace reactions. Thermodynamics of iron oxide reduction by $CO + CO_2$ and H_2 and H_2O mixtures. Control of C, Si, S, P in metals and slags. Blast furnace slags. Burden calculations.

UNIT – IV: Modern trends in blast furnace: High top pressure, humidification of blast, Oxygen enrichment,hot blast temperature, BF additives, and top charging systems.

UNIT – V: Alternative routes of iron making: Sponge iron making: HYL, Rotary Kiln, Midrex process.Smelting and reduction methods such as Corex process.

Suggested Readings:

1. Iron making and steel making – Theory and practice Ahindra and Ghosh.
2. Beyond the B.F – Amit Chatterjee
3. Sponge Iron production by direct reduction of Iron ores - Amit Chatterjee, P & H. publications,2010
4. Hot metal production by smelting reduction of Iron ore - Amit Chatterjee. P & H publications,2010.

B. Tech. III Semester

L	T	P	C
3	0	0	3

MM302PC: Mineral Processing

Course Objectives:

- The prime objective of the mineral processing course is to build the solid foundation on principles and equipment of various unit operations such as Liberation done by size reduction process.
- To determine the mineral sizes by Screening and Classification process and finally the Separation of metal bearing minerals from rocky mass that would facilitate metal extraction.
- The emphasis on the Indian mineral industry is a key component of this course.

Course Outcomes: The student will be able to

- Recognize the importance of mineral processing from economic front and sampling process.
- Appraise the comminution operations - principles, types and equipment and industrial practice.
- Categorize laboratory sizing and industrial screening and classification methods.
- Propose the concentration operation such as Heavy Media Separation, Magnetic Separation and Electrostatic Separation based on nature of minerals.
- Justify the Gravity Concentration and Froth Flotation for economic recovery of valuable minerals.

UNIT I: Scope and Objectives of Ore Dressing; Sampling of ores by different methods; Theory of liberation of minerals; Crushing - Jaw, Gyratory, Cone, Rolls and Toothed Roll crushers. Grinding - Types of grinding operations like Batch and Continuous grinding, Dry and Wet grinding, Open circuit and Closed-circuit grinding, Grinding Mills - Ball mills, Theory of ball mill operation, Rod and Tube mills; Comminution laws - Rittinger's laws, Kick's law and Bond's law.

UNIT 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; **Classification** – Types of classifiers, Study of Settling Cones, Rake Classifier, Spiral Classifier and Cyclones. **Movement of solids in fluids** – Stokes' and Newton's laws, Terminal velocity and its relationship with size, Relation between time and velocity, Relation between distance travelled and velocity; Equal settling ratio, Free and hindered settling ratios; **Quantifying concentrating operations**– Ratio of concentration, Recovery, Selectivity Index and Economic Recovery.

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 processes.

UNIT IV: Jigging: - Theory of jigging, Jigging machines – Harz jig, Denver jig Baum jig, Hancock jig, James coal jig and Halkyln jig, Design considerations in a jig. Tabling - Study of stratification on a table. Shaking tables, Wilfley table.

UNIT V: Flotation - Principles of flotation, Factors affecting flotation, Classification of Collectors and Frothers, Regulators, and Factors affecting their efficiency, Application of flotation process for Cu, Pb and Zn ores.

Suggested Readings:

1. Mineral Processing Technology - Barry A. Wills, Tim Napier-Munn, Elsevier Science and Technology Books, ISBN:0750644508, October 2006.
2. Principles of Mineral Dressing - A.M. Gaudin, McGraw Hill Book Company, 1940

Reference Books:

1. Mineral Processing - S. K. Jain, CBS Publishers & Distributors, ISBN: 9788123907536,
2. Elements of Ore Dressing - A. F. Taggart, New York, John Wiley and Sons, Inc. London Chapman and Hall, Ltd.1951.

B. Tech. III Semester

L	T	P	C
3	1	0	4

MM303PC: Metallurgical Thermodynamics and Kinetics

Course Objectives:

- The course is primarily intended to give the students a fundamental insight into the Science and Engineering of Thermodynamics.
- The Course is instructed to get the students know about the inter-conversion of work and heat in various thermodynamic processes.
- The Course also focuses on significant applications of Thermodynamics and Kinetics in metallurgical concerned processes viz., extraction, refining, and diffusion.

Course Outcomes: At the conclusion of the course, the student will be able to…….

- Apply the knowledge of thermodynamics in the real engineering world.
- Interpret and apply the data of thermodynamics in the Metallurgical Engineering processes.
- Conclude the most appropriate correlations of thermodynamic functions with the thermodynamic variables.
- Identify and recommend the optimum operational parameters to be employed in significant Metallurgical Engineering processes.

UNIT I: Fundamental Thermodynamics: Conceptual outlook on Thermodynamics: Scope, prime objectives, merits, and limitations. Thorough understanding on some of the significant thermodynamic quantities viz., system, state, process, path, reversibility, irreversibility, intensive property and extensive property, heat capacity, and enthalpy. The Laws of Thermodynamics (Zeroth, First, Second). Heat and Work Calculations. Calculation of Thermodynamic efficiency: Carnot's theorem and concerned case studies. Third Law of Thermodynamics.

UNIT II: The Thermodynamic functions: Free Energy-purpose, significance, and applications. Temperature's influence on Free Energy, Determination of Free Energy Change. Maxwell's Equations. Concepts of Fugacity, Activity, and Equilibrium Constant. Clausius-Clapeyron Equation.

UNIT III: Phase Equilibrium Diagrams-Thermodynamics Application: Concepts of Chemical Potential, Gibbs Phase Rule. Free Energy-Composition curves. Determination of liquidus and solidus lines. Construction of distinct phase equilibrium diagrams with thermodynamics viewpoint.

UNIT IV: Solution Thermodynamics: Applications in Metallurgy: An Overview of the concept of solutions applied for metallurgy. Classification of solutions based on Raoult's Law and Henry's Law. Concept of partial molar thermodynamic quantities. Gibbs-Duhem Equation-Derivation, applications, and significance. Excess Thermodynamic functions. Application of Sievert's Law in process metallurgy.

UNIT V: Metallurgical Kinetics: Fundamental understanding on Chemical Kinetics and its

related terms and Laws. Concept of Diffusion-a significant case study of Kinetics applied to metallurgical processes. Diffusion along the grain boundaries. Fick's Laws of Diffusion-Applications in Processes related to Metallurgical Industries.

Suggested Readings:

1. Problems in Metallurgical Thermodynamics: G.S Upadhyaya, R.K. Dubey, Elsevier Science, 2013.
2. Introduction to the Thermodynamics of Materials, David R Gaskell, 4th Edition, Taylor & Francis pub., 2009.

Reference Books:

- Physical Chemistry of Metals- L.S. Darken & Gurry, CBS publishers & Distributors 2002.

B. Tech. III Semester

L	T	P	C
3	0	0	3

ME331ES: Mechanics of Solids and Fluids

Course Objectives:

The objective is to learn the fundamental concepts of stress, strain, and deformation of solids with applications to bars and beams. To learn a number of potentially useful phenomena involving movement of solids and fluids. This course will advance the students' development of the following broad capabilities:

- Students will be able to understand basic concepts of stress, strain and their relations based on linear elasticity.
- Material behaviors due to different types of loading will be discussed.
- To understand how to develop shear-moment diagrams of a beam.
- To understand how to find the maximum moment/shear and their locations.
- To understand the basic principles of fluid mechanics.
- To identify various types of flows

Course Outcomes: At the end of the course, the student will be able to

- Analyse the behaviour of the solid bodies subjected to various types of loading.
- Apply knowledge of materials and structural elements to the analysis of simple structures.
- Undertake problem identification, formulation and solution using a range of analytical methods.
- Able to explain the effect of fluid properties on a flow system.

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 – Temperature stresses.

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, uniformly distributed loads, and uniformly varying loads – Point of contra flexure.

UNIT – III: Flexural Stresses: Theory of simple bending – Assumptions – Derivation of bending equation: $M/I = f/y = E/R$; Neutral axis – Determination of bending stresses; section modulus of rectangular and circular sections (Solid). 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– Polar section modulus.

UNIT – IV: Fluid Properties: Dimensions and Units: Physical properties of Fluids -density, specific weight, specific gravity, viscosity vapour pressure -atmospheric gauge and vacuum pressure -measurement of pressure – manometers – Piezometer, U-tube, and Differential Manometers.

UNIT – V: Fluid Kinematics: Basic definition of Streamline, path line, streak lines, and classification of flows: steady, unsteady, uniform, non-uniform, laminar, turbulent, rotational and irrotational flows. Equation of continuity for 1-dimensional flow.

Fluid Dynamics: Surface and body forces- Euler's and Bernoulli's equations for flow along a streamline, Measurement of Flow: Venturi meter, Orifice meter.

Suggested Readings:

1. Strength of Materials by S. S. Rattan, Tata McGraw Hill Education Pvt. Ltd
2. Strength of Materials by Bhanikatti
3. Hydraulics, Fluid mechanics and Hydraulic Machinery - MODI and SETH.
4. Fluid Mechanics and Hydraulic Machines by Rajput.

Reference Books:

1. U. C. Jindal, “Strength of Materials”, Pearson Education India,2012
2. Strength of Materials by R.K.Bansal
3. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, Kotaria & Sons.

B. Tech. III Semester

L	T	P	C
3	1	0	4

MM304PC: Physical Metallurgy

Course Objectives:

- The prime objective of this course is to make the student gain an understanding of the relation between microstructural characteristics and properties 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.

Course Outcomes:

- Apply the concepts of strengthening mechanisms to alloy systems.
- Construct the binary alloy phase diagrams.
- Apply the Kinetics of phase transformations in alloy systems.
- Analyse the microstructure-property correlation of alloy systems.
- Select the materials required for engineering applications.
- Learn the physical metallurgy concepts of non-ferrous alloy systems.

UNIT-I: Introduction: Importance of alloying, Constitution of Alloys. Grain size measurement methods–ASTM grain size measurement, Linear intercept method, Jeffrey's planimetric method, microstructures of pure metals, microstructure of different alloys; Dislocation strengthening mechanisms and slip systems, strengthening mechanisms: Grain boundary strengthening, work hardening, solid solution strengthening, precipitation hardening and dispersion strengthening.

UNIT-II: Equilibrium Diagrams: Experimental methods for construction of equilibrium diagrams, Unary phase diagram, Isomorphous systems, Phase rule and its applications, Lever rule and its applications, Equilibrium heating and cooling of an isomorphous alloy, Coring, Miscibility gaps, Eutectic systems, Congruent melting intermediate phases, Eutectoid, Peritectic, Peritectoid, Monotectic and Syntectic reactions. Study of important binary systems of Cu-Zn, Cu-Sn, Pb-Sn.

UNIT-III: Study of Fe-Fe_3C phase diagram. Interpretation of solidification behaviour and microstructure of different alloys belonging to different systems. Introduction to TTT diagrams of Steels, Effect of alloying elements on Fe-Fe_3C phase diagram and TTT diagrams; CCT diagrams, Austempering and Martempering.

UNIT-IV: Types of Cast Irons; Classification of Stainless steels; Maraging steels, Hadfield Mn steels, Electrical steel, Introduction to Dual phase steels, Twinning induced plasticity (TWIP) steels and Transformation induced plasticity (TRIP) steels.

UNIT-V: Introduction to Al alloys, classification, properties, and applications. Physical metallurgy of Al-Cu, Al-Mg, Al-Mn systems. Introduction to ternary phase diagrams, Study of Al-Mg-Si Al-Zn-Mg Systems. Introduction to Ti alloys: Commercially pure Ti, its properties, and applications. Classification of Ti alloys. Alpha Ti alloys, Beta Ti alloys and alpha plus beta Ti alloys, Ti–5Al–2.5Sn, Ti-5553 alloy and Ti-6Al-4V alloys.

Textbooks:

1. Introduction to Physical Metallurgy - Sidney H Avner - Mc Graw Hill Publications
2. Physical Metallurgy Principles - Robert E. Reed-Hill – Cengage Learning 4th Ed.

Physical Metallurgy: Principles and Practice - V. Raghavan – PHI Publications.

B. Tech. III Semester

L	T	P	C
0	0	2	1

MM351PC: Physical Metallurgy Lab

Course Objectives:

The laboratory course helps to:

- Gain skills of preparation of samples for metallographic examinations.
- Find and analyze the microstructures of various ferrous and non-ferrous materials.
- Use the suitable metallurgical microscope with suitable magnification.

Course Outcomes: By completing this laboratory course, students:

- Can describe the sample preparation, mounting and use/choosing of different etching reagents.
- Can identify and report the microstructural features of ferrous and non-ferrous samples observed.
- Can operate optical microscope with an ease.
- Characterize microstructures of engineering alloys using optical microscopy and image analyzer.

List of Experiments

1. Understanding of Constructional features and principle of Optical microscope.
2. Cold and Hot mounting of miniature samples
3. Metallographic preparation and microstructure evaluation of steels.
4. Metallographic preparation and microstructure evaluation of Non-ferrous metals and alloys.
5. Metallographic preparation and microstructure evaluation of different cast irons (grey cast iron, white cast iron, malleable cast iron, spheroidal graphite iron).
6. Measurement of Grain size by ASTM method, Heyn's Intercept Method, Jeffery's Planimetric method
7. Determination of phase fraction and grain size using Image analyser.
8. Identification of various zones in welded structures
9. Compare and evaluate the microstructures of stainless steels using chemical etching and electrolytic etching.
10. Determination of type of inclusions in steels, using ASTM Standard charts
11. Drawing of the Binary phase diagrams of (Cu-Ni), Eutectic (Pb-Sn, Al-Si) and partial solubility diagram (Al-Cu) with interpretation.
12. Study of sample preparation for electron microscopy

B. Tech. III Semester

L	T	P	C
0	0	2	1

MM352PC: Mineral Processing Lab

Course Objectives:

- This laboratory course is designed to make the student to recognize and demonstrate the process variables in mineral processing operations. The students also gain hands-on laboratory experience by performing mineral liberation, sizing and finally concentration processes.

Course Outcomes: The student would gain hands on experience to

- Recognize the sampling process and movement of the mineral particle in fluid by justified by Stoke's Law.
- Identify the Particle Size and its distribution of a given material using Sieve Analysis Data.
- Differentiate the reduction ratio, capacities of Jaw crusher and Roll crusher.
- Appraise the ability of the minerals to be grounded using Grinding mill and Hard groove Grindability Tester.
- Analyze the concentration operation such as Magnetic separation, Jigging, Wilfley Table for economic recovery of minerals.

List of experiments:

1. Sampling of an ore from the bulk by
(a) Coning and quartering method and (b) Riffle sampler methods
2. Sizing of material by Sieve analysis.
3. Verification of Stokes' Law.
4. Determining the reduction ratio of a Jaw crusher.
5. To determine the variation of reduction ratio with process variables in Rolls crusher.
6. Effect of process variables on reduction ratio and particle size distribution in Ball mill.
7. To find the grindability index of coal.
8. Study the Laws of Comminution and their verification.
9. Determination of the efficiency of a magnetic separator.
10. Study the working principle of a jig.
11. Study the particle separation by fluid flow using Wilfley table.

B. Tech. III Semester

L	T	P	C
0	0	2	1

MM353PC: Basic Metallurgical Computations Lab

Course Objectives:

- This course is designed to make the student to demonstrate simple programming skills.
- To provide practice on the computational methods for evaluation of metallurgical and materials engineering problems**.**

Course Outcomes: Upon successful completion of this course, the student will be able to write simple computer programmes,

- For phase rule, ASTM grain size number and packing factor in cubic crystals.
- For calculation of ultimate tensile strength (UTS), yield strength (YS), % elongation and % reduction in area and Hall Petch relation.
- For determination of heat transfer
- For determination of free energy, entropy, and enthalpy
- For determination of electrochemical properties

List of Experiments: Programming of

1. Estimation of proportion of phases using Lever rule, ASTM grain size and packing factor for BCC, FCC, and HCP cubic crystals.
2. Determination of ΔH using Kirchhoff's equation, ΔG° from enthalpy and entropy data.
3. To solve the problems on heat conductions
4. Calculation of ultimate tensile strength (UTS), yield strength (YS), and Hall Petch relation
5. Functions in computing free energy of common metallurgical systems from enthalpy, entropy and/or heat capacity and determination of temperature of reduction of metal oxides.
6. Computation of % CO/CO_2 with a given temperature profile along the height of blast furnace and reduction reactions.
7. Write a program to simulate mechanical properties of pure metal/ simple binary isomorphous/ eutectic system from given composition, heat treatment condition, % cold working etc.
8. Write a program to design sacrificial anode for cathodic protection of underground pipeline with given pipe dimensions and electrochemical properties.

Suggested Readings:

1. Computer oriented Numerical methods – V. Rajaraman (PHI Publications)
2. Computer programming and Numerical methods – S. Saran
3. Numerical methods in engineering – Mario G. Salvadori and Melvin L. Baron
4. Matrix operation on Computer – L.L. Brirud (LCUE Publication)

B. Tech. III Semester

L	T	P	C
3	0	0	0

MC301HS: Constitution of India

(Common to ME, ECE, CSM, MCT & MME)

Course Objectives:

- To understand the history of making of Indian Constitution and the role of drafting committee.
- To list the salient features of the Preamble to the Constitution of India
- To identify the importance of fundamental rights as well as fundamental duties
- To understand the powers and functions of parliament, President, Council of Ministers, Governor
  Judges, etc and their qualifications.
- To have a thorough understanding of Local self-government and its associated agencies.
- To learn and realise the role and functioning of election commission and Institute and Bodies for the
  welfare of SC/ST/OBC and women.

Course Outcomes: At the end of the course, students will be able to:

- Describe the history of making of Indian Constitution and the role of drafting committee
- Explain the purpose of Preamble to the Constitution of India
- Outline the Fundamental Rights and Fundamental Duties of a citizen.
- Acquire knowledge on functioning of Parliament, Executive and judiciary systems.
- Comprehend and evaluate the role of Local self government and its associated agencies.
- Assess and analyze the role and functioning of the Election Commission.

Unit – 1 History of Making of the Indian Constitution- History of Drafting Committee.
Unit - 2 Philosophy of the Indian Constitution- Preamble Salient Features
Unit - 3 Contours of Constitutional Rights & Duties - Fundamental Rights

- Right to Equality
- Right to Freedom
- Right against Exploitation
- Right to Freedom of Religion
- Cultural and Educational Rights
- Right to Constitutional Remedies
- Directive Principles of State Policy
- Fundamental Duties.

Unit - 4 Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions

Unit - 5 Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Panchayat raj: Introduction, PRI: Zila Panchayat. Elected officials and their roles, CEO ZilaPanchayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

Unit - 6 Election Commission: Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

Suggested Reading:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

B. Tech. IV Semester

L	T	P	C
3	0	0	3

EE431ES: Basic Electrical And Electronics Engineering

(Common for ME and MME)

Prerequisite: Mathematics and Physics

Course Objectives:

1. To understand magnetic circuits, DC circuits and AC single phase & three phase circuits
2. To impart the knowledge of various electrical installations
3. To study and understand the different types of DC/AC machines and Transformers.
4. To introduce the concepts of diodes & filters
5. To impart the knowledge of various configurations, characteristics and applications in transistors and field effect transistors.

Course Outcomes: After completion of the course, students will be able to:

CO1. To analyze and solve electrical circuits using network laws and theorems.
CO2. To introduce components of Low Voltage Electrical Installations
CO3. To study the working principles of Electrical Machines
CO4. To understand and analyze basic diode and rectifier configurations
CO5. To identify and characterize various types of transistors.

UNIT-I: ELECTRICAL CIRCUITS

DC Circuits: Electrical circuit elements (Resistor, Inductor & Capacitor), Ohm's Law, voltage and current sources (Independent and Dependent), Kirchhoff's Laws, Mesh Analysis, Nodal Analysis, Delta-Star & Star Delta Conversion

AC Circuits: Representation of sinusoidal waveforms, peak value and rms values, phasor representation, Analysis of single-phase ac circuits with phasor diagrams, Three-phase balanced circuits, voltage and current relations in star and delta connections

UNIT-II: ELECTRICAL INSTALLATION

Miniature Circuit Breaker (MCB), Types of Wires and Cables, Earthing, Types of earthing, Batteries, Elementary calculations for energy consumption.

UNIT-III: ELECTRICAL MACHINES

Working principle of Single-phase transformer, equivalent circuit, phasor diagram of transformer at no load and load, losses in transformers, efficiency & regulation calculation. Construction and working principle of DC generators, Types of DC generators: Separately excited, Self-Excited (Shunt, Series, Compound), EMF equation. Working principle of DC motors, Types of DC motors,

Torque equations Construction and working principle of Three-phase Induction motor, Slip, Torque equations, Construction and working principle of synchronous generators.

UNIT-IV: ELECTRONIC DEVICES

Diodes : Principle of Operation, Forward bias, Reverse bias, Static Volt-Ampere characteristics,

Static and dynamic resistances, Operation of Zener diode, Characteristics of zener diode and applications.

Rectifiers and Filters: P-N junction as a rectifier - Half Wave Rectifier, Full Wave Rectifier, Bridge Rectifier, Filters – Inductor Filters, Capacitor Filters

UNIT-V: TRANSISTORS

Bipolar Junction Transistor (BJT) - Construction, Principle of Operation, Common Emitter, configurations, Input and Output Characteristics. Transistor Application: Transistor as Amplifier & Transistor as Switch.

Field Effect Transistor (FET): Construction, Principle of Operation of JFET, Output Characteristics, Transfer Characteristics, JFET applications: JFET as Amplifier & JFET as a Switch, Comparison of Bipolar Junction Transistor and Field Effect Transistor, Biasing of FET.

Suggested Readings:

1. Sukija, TK Nagasarkar Basic Electrical and Electronics Engineering – Oxford University.
2. D.P. Kothari, I J Nagrath, Basic Electrical and Electronics Engineering - McGraw Hill Education.

Reference Books:

1. R. L. Boylestad and Louis Nashelsky, Electronic Devices and Circuits, PEI/PHI, 9th Ed, 2006.
2. Millman and C. C. Halkias, Satyabrata Jit, Millman’s Electronic Devices and Circuits, TMH, 2/e, 1998.
3. William Hayt and Jack E. Kemmerly, Engineering circuit analysis, McGraw Hill Company, 6th edition.

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Mahatma Gandhi Institute of Technology (A)
B.Tech. IV Semester
MA403BS: Probability, Statistics and Complex Variables
(ME, MCT and MME)

Course Objectives

- The ideas of random variables and various discrete and continuous probability distributions and their properties.
- The concept of theoretical distributions
- The testing of hypothesis and making statistical inferences
- Differentiation of complex valued functions.
- Evaluation of integrals using Cauchy's integral formula and Cauchy's residue theorem. Expansion of complex functions using Taylor's and Laurent's series.

Course Outcomes: After completion of the course the students will be able to:

- Formulate and solve problems involving random variables and probability distributions
- Understand the theoretical distributions
- Apply concept of testing of hypothesis to case studies
- Analyze the complex function with reference to their analyticity
- Evaluating integrals using Cauchy's integral and residue theorems. Taylor's and Laurent's series expansions of complex function

UNIT-I: Random Variables and Probability Distributions

Concept of a Random variables - Discrete and Continuous random variables and their distribution functions – Expectation, Variance and standard deviation of random variables.

UNIT-II: Theoretical Distributions

Binomial, Poisson distributions and their properties, Poisson approximation to the binomial distribution, Uniform distribution, Normal distributions and its properties. Normal approximation to Binomial distribution

UNIT-III: Tests of Hypotheses:

Test of significance- Basics of testing of hypothesis, Null and Alternate hypothesis, types of errors, level of significance, Critical region, Large sample test - single mean, single proportion, difference of means, difference of proportions; Small sample tests- Student's t-distribution, single mean, difference of means.

UNIT-IV: Complex Differentiation

Limit, Continuity and Differentiation of Complex functions, Analyticity, Cauchy-Riemann equations in Cartesian and Polar co-ordinates (without proof), finding harmonic conjugate, Mobius transformation.

UNIT-V: Complex Integration

Line integral, Cauchy's theorem, Cauchy's Integral formula, Zeros of analytic functions, Singularities, Taylor's series, Laurent's series, Residues, Cauchy Residue theorem (All theorems without Proof).

Text Books:

1. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition,2010.
2. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, keying Ye, Probability and statistics for engineers and scientists, 9th Edition, Pearson Publications.

Reference Books:

1. Fundamentals of Mathematical Statistics, Khanna Publications, S.C.Guptha and V.K.Kapoor.
2. Miller and Freund's, Probability and Statistics for Engineers, 8th Edition, Pearson Educations.
3. N.P.Bali and Manish Goyal, A textbook of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
4. J. W. Brown and R.V.Churchill, ComplexVariables and Applications, 7th Edition, Mc-GrawHill,2004.

B. Tech. IV Semester

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MM401PC: Mechanical Metallurgy

Course Objectives:

- To develop a fundamental understanding of stress-strain behaviour, fracture mechanism
- To provide practical skills on mechanical testing of metals
- To learn issues related to high temperature such as creep.
- To gain knowledge in strengthening mechanisms of metals
- To understand the failure mechanism

Course Outcomes:

- Describe the basics of elastic and plastic deformation behaviour in metals and analyse the role of dislocations in plastic deformation of metals (PO 1,2)
- Recognise the types of fracture in metals and demonstrate the hardness testing practices. (PO 1,2)
- Analyse the tensile behaviour of metals and other mechanical testing practices. (PO 1,2)
- Explain fatigue and creep behaviour of metals. (PO 1,2)
- Evaluate &design metals for better Fatigue &creep resistance (PO 1,2,3,4)

UNIT – I: Plastic Deformation in Metals and Alloys: Introduction. Defects in crystalline materials Point defects and line defects. The concept of dislocation - Theoretical Shear Strength, Edge dislocation and screw dislocation. Burger's vector, Critical resolved shear stress. Energy of Dislocations, Force Required to Bow a Dislocation, Intersection of Dislocations, Dislocation Pileups, The Peierls--Nabarro Stress, extended dislocations, sessile dislocation, glissile dislocation, dislocation climb, Jogs, Forces on dislocations. Frank Reed source, slip and twinning.

UNIT -II: Hardness Test: Brinell, Vickers, Rockwell, Microhardness test, relationship between hardness and other mechanical properties, Nanoindentation. **The Tension Test:** Engineering stress-strain and True stress-strain curve. Tensile properties, conditions for necking, effect of temperature and strain rate on tensile properties. Elastic and in-elastic action and properties in compression test. **The Impact Test:** Notched bar impact test and its significance, Charpy and Izod Tests, fracture toughness testing - COD and CTOD tests, significance of DBTT, metallurgical factors affecting on transition temperature, temper embrittlement.

UNIT - III Fracture: Types of fracture in Metals, Elementary theories of fracture, Griffith's theory of brittle fracture, Theoretical cohesive Strength of metals, ductile fracture, notch sensitivity. Strain-Energy release rate, Stress Intensity Factor, Fracture Toughness, and design, K_{IC} Plane-Strain Toughness testing, plasticity corrections, J-Integral.

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

UNIT - V Creep and Stress Rupture: Introduction, The high temperature materials problem,

Time dependent mechanical behaviour, The creep curve, Stress-rupture test, Structural changes during creep, Mechanism of creep deformation, Deformation mechanism maps, Activation energy for steady state creep, superplasticity, fracture at elevated temperature, High temperature alloys. Effect of Metallurgical variables on creep.

Suggested Readings:

1. Mechanical Metallurgy, McGraw Hill Book Company, – G. E. Dieter.
2. Mechanical Behaviour Materials, McGraw Hill, – Thomas H. Courtney
3. Mechanical behaviour of materials, Meyers, and Chawla

Reference Books:

1. Derek Hull and D.J. Bacon: Introduction to Dislocations, Pergamon Press,
2. K. Bowman: Mechanical Behaviour of Materials, Wiley,

B. Tech. IV Semester

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MM402PC: Heat Treatment and Phase Transformations

Course Objectives:

- To introduce the student to key concepts in Phase transformations and enable an understanding of the steps involved in several important phase transformations like Pearlitic, Bainitic, Martensitic, Order and Disorder Transformations.
- Introduce the concepts of heat treatments, Surface treatments and Thermo-mechanical treatments.

Course Outcomes:

- Apply the fundamental concepts of diffusion and derive solutions to real time industrial problems.
- Co-relate the microstructure and mechanical properties of alloys, by learning the fundamental
- concepts of phase transformations.
- Design of heat treatment cycles to ferrous and non-ferrous alloys to achieve the desired properties required by the industry.
- Determination the hardenability of steels
- Apply the concepts of surface treatments in producing the automobile components
- Learn and apply the concepts of thermomechanical treatment of steels.

Unit-I: Diffusion in Solids: Atomic model of diffusion and role of crystal defects, Fick's laws of diffusion, solution of Fick's second law and its applications, temperature dependence of diffusion coefficient, Kirkendall effect.

Unit-II: Phase transformations with diffusion: Diffusional transformation in solids, Nucleation and growth, energy considerations; homogeneous nucleation, heterogeneous nucleation, growth kinetics, overall transformation rates. Mechanisms of Pearlitic and Bainitic transformations. Order-disorder transformation, examples of ordered structures, long and short range order, detection of super lattices, influence of ordering on properties. Residual stresses and their evaluation.

Unit-III: Diffusion less phase transformation in solids: Martensitic Transformations, General characteristics of martensitic reactions, similarity to deformation twinning, Bain distortion, crystallography and kinetics of martensitic transformations, examples from ferrous and non-ferrous alloy systems.

UNIT-IV: Heat treatment: Annealing, Normalizing, Hardening, and tempering. Mechanism of heat removal during quenching, quenching media, size effect and mass effect. Tempering and its stages, Heat Treatment of tool steels (double tempering and triple tempering, Subzero treatment, Patenting. Phase transformations in low alloys steels (bainitic transformations), Hardenability of steels, Factors affecting and its determination.

UNIT-V: Surface treatments and Thermo mechanical treatments: Surface Hardening:

Principles and Applications of Carburizing, Nitriding, Carbonitriding, Nitrocarburizing, Boronizing and Aluminizing; Flame, Induction and Laser surface hardening. Thermo mechanical treatments: HTMT, LTMT, Ausforming, Isoforming, Cryoforming.

Suggested Readings:

1. Heat Treatment Principle and Techniques – T.V. Rajan, C.P. Sharma, Ashok Sharma, 2nd edition, 2011.

2. Phase Transformations in Metals and Alloys - David A. Porter, Kenneth E. Easterling, and Mohamed Y. Sherif, 4th edition, CRC Press, Taylor & Francis Group, 2021

Reference Books:

1. Heat Treatment of Metals - Vijendra Singh, Standard Publishers Distributors, 2020.
2. Engineering Physical Metallurgy –Y. Lakhtin, CBS Publishers & Distributors, 2009.
3. Physical Metallurgy for Engineers - R. Varney Wilbur Donald S. Clark, published by Affiliated East-West Press (Pvt.) Ltd, 2018.
4. Physical Metallurgy Principles - Robert E. Reed-Hill, published by Affiliated East-West Press, 2008.

B. Tech. IV Semester

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MM403PC: Steel Making

Course Objective: This course is primarily of industrial oriented and designed to make the student to understand and demonstrate the

- Principles of steel making processes
- Various primary steel making processes, Hot metal route and scrap route,
- Casting pit side practice, Continuous casting of steel.
- Secondary steel making process to produce quality steels for critical applications.

Course Outcomes: At the end of the course, the student will be able

- To apply the principles in steel making processes.
- To suggest the steel making process based on the available sources.
- To know the importance of secondary steel making processes and apply the same to produce steels for critical applications.
- To get the knowledge of producing quality steels with more efficiency.

UNIT I: Introduction to Steel Making: Current scenario of steel making in India and world, Raw materials of steel making. Factors affecting the efficiency of steel making. **Principles of Steel making**; Removal of Carbon, Silicon, Manganese, phosphorous and sulphur. Role of slag, types, and properties of slags. Molecular and ionic theory of slags. Principles of deoxidation. Precipitation and diffusion deoxidation.

UNIT II: Primary Steel Making (Hot Metal): Steel making by Acid and Basic Bessemer Processes, Construction and lining details, sequence of elimination of impurities, Steel Making by LD process, Construction, lining and process details in LD, LD-AC or OLP, Kaldo, LD-Kaldo, Rotor oxygen steel making, Oxygen bottom blowing (OBM), Hybrid process of steel making, Improvements and modification of the above steel making process.

UNIT III: Primary Steel Making (From Scrap): Open Hearth Steel Making: Construction and process details; Electric Arc Furnace (EAF); Construction and Process details: Induction furnace. Stainless steel making.

UNIT IV: Secondary Steel Making: Secondary steel making processes. Electro Slag Remelting (ESR), Vacuum Arc Remelting (VAR). Brief outline of manufacture of alloy steels. Vacuum treatment of steels. AOD, VOD, Synthetic slag treatments, De-carburization techniques de-gassing of steel Powder injection etc. methods

UNIT V: Solidification of steels: Ingot defects and remedies; Casting pit side practice: Types of Moulds, Teeming Methods, Killed, Semi Killed, capped, and rimmed Steels, Continuous casting of steels.

Suggested Readings:

1. Steel Making – V. Kudrin
2. Modern Steelmaking – Dr. R.H. Tupkary and V.H. Tupkary
3. Steel Making – A. K. Chakravarthy (PHI) 2007

References:

1. Iron Making & Steel Making Theory and Practice - Ahindra Ghosh & Amit Chatterjee

2. Secondary Steel Making; Principles and applications – Ahindra Ghosh
3. Physical Chemistry of Iron & Steel by Bodsworth.

B. Tech. IV Semester

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EE461ES: Basic Electrical and Electronics Engineering Laboratory

(Common for CE, ME and MME)

Prerequisite: Basics of Electrical and Electronics Engineering

Course Objectives:

- To study a given network by applying various electrical laws
- To understand the performance characteristics of DC and AC machines
- To understand the characteristics of PN junction and Zener Diode
- To understand the applications of diode as rectifiers
- To understand the characteristics of BJT and FET

Course Outcomes:

After completion of the course, students will be able to:

- Analyze network by applying various electrical laws
- Analyze performance characteristics of DC and AC machines
- Analyze the characteristics of PN junction and Zener Diode
- Acquire the knowledge of various rectifier configurations
- Analyze the characteristics of BJT and FET

LIST OF EXPERIMENTS/ DEMONSTRATIONS:

PART A: ELECTRICAL

1. Verification of KVL and KCL
2. Measurement of Voltage, Current and Real Power in primary and Secondary Circuits of a Single-Phase Transformer
3. Measurement of Active and Reactive Power in a balanced Three-phase circuit
4. Performance Characteristics of a DC Shunt Motor
5. Performance Characteristics of a Three-phase Induction Motor
6. No-Load Characteristics of a Three-phase Alternator

PART B: ELECTRONICS

1. Study and operation of
    a. Multi-meter (ii) Function Generator (iii) Regulated Power Supply (iv) Cathode Ray Oscilloscope.
2. PN Junction diode characteristics
3. Zener diode characteristics and Zener as voltage Regulator
4. Input & Output characteristics of Transistor in CE configuration
5. Full Wave Rectifier with & without filters
6. Input and Output characteristics of FET in CS configuration

Any 5 experiments from PART-A and 5 experiments from PART-B are to be conducted.

Suggested Readings:

1. Basic Electrical and electronics Engineering –M S Sukija TK Nagasarkar Oxford University
2. Basic Electrical and electronics Engineering-D P Kothari. I J Nagarath, McGraw Hill Education

Reference Books:

1. Electronic Devices and Circuits – R. L. Boylestead and Louis Nashelsky, PEI/PHI, 9th Ed, 2006.
2. Engineering circuit analysis- by William Hayt and Jack E. Kemmerly, McGraw Hill Company, 6th edition.
3. Network Theory by N. C. Jagan& C. Lakshminarayana, B.S. Publications.
4. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
5. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
6. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989

B. Tech. IV Semester

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MM451PC: Mechanical Metallurgy Lab

Course Objectives:

- To gain knowledge of various mechanical tests and working principle of different mechanical testing machines.

Course Outcomes: At the end of the course, the student will be able to.

- Analyse, interpret and present the observation from the tests conducted.
- Understand and conduct hardness, tension, and impact tests
- Explain the relationships between metallurgy of the metals and their mechanical properties.
- Prepare formal laboratory reports describing the experimental and the results obtained.

List of Experiments:

1. Determine the hardness of ferrous and non-ferrous samples using Brinell hardness Testing Machine.
2. Determine the hardness of ferrous and non-ferrous samples using Rockwell hardness Testing machine
3. Determine the hardness of ferrous and non-ferrous samples using Vickers hardness Testing machine
4. To determine the tensile properties of ductile ferrous materials.
5. To determine the tensile properties of ductile non-ferrous materials.
6. To determine the impact toughness of a given material by Charpy and Izod tests.
7. Torsion Test: -To determine the modulus of rigidity of a given material
8. Compare engineering stress-strain curve and true stress true-strain curve of ferrous/nonferrous metal.

B. Tech. IV Semester

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MM452PC: Heat Treatment and Phase Transformations Lab

Course Objectives:

This course is designed to.

- To conduct various heat treatment processes, surface hardening techniques and age hardening processes on different materials.
- Gain knowledge of phase transformations taking place under various conditions of heat treatment.
-

Course Outcomes: At the end of the course the student will be able to:

- Conduct heat treatment in furnaces under suitable/ required time, temperature and atmospheric
- conditions.
- Modify the microstructures of metals and alloys through heat treatment practice for obtaining desired properties in present and future.
- To modify the surface properties of steels.
- To determine hardenability by performing Jominy end quench test
- Analyze, correlate, and interpret the results obtained in the tests conducted.
- Report the observations in a formal manner

List of Experiments:

1. Annealing of plain carbon steel and observation of microstructure.
2. Normalizing of plain carbon steel and observation of microstructure.
3. Hardening of plain carbon steel with quenching in water and brine solution and observation of microstructures.
4. Hardening of plain carbon steel with quenching in oil and observation of microstructure.
5. Effect of tempering temperature on plain carbon steel.
6. Effect of tempering time on plain carbon steel.
7. Age hardening of Aluminum - Copper alloys.
8. Spheroidizing of a given high carbon steel.
9. Recrystallization studies of nonferrous metals and alloys.
10. Determination of hardenability of medium carbon steel by Jominy end quench test.
11. Determination of phase fraction and grain size of heat treated samples using Image analyzer

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B. Tech. IV Semester

MC451HS: Gender Sensitization Laboratory

(Common to CE, ME, ECE, MCT & MME)

Course Objectives

This course aims:

- To develop students' sensibility with regard to issues of gender in contemporary India.
- To provide a critical perspective on the socialization of men and women.
- To introduce students to information about some key biological aspects of genders.
- To expose the students to debates on the politics and economics of work.
- To help students reflect critically on gender violence.
- To expose students to more egalitarian interactions between men and women.

Course Outcomes

Students will have developed a better understanding of important issues related to gender in contemporary India.
Students will be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature and film.
Students will attain a finer grasp of how gender discrimination works in our society and how to counter it.
Students will acquire insight into the gendered division of labour and its relation to politics and economics.
Men and women students and professionals will be better equipped to work and live together as equals.
Students will develop a sense of appreciation of women in all walks of life.
Through providing accounts of studies and movements as well as the new laws that provide protection and relief to women, the textbook will empower students to understand and respond to gender violence.

Course Description

This course offers an introduction to Gender Studies, an interdisciplinary field that asks critical questions about the meanings of sex and gender in society. The primary goal of this course is to familiarize students with key issues, questions and debates in Gender Studies, both historical and contemporary. It draws on multiple disciplines – such as literature, history, economics, psychology, sociology, philosophy, political science, anthropology and media studies – to examine cultural assumptions about sex, gender, and sexuality. This course integrates analysis of current events through student presentations, aiming to increase awareness of contemporary and historical experiences of women, and of the multiple ways that sex and gender interact with race, class, caste, nationality and other social identities. This course also seeks to build an understanding and initiate and strengthen programmes combating gender-based violence and discrimination. The course also features several exercises and reflective activities designed to examine the concepts of gender, gender-based violence, sexuality, and rights. It will further explore the impact of gender- based violence on education, health and development.

Unit-I: Understanding Gender

Introduction: Definition of Gender-Basic Gender Concepts and Terminology-Exploring

Attitudes towards Gender- Construction of Gender-Socialization: Making Women, Making Men - Preparing for Womanhood. Growing up Male.

Unit-II: Gender Roles and Relations

Two or Many? -Struggles with Discrimination-Gender Roles and Relations-Types of Gender Roles-Gender Roles and Relationships Matrix-Missing Women-Sex Selection and Its Consequences-Declining Sex Ratio. Demographic Consequences-Gender Spectrum: Beyond the Binary

Unit-III: Gender and Labour

Division and Valuation of Labour-Housework: The Invisible Labor- "My Mother doesn't Work." "Share the Load."- Work: Its Politics and Economics -Fact and Fiction. Unrecognized and Unaccounted work. -Gender Development Issues-Gender, Governance and Sustainable Development-Gender and Human Rights-Gender and Mainstreaming

Unit–IV: Gender - Based Violence

The Concept of Violence- Types of Gender-based Violence-Gender-based Violence from a Human Rights Perspective-Sexual Harassment: Say No! -Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading: "Chupulu".

Domestic Violence: Speaking Out -Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Thinking about Sexual Violence Blaming the Victim-"I Fought for my Life…."

Unit – V: Gender and Culture

Gender and Film-Gender and Electronic Media-Gender and Advertisement-Gender and Popular Literature- Gender Development Issues-Gender Issues-Gender Sensitive Language-Gender and Popular Literature - Just Relationships: Being Together as Equals Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers. Rosa Parks-The Brave Heart.

Note: Since it is Interdisciplinary Course, Resource Persons can be drawn from the fields of **English Literature** or Sociology or Political Science or **any other qualified faculty who has expertise in this field from engineering departments.**

- Classes will consist of a combination of activities: dialogue-based lectures, discussions, collaborative learning activities, group work and in-class assignments. Apart from the above prescribed book, Teachers can make use of any authentic materials related to the topics given in the syllabus on "Gender".

Suggested Readings:

- The Textbook, "Towards a World of Equals: A Bilingual Text Book on Gender" written by A. Suneetha, Uma Bhrugubanda, DuggiralaVasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu published by Telugu Akademi, Telangana Government in 2015.

Assessment and Grading:

- Discussion & Classroom Participation: 20%
- Project/Assignment: 30%
- End Term Exam: 50%.