JNTUHCOLLEGEOFENGINEERING HYDERABAD

(AUTONOMOUS)

B.TECH.FOURYEARDEGREECOURSE

(METALLURGICAL ENGINEERING)

COURSE STRUCTURE

I YEAR **I SEMESTER**

Sl.No.	Course Code	Course Title	L	T	P	Credits
1	BSC	Matrix AlgebraandCalculus	3	1	0	4
2	BSC	Engineering Physics	3	1	0	4
3	ESC	Programming for Problem Solving	3	0	0	3
4	ESC	Engineering Graphics	1	0	3	2.5
5	BSC -LC	Engineering Physics Lab	0	0	3	1.5
6	ESC -LC	Programming for Problem Solving Lab	0	0	3	1.5
7	MC	Induction program	2	0	0	0
		Total Credits				**16.5**

I YEAR **II SEMESTER**

Sl.No.	Course Code	Course Title	L	T	P	Credits
1	BSC	Applied and Multivariable Calculus	3	1	0	4
2	BSC	Engineering Chemistry	3	1	0	4
3	ESC	Classical Mechanics	3	1	0	4
4	HSMC	English	2	0	0	2
5	BSC -LC	Engineering Chemistry Lab	0	0	2	1
6	ESC-L	Engineering Work Shop Practice	0	0	3	1.5
7	HSMC-LC	English Language and Communication Skills Lab	0	0	2	1
8	ESC	Applied Python Programming Lab	0	1	2	2
		Total Credits				**19.5**

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II YEAR **I SEMESTER**

S.No.	Course Code	Course Title	L	T	P	Credits
1	BSC	Probability Distributions and Complex Variables	3	1	0	4
2	ESC	Basic Electrical Engineering	3	0	0	3
3	PCC - 1	Mineral Dressing	4	0	0	4
4	PCC- 2	Metallurgical Analysis	3	0	0	3
5	PCC- 3	Thermodynamics and Kinetics	3	1	0	4
6	ESC – Lab 3	Basic Electrical Engineering Lab	0	0	2	1
7	PCC- Lab 1	Mineral Dressing Lab	0	0	2	1
8	PCC- Lab 2	Metallurgical Analysis Lab	0	0	2	1
9	*MC	Environmental Science	2	0	0	0
		Total Credits				**21**

II YEAR **II SEMESTER**

S.No.	Course Code	Course Title	L	T	P	Credits
1	HSMC	Economics and Financial Analysis	3	0	0	3
2	PCC - 4	Physical Metallurgy	3	1	0	4
3	PCC - 5	Principles of Extractive Metallurgy	3	1	0	4
4	PCC - 6	Metallurgical Thermodynamics	3	1	0	4
5	PCC - 7	Fuels, Furnaces and Refractories	3	0	0	3
6	PCC- Lab 4	Physical Metallurgy Lab	0	0	2	1
7	PCC- Lab 5	Principles of Extractive Metallurgy Lab	0	0	2	1
8	PCC- Lab 6	Fuels, Furnaces and Refractories Lab	0	0	2	1
9	*MC	Constitution of India	2	0	0	0
		Total Credits				**21**

Note:* MC- Mandatory Course (Non credit course)

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COURSE STRUCTURE

III YEAR **I SEMESTER**

S.No.	Course Code	Course Title	L	T	P	Credits
1	HSMC	Management Fundamentals for Engineers	3	0	0	3
2	PCC- 8	Heat Treatment and Phase Transformations	3	1	0	4
3	PCC- 9	Mechanical Metallurgy	3	1	0	4
4	PCC-10	Metal Casting	3	1	0	4
5	PEC-1	Professional Elective – I	3	0	0	3
6	PCC- Lab 7	Heat Treatment and Phase Transformations Lab	0	0	3	1.5
7	PCC- Lab 8	Mechanical Metallurgy lab	0	0	3	1.5
8	PCC- Lab 9	Metal Casting Lab	0	0	2	1
9	*MC	Introduction to Artificial Intelligence	2	0	0	0
		Total Credits				**22**

III YEAR **II SEMESTER**

S.No.	Course Code	Course Title	L	T	P	Credits
1	OEC-I	Open Elective - I	3	0	0	3
2	PCC – 11	Non Ferrous Extractive Metallurgy	4	0	0	4
3	PCC – 12	Metal Forming	3	1	0	4
4	PCC – 13	Iron Making and Steel Making Technology	4	0	0	4
5	PEC-2	Professional Elective – II	3	0	0	3
6	HSMC Lab10	Advanced English Communication Skills Lab	0	0	2	1
7	PCC- Lab 11	Metal Forming Lab	0	0	3	1.5
8	PCC- Lab12	Metal Joining Lab	0	0	3	1.5
9	*MC	Introduction to Cyber security	2	0	0	0
		Total Credits				**22**

Note: * MC- Mandatory Course (Non credit course)

During Summer Vacation between III and IV Years: Industry Oriented Mini Project

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IV YEAR **I SEMESTER**

S.No.	Course Code	Course Title	L	T	P	Credits
1	ESC	Introduction to Instrumentation	2	0	0	2
2	OEC - II	Open Elective – II	3	0	0	3
3	PCC - 14	Environmental Degradation of Materials	3	0	0	3
4	PEC - 3	Professional Elective – III	3	0	0	3
5	PEC - 4	Professional Elective – IV	3	0	0	3
6	PCC- Lab 13	Environmental Degradation and Protection Lab	0	0	2	1
7		SEMINAR	0	0	2	1
8		MINI PROJECT	-	-	4	2
9	UG	Project Stage - I	0	0	6	3
		Total Credits				**21**

IV YEAR II SEMESTER

S.No.	Course Code	Course Title	L	T	P	Credits
1	OEC-III	Open Elective – III	3	0	0	3
2	PEC-5	Professional Elective – V	3	0	0	3
3	PEC-6	Professional Elective – VI	3	0	0	3
4	PROJ	Project Stage-II	0	0	16	8
		Total Credits				**17**

Professional Elective-I

1. Ceramics and Composite Materials
2. Computational Materials Engineering
3. Ferro Alloy technology

Professional Elective -II

1. Metal Joining
2. Non Metallic Materials
3. Electronic Materials

Professional Elective -III

1. Light Metals & Alloys
2. Fatigue and Fracture Mechanics
3. Failure Analysis

Professional Elective -IV

1. Surface Engineering
2. Nano Materials
3. Non Destructive Testing

Professional Elective -V

1. Materials Characterization Techniques
2. Nuclear Metallurgy
3. Functional Materials

Professional Elective - VI

1. Powder Metallurgy
2. Bio Materials
3. Transport Phenomena

Open Elective – I:

1. Metallurgy for Non Metallurgists

Open Elective – II:

1. Testing of Materials

Open Elective-III:

1. Alloy Steels

Matrix Algebra and Calculus

I Year B.Tech. I-Sem

L	T	P	C
3	1	0	4

Pre-requisites: Mathematical Knowledge of 12th / Intermediate level

Course Objectives: To learn

1. Types of matrices and their properties.
2. Concept of a rank of the matrix and applying this concept to know the consistency and solving the system of linear equations.
3. Concept of Eigenvalues and Eigenvectors and to reduce the quadratic form to canonical form.
4. Methods of solving the differential equations of first and higher order.
5. Geometrical approach to the mean value theorems and their application to the mathematical problems.
6. Evaluation of surface areas and volumes of revolutions of curves.
7. Evaluation of improper integrals using Beta and Gamma functions.

UNIT-I: Matrices

Rank of a matrix: Echelon form, Normal form, system of linear equations: solving system of Homogeneous and Non-Homogeneous equations, Gauss-elimination method,
LU Decomposition method.
Linear Transformation and Orthogonal Transformation: Eigenvalues and Eigenvectors and their properties, Eigenvalues and Eigenvectors of Symmetric, Hermitian, Skew-Symmetric, Skew-Hermitian, Orthogonal and Unitary matrices.

UNIT-II: Diagonalization of a Matrix

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: Mean value theorems and Beta, Gamma functions

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. (All theorems without proof).

Applications of definite integrals to evaluate surface areas and volumes of revolutions of curves (Only in Cartesian coordinates), Definition of Improper Integral: Beta and Gamma functions and their applications.

UNIT-IV: First Order ODE

Exact differential equations, converting non-exact equations to exact equations, Linear and Bernoulli's differential equations. Applications: Newton's law of cooling, Law of natural growth and decay, orthogonal trajectories and electrical circuits. First order equations with higher degree: solvable for the differential coefficient, dependent variable and Independent variable.

UNIT-V: Ordinary Linear 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 ODE with constant coefficients, Legendre's equation, Cauchy-Euler equation. Applications: Bending of beams, Electrical circuits and simple harmonic motion.

Text Books

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

References

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9thEdition,Pearson, Reprint, 2002.
2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, LaxmiPublications, Reprint, 2008.
3. RamanaB.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi,11thReprint, 2010.

Course outcomes:

After learning the contents of this paper the student must be able to

1. Write the matrix representation of a set of linear equations and to analyse the solution of the system of equations
2. Find the Eigenvalues and Eigenvectors
3. Reduce the quadratic form to canonical form using orthogonal transformations.
4. Identify whether the given differential equation of first order is exact or not
5. Solve higher differential equation and apply the concept of differential equation to real world problems
6. Solve the applications on the mean value theorems.
7. Evaluate the improper integrals using Beta and Gamma functions

ENGINEERING PHYSICS

I Year B.Tech. I-Sem

L	T	P	C
3	1	0	4

Course Objectives:

The course enables the students to understand:

1. Fundamental properties of free, damped and forced harmonic oscillators.
2. The concepts of wave optics for the exploration of inference, diffraction and polarization.
3. Lasing action and study various types of lasers and to learn fundamental principles of Optical fibres.
4. The concepts of various theories of solids and the classification of materials into three groups.
5. Principles, fabrication and characterization of nanomaterials.

UNIT-I: OSCILLATIONS & WAVES

Oscillations: Introduction, Oscillations-Simple harmonic oscillations, Simple harmonic motion–Energy function, Simple harmonic motion-Equation, Oscillations of a spring, Torsional pendulum, Projection of a uniform circular motion, Combination of simple harmonic motions, Damped harmonic motion, Forced oscillations, Resonance.

Waves: Mechanical waves and types of waves, Travelling wave equation, Wave speed – Dimensional method, Wave speed-Mechanical method, Power and intensity of a wave,Standing waves, Waves in string-Laws of transverse vibration, Verification of laws of transverse vibration-Sonometer, Melde’s apparatus.

UNIT-II: OPTICS

Interference and Diffraction: Introduction, Huygen’s principle, Superposition of waves, Interference of light by wave front splitting- Young’s double slit experiment, Amplitude splitting- Newton’s rings, Fresnel and Fraunhofer diffractions, Fraunhofer diffraction at a single slit and double slit, Diffraction grating.

Polarization: Introduction to polarization, Polarized and unpolarised light, Types of polarization: Plane polarized, Circularly polarized and Elliptically polarized light, Polarizer and Analyser: Production and Detection of linearly polarized light, Malus law.

UNIT-III: LASERS AND FIBRE OPTICS

Lasers: Introduction, Laser Beam Characteristics, Interaction of light with matter and the three Quantum Processes, Einstein Coefficients and their relations, Light Amplification, Components of Laser, Three requirements for Lasing Action, Pumping Methods, Types of Lasers: Ruby Laser, He-Ne Laser, Semiconductor Laser, Applications of laser.

Fibre Optics: Introduction to Optical Fibre, Total Internal Reflection, Construction of optical fibre, Acceptance angle - Numerical Aperture, Classification based on materials, Refractive index profile and mode propagation, Losses in Optical Fibre, Fibre Optic Communication System, Merits of Optical Fibres,Applications.

UNIT-IV: ELECTRON THEORY OF SOLIDS

Classical and Quantum theories: Introduction, Free electron theory of metals, Classical and quantum free electron theory, Estimation of Fermi energy,Dependence of Fermi level on temperature, Density of states

Band theory of solids: Bloch's theorem, Kronig – Penny model, E-K diagram, Effective mass of electron, Origin of energy bands, Classification of materials on the basis of energy bands.

UNIT-V: NANOMATERIALS

Introduction, nanoscale, Quantum confinement, Surface to volume ratio, Bottom-up Fabrication: Sol-Gel, Precipitation, Combustion Methods, Top-Down Fabrication: Chemical Vapor Deposition, Physical Vapor Deposition, Characterization Techniques: XRD, SEM &TEM, Applications of nanomaterials.

Text Books:

1. Principles of Physics, Jearl Walker, David Halliday and Robert Resnick- Wiley publications.
2. A textbook of Engineering Physics, Dr. M.N. Avadhanulu, Dr. P.G Kshirsagar – S.Chand.
3. Engineering Physics, R.K. Gaur - S.L.Gupta, Dhanpat Rai & Sons

References:

1. Introduction to Solid State Physics by Charles Kittel, Wiley student edition.
2. Ajoy Ghatak, "Optics", Mc Graw-Hill Education, 2012.
3. Applied Physics by P.K.Mittal, I.K. International.
4. Introduction to Nanotechnology, Charles P.Pode, Jr.FrankJ.Owens, Wiley-India Edition.

Course Outcomes:

The student should be able to gain knowledge on:

1. Formulation of differential equations that describe the behaviour of oscillators under various conditions.
2. The principle of optical phenomenon like interference, diffraction and polarization of light.
3. Various types of lasers and transmission characteristics of fibre optics.
4. Classical, Quantum and band theories on electrical behavior of solids and their classifications.
5. Origin, fabrication and characterization of nanomaterials.

PROGRAMMING FOR PROBLEM SOLVING

I Year B.Tech. I-Sem

L	T	P	C
3	0	0	3

Course Objectives

1. To learn the fundamentals of computers.
2. To understand the various steps in Program development.
3. To learn the syntax and semantics of C Programming Language.
4. To learn the usage of structured programming approach in solving problems.

UNIT-I:

INTRODUCTION TO COMPUTERS – Computer Systems, Computing Environments, Computer Languages, Creating and running programs, Software Development Method, Algorithms, Pseudo code, flow charts, applying the software development method.

INTRODUCTION TO C LANGUAGE – Background, Simple C programs, Identifiers, Basic data types, Variables, Constants, Input / Output, Operators. Expressions, Precedence and Associatively, Expression Evaluation, Type conversions, Bit wise operators, Statements, Simple C Programming examples.

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, Simple C Programming examples.

DESIGNING STRUCTURED PROGRAMS- Functions, basics, user defined functions, inter function communication, Scope, Storage classes-auto, register, static, extern, scope rules, type qualifiers, recursion- recursive functions, Preprocessor commands, example C programs

UNIT-III:

ARRAYS AND STRINGS – Concepts, using arrays in C, inter function communication, array applications, two – dimensional arrays, multidimensional arrays, C program examples. Concepts, C Strings, String Input / Output functions, arrays of strings, string manipulation functions, string / data conversion, C program examples.

UNIT-IV:

POINTERS – Introduction (Basic Concepts), Pointers for inter function communication, pointers to pointers, compatibility, memory allocation functions, array of pointers, programming applications, pointers to void, pointers to functions, command –line arguments.

INPUT AND OUTPUT – Concept of a file, streams, standard input / output functions, formatted input / output functions, text files and binary files, file input / output operations, file status functions (error handling), C program examples.

UNIT-V:

DERIVED TYPES – Structures – Declaration, definition and initialization of structures, accessing structures, nested structures, arrays of structures, structures and functions, pointers to structures, self referential structures, unions, typedef, bit fields, enumerated types, C programming examples.

SORTINGANDSEARCHING – Selection sort, Bubble sort, Insertion sort, Linear search and Binary search methods.

Textbooks:

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, Fifth Edition, Pearson Education.
3. The C Programming Language, B.W. Kernighan and Dennis M.Ritchie, PHI/Pearson Education

References:

1. C for Engineers and Scientists, H.Cheng, Mc.Graw-Hill International Edition
2. Data Structures using C – A. M.Tanenbaum, Y.Langsam, and M.J. Augenstein, Pearson Education / PHI
3. C Programming & Data Structures, P. Dey, M Ghosh R Thereja, Oxford University Press

Course Outcomes

1. Write algorithms and to draw flowcharts for solving problems.
2. Translate the algorithms/flowcharts to programs (in C language).
3. Code and test a given logic in C programming language.
4. Formulate simple algorithms for arithmetic and logical problems.
5. Decompose a problem into functions and to develop modular reusable code.
6. Use arrays, pointers, strings and structures to formulate algorithms and programs.
7. Searching and sorting problems.

ENGINEERING GRAPHICS

I Year B.Tech. I-Sem **L T P C**
1032.5

Pre-requisites: Nil

Course objectives:

1. To provide basic concepts in engineering drawing
2. To impart knowledge about standard principles of orthographic projection of objects
3. To draw sectional views and pictorial views of solids

UNIT–I:

INTRODUCTION TO ENGINEERING DRAWING:

Principles of Engineering Graphics and their Significance, Conic Sections including the Rectangular Hyperbola – General method only. Cycloid, Epicycloid and Hypocycloid, Involute. Scales – Plain, Diagonal and Vernier Scales.

UNIT-II:

ORTHOGRAPHIC PROJECTIONS:

Principles of Orthographic Projections – Conventions – Projections of Points and Lines, Projections of Plane regular geometric figures. —Auxiliary Planes.

UNIT–III:

Projections of Regular Solids – Auxiliary Views.

UNIT–IV:

Sections or Sectional views of Right Regular Solids – Prism, Cylinder, Pyramid, Cone – Auxiliary views – Sections of Sphere. Development of Surfaces of Right Regular Solids – Prism, Cylinder, Pyramid and Cone

UNIT–V:

ISOMETRIC PROJECTIONS:

Principles of Isometric Projection – Isometric Scale – Isometric Views – Conventions – Isometric Views of Lines, Plane Figures, Simple and Compound Solids – Isometric Projection of objects having non- isometric lines. Isometric Projection of Spherical Parts. Conversion of Isometric Views to Orthographic Views and Vice-versa – Conventions Auto CAD: Basic principlesonly

Text Books:

1. Engineering Drawing by N.D. Bhatt, Charotar
2. Engineering Drawing and Graphics by Rane and Shah, Pearson Edu.

Reference Books:

1. A Text Book of Engineering Drawing by Dhawan R K, S. Chand
2. Engineering Graphics with Auto CAD by James D Bethune, Pearson Edu.
3. Engineering Graphics by K R Mohan, Dhanpat Rai.
4. Text book on Engineering Drawingby KL Narayana, P Kannaih, Scitech

Course Outcomes:

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

1. Prepare working drawings to communicate the ideas andinformation.
2. Read, understand and interpret engineeringdrawings.

ENGINEERING PHYSICS LAB

IYearB.Tech.I-SemL TPC
0 0 31.5

CourseObjectives:

The course enables the students to understand:

1. The concepts of mechanical waves and their resultant phenomena.
2. The phenomena of interference using Newton's rings and diffraction phenomena using diffraction grating.
3. The electrical resonance using LCR circuit.
4. The band concept of semiconductor diode and light phenomenon of Lasers and Optical fibres.

List of Experiments:

1. Melde'sexperiment:Determination of thefrequencyofavibratingbarorturningforkusing Melde's arrangement.
2. Torsionalpendulum:Determination of therigiditymodulusofthematerialofthegivenwireusingtorsional pendulum.
3. Newton'srings:Determination of theradiusofcurvatureofthelensbyforming Newton'srings.
4. Diffractiongrating:Determination of thenumberoflinesperinchofthegrating.
5. Dispersivepower:Determination of thedispersivepowerofprismbyusingspectrometer.
6. CoupledOscillator: Determination of thespringconstantbysinglecoupledoscillator.
7. LCRCircuit: Determination of qualityfactorandresonantfrequencyofLCRcircuit.
8. LASER: ThecharacteristicsofLASERsources.
9. Opticalfibre:Determination of thebendinglossesofOpticalfibres.
10. Opticalfibre:Determination of theNumericalapertureofagivenfibre.
11. Sonometer:Determination of theACfrequency.
12. Energy gap of PN Junction diode: determination energy gap of a semiconductor diode

Note:Any8experimentsaretobeperformedbyeachstudent

CourseOutcomes:

Bytheendofthecoursestudentswillbeable to:

1. Understand the mechanical waves concepts and elastic properties.
2. Understand the light phenomena such as interference and diffraction.
3. Confirm the resonance produced by electrical waves.
4. Understand the band gap of semiconductor and certain characteristics of lasers and optical fibres.

PROGRAMMING FOR PROBLEM SOLVING LAB

I Year B.Tech. I-Semester

L	T	P	C
0	0	3	1.5

Course Objectives

1. To learn the fundamentals of computers.
2. To understand the various steps in Program development.
3. To learn the syntax and semantics of C Programming Language.
4. To learn the usage of structured programming approach in solving problems.

Week 1:

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 sequence are 0 and 1.Subsequent terms are found by adding the preceding two terms in the sequence.
3. Write a C program to generate the first n terms of the sequence.
4. Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.
5. Write a C program to find the roots of a quadratic equation.

Week 2:

6. Write a C program to find the factorial of a given integer.
7. Write a C program to find the GCD (greatest common divisor) of two given integers.
8. Write a C program to solve Towers of Hanoi problem.
9. Write a C program, which takes two integer operands and one operator from the user, performs the operation and then prints the result. (Consider the operators +,-,*, /, % and use Switch Statement)

Week 3:

10. Write a C program to find both the largest and smallest number in a list of integers.
11. Write a C program that uses functions to perform the following:

i) Addition of Two Matrices ii) Multiplication of Two Matrices

Week 4:

12. 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.

13. Write a C program to determine if the given string is a palindrome or not
14. Write a C program that displays the position or index in the string S where the string T begins, or – 1 if S doesn't contain T.
15. Write a C program to count the lines, words and characters in a given text.

Week 5:

16. Write a C program to generate Pascal's triangle.
17. Write a C program to construct a pyramid of numbers
18. Write a C program to read in two numbers, x and n, and then compute the sum of this geometric progression:
    $+x+x^2+x^3+\ldots\ldots\ldots\ldots+x^n$
    For example: if n is 3 and x is 5, then the program computes 1+5+25+125.
    Print x, n, the sum
    Perform error checking.
    For example, the formula does not make sense for negative exponents– if n is less than0.
    Have your program print an error message if n<0, then go back and read in the next pair
    of numbers ofwithout computing the sum. Are any values of x also illegal? If so, test for them too.

Week 6:

19. 2's complement of a number is obtained by scanning it from right to left and complementing all the bits after the first appearance of a 1. Thus 2's complement of 11100 is 00100. Write a C program to find the 2's complement of a binary number.
20. Write a C program to convert a Roman numeral to its decimal equivalent.

Week 7:

21. Write a C program that uses functions to perform the following operations:
    i) Reading a complex number
    ii) Writing a complex number
    iii) Addition of two complex numbers
    iv) Multiplication of two complex numbers

(Note: represent complex number using a structure.)

Week 8:

22. . i) Write a C program which copies one file to another.
    ii) Write a C program to reverse the first n characters in a file.

(Note: The file name and n are specified on the command line.)

23. . 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 filefollowed by those of the second are put in the third file)

Week 9:

24. Write a C program that implements the following sorting methods to sort a given list ofintegers in ascendingorder

i) Bubble sort ii) Selection sort iii) Insertion sort

Week 10:

25. Write C programs that use both recursive and non recursive functions to perform the following searching
    Operations for a Key value in a given list of integers:

i) Linear search ii) Binary search

Textbooks:

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, Fifth Edition, Pearson Education.
3. The C Programming Language, B.W. Kernighan and Dennis M.Ritchie, PHI/Pearson Education

References:

1. C for Engineers and Scientists, H.Cheng, Mc.Graw-Hill International Edition
2. Data Structures using C – A.M.Tanenbaum, Y.Langsam, and M.J. Augenstein, Pearson Education / PHI
3. C Programming & Data Structures, P. Dey, M Ghosh R Thereja, Oxford University Press

Course Outcomes

1. Write algorithms and to draw flowcharts for solving problems.
2. Translate the algorithms/flowcharts to programs (in C language).
3. Code and test a given logic in C programming language.
4. Formulate simple algorithms for arithmetic and logical problems.
5. Decompose a problem into functions and to develop modular reusable code.
6. Use arrays, pointers, strings and structures to formulate algorithms and programs.
7. Searching and sorting problems.

INDUCTION PROGRAM

I Year B.Tech. I-Semester

L	T	P	C
2	0	0	0

APPLIED AND MULTIVARIABLE CALCULUS

I Year B.Tech. II-Semester **L T P C**

3 1 0 4

Pre-requisites: Mathematical Knowledge of 12^{th} / Intermediate level

Course Objectives: To learn

1. Concept, properties of Laplace transforms
2. Solving ordinary differential equations using Laplace transforms techniques.
3. Partial differentiation, concept of total derivative
4. Finding maxima and minima of function of two and three variables.
5. Evaluation of multiple integrals and their applications
6. The physical quantities involved in engineering field related to vector valued functions.
7. The basic properties of vector valued functions and their applications to line, surface and volume integrals.

UNIT-I: Laplace transforms

Laplace Transforms; Laplace Transform of standard functions, first shifting theorem, 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), solving Initial value problems by Laplace Transform method.

UNIT-II: Partial Derivatives and applications

Definitions of Limit and continuity.

Partial Differentiation, Euler's Theorem, Total derivative, Jacobian, Functional dependence & independence, Maxima and minima of functions of two variables and three variables, method of Lagrange multipliers.

UNIT-III: Multiple 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) for triple integrals.

Applications: Areas (by double integrals) and volumes (by double integrals and triple integrals), Centre of mass and Gravity (constant and variable densities) by double and triple integrals (applications involving cubes, sphere and rectangular parallel piped).

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.

Text Books

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. M Apostol, Calculus vol-2, John Wiley & Sons

References

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002
2. Paras Ram, Engineering Mathematics, 2nd Edition, CBS Publishes
3. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.

Course outcomes:

After learning the contents of this paper the student must be able to

1. Use the Laplace transforms techniques for solving ODE's.
2. Find the extreme values of functions of two variables with/ without constraints.
3. Evaluate the multiple integrals and apply the concept to find areas, volumes, centre of mass and gravity for cubes, sphere and rectangular parallel piped
4. Evaluate the line, surface and volume integrals and converting them from one to another

ENGINEERING CHEMISTRY

I Year B.Tech. II-Semester **L T P C**
3 1 0 4

Course Objectives:

1. To bring adaptability to the concepts of chemistry and to acquire the required skills to become a perfect engineer.
2. To acquire the knowledge of water treatment, electrochemistry and corrosion which are essential for the Engineers and in industry.
3. To acquire the skills pertaining to Polymers and Energy sources to apply them for various engineering fields etc.
4. To impart then knowledge of Engineering materials and their aspects useful for understanding material chemistry.

Unit-1: Water and its treatment:

Introduction – hardness of water – Causes of hardness. Types of hardness: temporary and permanent. Expression and units of hardness. Estimation of hardness of water by complexometric method. Potable water and its specifications. Steps involved in treatment of water – Disinfection of water by chlorination, breakpoint chlorination, Ozonisation. Boiler troubles - Scale, Sludge, Priming, Foaming and Caustic embrittlement. Treatment of boiler feed water by Calgon conditioning, Phosphate conditioning and Colloidal conditioning. External treatment of water- Ion exchange process. Desalination of water – Reverse osmosis. Numerical problems based on Determination of hardness of water.

Unit-2: Electrochemistry and corrosion:

Electrochemistry: Electrochemical cells – Cell, Electrode, electrode potential, standard electrode potential, Nernst equation-derivation and significance- Electrochemical series and its applications. Construction and functioning of Calomel, Quinhydrone and glass electrode.Determination of pH of a solution by using quinhydrone and glass electrode. Numerical problems. Potentiometric titrations. Batteries – Primary (Lithium cell) and secondary batteries (Lead – acid storage battery and Lithium ion battery).

Corrosion: Causes and effects of corrosion – Theories of chemical and electrochemical corrosion – mechanism of electrochemical corrosion. Galvanic corrosion, Concentration cell corrosion- water-line and pitting corrosion. Factors affecting rate of corrosion, Corrosion control methods- Cathodic protection – Sacrificial anodic protection and impressed current cathodic methods. Surface coatings – metallic coatings –Methods of coatings - Hot dipping -galvanization, tinning. cementation,electroplating and electroless plating of copper.

Unit – 3: Polymeric materials:

Polymers: Definition, Monomer, functionality and degree of polymerisation. Classification – Types of Polymerisation - Addition & Condensation – Mechanisms ofPolymerisation. Plastics: Definition, characteristics - Compounding and fabrication-Methods of Moulding - Thermoplastics and Thermosets– Preparation, properties and applications– PVC, Teflon and Bakelite. Fibres: Definition, Characteristics. Preparation, Properties and applications of Terylene, Nylon 6:6. Elastomers: Definition and

characteristics. Natural rubber- structure, processing of latex, Vulcanisation. Preparation, properties and applications of BuNa-S and Butyl rubber. Conducting Polymers- Definition, Classification. Mechanism of conduction in Polyacetylene, Polyaniline & Applications. Biodegradable polymers - Concept, Synthetic and Natural polymers, Polylactic acid, Poly Vinyl alcohol, Nylon-2 and Nylon – 6. Applications and advantages of biodegradable polymers.

Unit – 4: Energy sources:

Fuels: Definition, classification with examples. Calorific value. Determination of calorific value by Junker's gas Calorimeter. Characteristics of good fuel. Coal: Types- Analysis of coal- proximate analysis. Petroleum- Refining- Fractional distillation- composition, properties and uses of petrol, diesel and kerosene. Cracking-types, Moving bed catalytic cracking. Knocking - Octane and Cetane rating, Composition, characteristics and uses of LPG, CNG. Biodiesel-Transesterification. Advantages. Hydrogen fuel- Production, storage, advantages and limitations. Combustion - Definition, Calculation of air required for the combustion of fuel, numerical problems related to calorific value and combustion.

Unit-5: Engineering Materials:

Portland cement: Composition and constituents. Setting and hardening of cement, special cements- properties and uses of High alumina cement, White cement and water proof cement. RCC, Decay of Concrete. Refractories: Classification, Properties - Refractoriness, RUL, Chemical inertness and porosity. Characteristics of a good refractory. Engineering Applications. Failure of a refractory. Lubricants: functions of lubricants, Classification, Mechanism of Lubrication, Properties - Viscosity, Acid value, Flash & Fire point, Cloud & Pour point, Aniline point.

Text Book:

1. Engineering Chemistry – PC Jain and M Jain – DhanpathRai and Sons, New Delhi.

Reference Books:

1. Text book of Engineering Chemistry by Ramadevi, Venkata Ramana Reddy & Prashanth Rath, Cengage learning publications.
2. A text book of Engineering Chemistry by Thirumala Chary, Laxminarayana, Shashikala. Pearson Publications.

Course Outcomes:

The basic concepts included in this course will help the student to gain:

1. Differentiate hard and soft water; solve the related problems on water purification and its significance in industry and daily life.
2. Understand the principles, concepts of electrochemistry and causes of corrosion, its consequences and methods to minimize corrosion to improve industrial designs.
3. The required skills to get clear concepts on polymers and energy sources and their applications to various engineering fields etc.
4. The knowledge of engineering materials such as Portland cement, white cement, concrete and lubricants etc.

CLASSICAL MECHANICS

I Year B.Tech. II-Semester **L T P C**

3 1 0 4

Course Objectives:

1. To understand the resolving forces and moments for a given force system.
2. To analyze the types of friction for moving bodies and problems related to friction.
3. To determine the centroid and second moment of area.

UNIT-I:

Introduction to Mechanics: Basic Concepts, system of Forces Coplanar Concurrent Forces -Components in Space -Resultant -Moment of Forces and its Application - Couples and Resultant of Force Systems. Equilibrium ofsystemofForces:Freebodydiagrams,EquationsofEquilibriumofCoplanarSystemsandSpatialSystems.

UNIT-II:

Friction: Types of friction -Limiting friction -Laws of Friction -static and Dynamic Frictions -Motion of Bodies-Wedge Screw, Screw-jack and differential screw –jack

UNIT-III:

Centroid and Center of Gravity: Introduction – Centroids of lines – Centroids of area - Centroids of Composite figures - Theorem of Pappus -Centre of Gravity of Bodies – Centroids of Volumes – Center of gravity of compositebodies.

UNIT-IV:

Area moments of Inertia: Introduction – Definition of Moment of Inertia -Polar Moment of Inertia – Radius of gyration - Transfer Theorem for moment of inertia – Moments of inertia by integration - Moments of Inertia of Composite Figures, Product of Inertia, Transfer Formula for Product of Inertia.

UNIT-V:

Mass Moment of Inertia: Introduction - Moment of Inertia of Masses – Radius of gyration - Transfer Formula for Mass Moments of Inertia – Mass moments of inertia by integration - Mass moment of inertia of composite bodies.

Text Books:

1. Singer’s Engineering Mechanics Statics and Dynamics by K. Vijaya Kumar Reddy and J. Suresh Kumar, BS Publications, 3rd Edition (SI Units) Fifth impression2013.
2. Engg. Mechanics by Irving Shames, G. Krishna Mohan Rao, PrenticeHall

Reference Books:

1. Engineering Mechanics by Timoshenko &Young
2. Engineering Mechanics by UmeshRegl,Tayal.
3. A text of Engineering Mechanics by YVD Rao, K. GovindaRajulu, M. Manzoor Hussain, Academic PublishingCompany
4. Text Book in Applied Mechanics by Malhotra, Subramanian, Gahlot and Rathore, NewAge.
5. Engineering Mechanics by KL Kumar, Tata McGrawHill.
6. Engineering. Mechanics by M.V. Seshagiri Rao & D RamaDurgaiah.
7. Engineering Mechanics by S.S. Bhavikati& K.G.Rajasekharappa

Course Outcomes:

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

1. Resolve forces and moments for a given system.
2. Analyze the friction for moving bodies.
3. Determine centroid and second moment for a given area of a body.

ENGLISH

I Year B.Tech. II-Semester

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INTRODUCTION

In view of the growing importance of English as a tool for global communication and the consequent emphasis on training students to acquire language skills, the syllabus of English has been designed to develop linguistic, and communicative competencies of Engineering students. In English classes, the focus would be on the skills development in the areas of vocabulary, grammar, reading and writing. For this, the teachers use the prescribed text for detailed study. The students are encouraged to read the texts leading to reading comprehension and different known/unknown passages may be given for practice in the class. The time is utilized for working out the exercises given after each excerpt. Authentic materials of a similar kind, for example, newspaper articles, advertisements, promotional material are used to supplement exercises.*The focus in this syllabus is on skill development in the areas of Vocabulary, Grammar, Reading and Writing Skills and practice of language skills in various contexts.*

LEARNING OBJECTIVES

The course will help students to:

a. Improve the language proficiency of students in English with an emphasis on Vocabulary, Grammar, Reading and Writing skills.
b. Develop study skills and communication skills in formal and informal situations.
c. Equip students to study engineering subjects more effectively and critically using the theoretical and practical components of the syllabus.

Reading Skills

Objectives

1. To develop an awareness in students about the significance of silent reading and comprehension.
2. To develop students' ability to guess meanings of words from the context and grasp the overall message of the text, draw inferences, etc.,
3. To facilitate the students practice the sub-skills of reading viz., Skimming and Scanning the text, Intensive and Extensive Reading, Reading for Pleasure, Identifying the topic sentence, Inferring lexical and contextual meaning, Recognizing Coherence/Sequencing of Sentences.

☛ **NOTE:** *The students will be trained in reading skills using the prescribed texts for detailed study. They will be tested in reading comprehension of different 'unseen' passages which may be taken from authentic texts, such as magazines/newspaper articles.*

Writing Skills

Objectives

1. To bring an awareness in the students about the difference between formal and informal writing
2. To make students understand sentence structures and variations in process writing
3. To develop students' creativity in different disciplines of academic writing.

SYLLABUS

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

Unit –I

Chapter entitled '***Presidential Address' by Dr. A.P.J. Kalam*** from ***"Fluency in English– A Coursebook for Engineering Students"*** published by Orient BlackSwan, Hyderabad

Vocabulary: The Concept of Word Formation -The Use of Prefixes and Suffixes- Collocations

Grammar: Punctuation - Identifying Common Errors in Writing with reference to Articles.

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

Writing: Sentence Structures -Use of Phrases and Clauses in Sentences- Paragraph Writing - Creating Coherence and Cohesiveness.

Unit –II

Chapter entitled ***Satya Nadella: Email to Employees on his First Day as CEO*** from ***"Fluency in English– A Coursebook for Engineering Students"*** Published by Orient BlackSwan, Hyderabad.

Vocabulary: Synonyms and Antonyms – Homonyms, Homophones and Homographs

Grammar: Identifying Common Errors in Writing with Reference to Noun-Pronoun Agreement – Words with appropriate Prepositions - Phrasal Verbs

Reading: Improving Comprehension Skills – Techniques for Good Comprehension

Writing: Writing Formal Letters **–** Format - Letter of Complaint and Reply - Letter of Requisition and Reply.

Unit –III

Vocabulary: Acquaintance with Phrases from Foreign Languages (Latin/French) with a focus on usage in English

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

Reading: Sub-skills of Reading- Skimming and Scanning.

Writing: Job Application with Resume- Writing Introduction and Conclusion - Essay Writing.

Unit –IV

Chapter entitled ***'Good Manners' by J.C. Hill***from***Fluency in English – A Coursebook for Engineering Students"*** published by Orient BlackSwan, Hyderabad

Vocabulary: Standard Abbreviations in English – Idioms – One Word Substitutes

Grammar: Subject-Verb Agreement - Redundancies and Clichés in Oral and Written Communication – Sequence of Tenses.

Reading: Comprehension- Intensive Reading and Extensive Reading- Reading Practice – *'If'* by Rudyard Kipling.

Writing: Writing Practices - Information Transfer -Précis Writing.

Unit –V

Chapter entitled ***'Father Dear Father'*** **by Raj Kinger**from ***Fluency in English – A Coursebook for Engineering Students"*** Published by Orient BlackSwan, Hyderabad

Vocabulary: Technical Vocabulary and their Usage – Indian Colloquial Terms

Grammar: Common Errors in English

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**: 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/learningin the class.)

PRESCRIBED TEXTBOOK:

1. ***"Fluency in English – A Coursebook for Engineering Students"*** byBoard of Editors**:**Hyderabad:Orient BlackSwanPvt. Ltd. 2016. Print.

Suggested Reading:

(i) *Practical English Usage.* Michael Swan. OUP. 1995.

(ii) *Remedial English Grammar.* F.T. Wood. Macmillan.2007

(iii) *Contemporary English Grammar Structures and Composition*. David Green. Macmillan. 2010.

(iv) *Communication Skills*. Sanjay Kumar and Pushp Lata. Oxford University Press. 2011.

Course Outcomes: Students will be able to:

1. Choose appropriate vocabulary and sentence structures for their oral and written communication.
2. Demonstrate their understanding of the rules of functional grammar.
3. Develop comprehension skills from the known and unknown passages and respond appropriately.
4. Take an active part in drafting paragraphs, letters, essays, abstracts and reports in various contexts
5. Adapt basic proficiency in English

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ENGINEERING CHEMISTRY LAB

I Year B.Tech. II-Semester **L T P C**
0021

I. Volumetric Analysis:

1. Estimation of Ferrous iron by Dichrometry method.
2. Estimation of Ferrous iron by Permanganometry method.
3. Estimation of Hardness of water by EDTA Complexometry method.

II. Conductometry:

1. Estimation of the concentration of an acid by Conductometry.

III. Potentiometry:

1. Estimation of the amount of Fe^{+2} by Potentiomentry.

IV. *p*H Metry:

1. Determination of an acid concentration using pH meter.

V. Preparations:

1. Preparation of Bakelite.
2. Preparation Nylon-6.

VI. Lubricants:

1. Estimation of acid value of given lubricant oil.
2. Estimation Saponification value of a lubricant oil.
3. Estimation of Viscosity of lubricant oil using Ostwald's Viscometer.

VII. Corrosion:

1. Determination of rate of corrosion of mild steel in the presence and absence of inhibitor.

Recommended Books:

1. Inorganic Quantitative analysis by A.I. Vogel, ELBS Publications.
2. Laboratory Manual of Engineering Chemistry by Y. Bharathi Kumari & Jyotsna C, VGS Booklinks, Vijayawada, 2009.
3. College Practical Chemistry by V.K. Ahluwalia, Narosa Publications Ltd. New Delhi (2007).
4. Engineering Chemistry Lab Manual by Cengage Publications.

ENGINEERING WORK SHOP PRACTICE

I Year B.Tech. II-Semester **L T P C**

0031.5

Pre-requisites: Practical skill

Course Objectives: The objectives of this course is to acquire knowledge on the

1. To impart hands-on practice on Carpentry trade and skills.
2. To impart hands-on practice on Fitting trade and skills
3. To impart hands-on practice on Black Smithy trade and skills.
4. To impart hands-on practice on House Wiring trade and skills
5. To impart hands-on practice on Tin Smithy trade and skills
6. To impart hands-on practice on Plumbing trade and skills

Note: At least two exercises to be done from each trade.

A. Carpentry
1. T-Lap Joint
2. Cross Lap Joint
3. Dovetail Joint

B. Fitting
1. Vee Fit
2. Square Fit
3. Half Round Fit

C. Black Smithy
1. Round rod to Square
2. S-Hook
3. Round Rod to Flat Ring

D. House Wiring
1. Parallel / Series Connection of three bulbs
2. Stair Case wiring
3. Florescent Lamp Fitting

E. Tin Smithy
1. Taper Tray
2. Open Scoop
3. Funnel

F. Plumbing
1. Coupling Joint
2. Elbow Joint
3. T Joint

TEXT BOOKS:

1. Workshop Practice by B.L.Juneja CengageLearning
2. Elements of Workshop Technology–S. K.Hajra Choudhury and A. K. HajraChoudhury.

ENGLISH LANGUAGE AND COMMUNICATION SKILLS (ELCS) LAB

I Year B.Tech. II-Semester **L T P C**
0021

The **EnglishLanguage 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.

Objectives

- 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 their mother tongue influence
- To train students to use language appropriately for public speaking, group discussions and interviews

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 Phonetics – 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 – Sentence Stress – Intonation.

Practice: BasicRules of Word Accent - Stress Shift - Weak Forms and Strong Forms- Sentence Stress – 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-the Interference of Mother Tongue (MTI).

Practice: Common Indian Variants in Pronunciation – Differences between British and American Pronunciation -*Testing Exercises*

ICS Lab:

Understand: Descriptions- Narrations- Giving Directions and Guidelines.

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
Practice: Group Discussion

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 audio-visual aids with a Public Address System, a T. V. or LCD, a digital stereo – audio & video system and camcorder etc.

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, 8th 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).

References:

1. Suzanna, R. *A Practical Course in English Pronunciation (with CD).* McGraw Hill Education. 2017. Print.
2. *Exercises in Spoken English*. Part 1, 2 and 3. CIEFL. Oxford University Press, 1997. Print.
3. Hancock, M. *English Pronunciation in Use. Intermediate Cambridge*: Cambridge University Press. 2009. Print.

Learning Outcomes

Students will be able to:

- Understand the nuances of English language through audio- visual experience and group activities
- Neutralise their accent for intelligibility
- Speak with clarity and confidence which in turn enhances their employability skills

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APPLIED PYTHON PROGRAMMING LAB

I Year B.Tech. II-Semester **L T P C**
0122

LIST OF EXPERIMENTS

Cycle - 1

1. **Downloading and Installing Python and Modules**
   a) **Python 3 on Linux**
   Follow the instructions given in the URL https://docs.python-guide.org/starting/install3/linux/
   b) **Python 3 on Windows**
   Follow the instructions given in the URLhttps://docs.python.org/3/using/windows.html
   (Please remember that Windows installation of Python is harder!)
   c) **pip3 on Windows and Linux**
   Install the Python package installer by following the instructions given in the URL
   https://www.activestate.com/resources/quick-reads/how-to-install-and-use-pip3/
   d) **Installing numpy and scipy**
   You can install any python3 package using the command pip3 install <packagename>
   e) **Installing jupyterlab**
   Install from pip using the command pip install jupyterlab

2. **Introduction to Python3**
   a) Printing your biodata on the screen
   b) Printing all the primes less than a given number
   c) Finding all the factors of a number and show whether it is a *perfect* number, i.e., the sum of all its factors (excluding the number itself) is equal to the number itself

3. **Defining and Using Functions**
   a) Write a function to read data from a file and display it on the screen
   b) Define a boolean function *is palindrome*(<input>)
   c) Write a function *collatz(x)* which does the following: if x is odd, $x = 3x + 1$; if x is even, then $x = x/2$. Return the number of steps it takes for $x = 1$
   d) Write a function $N(m, s) = exp(-(x-m)^2/(2s^2))/sqrt(2\pi)s$ that computes the Normal distribution

4. **The package** numpy
   a) Creating a matrix of given order $m \times n$ containing *random numbers* in the range 1 to 99999
   b) Write a program that adds, subtracts and multiplies two matrices. Provide an interface such that, based on the prompt, the function (addition, subtraction, multiplication) should be performed
   c) Write a program to solve a system of n linear equations in n variables using matrix inverse

5. **The package** scipy **and** pyplot
   a) Finding if two sets of data have the same *mean* value
   b) Plotting data read from a file
   c) Fitting a function through a set a data points using *polyfit* function
   d) Plotting a histogram of a given data set

6. **The** strings **package**
   a) Read text from a file and print the number of lines, words and characters
   b) Read text from a file and return a list of all *n* letter words beginning with a vowel
   c) Finding a secret message hidden in a paragraph of text
   d) Plot a histogram of words according to their length from text read from a file

Cycle -2

7. Installing OS on Raspberry Pi
   a) Installation using PiImager
   b) Installation using image file
      - Downloading an Image
      - Writing the image to an SD card
        - using Linux
        - using Windows
      - Booting up

   Follow the instructions given in the URL
   https://www.raspberrypi.com/documentation/computers/getting-started.html

8. Accessing GPIO pins using Python
   a) Installing GPIO Zero library.

   First, update your repositories list:

   sudo apt update

   Then install the package for Python 3:

   sudo apt install python3-gpiozero

   b) Blinking an LED connected to one of the GPIO pin

   c) Adjusting the brightness of an LED

   Adjust the brightness of an LED (0 to 100, where 100 means maximum brightness) using the in-built PWM wavelength.

9. Collecting Sensor Data
   a) DHT Sensor interface
      - Connect the terminals of DHT GPIO pins of Raspberry Pi.
      - Import the DHT library using ***import Adafruit_DHT***
      - Read sensor data and display it on screen.

PROBABILITY DISTRIBUTIONS AND COMPLEX VARIABLES

II Year B.Tech. I-Sem

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Pre-Requisites: Mathematics courses of first year of study

Course Objectives: To learn

1. The ideas of probability and random variables and various discrete and continuous probability distributions and their properties.
2. The basic ideas of statistics including measures of central tendency, correlation and regression.
3. The statistical methods of studying data samples.
4. Differentiation and integration of complex valued functions.
5. Evaluation of integrals using Cauchy's integral formula and Cauchy's residue theorem.
6. Expansion of complex functions using Taylor's and Laurent's series.

UNIT-I: Basic Probability

Probability spaces, conditional probability, independent events, and Bayes' theorem.
Random variables: Discrete and continuous random variables, Expectation of Random Variables, Variance of random variables

UNIT-II: Probability distributions

Binomial, Poisson, evaluation of statistical parameters for these distributions, Poisson approximation to the binomial distribution, Continuous random variables and their properties, distribution functions and density functions,
Normal and exponential, evaluation of statistical parameters for these distributions

UNIT-III: Estimation & Tests of Hypotheses

Introduction, Statistical Inference, Classical Methods of Estimation.: Estimating the Mean, Standard Error of a Point Estimate, Prediction Intervals, Estimating a Proportion for single sample, Difference between Two Means, difference between two proportions for two Samples.
Statistical Hypotheses: General Concepts, Testing a Statistical Hypothesis, Tests Concerning a Single Mean, Tests on Two Means, Test on a Single Proportion, Two Samples: Tests on Two Proportions.

UNIT-IV: Complex Differentiation

Limit, Continuity and Differentiation of Complex functions, Analyticity, Cauchy-Riemann equations (without proof), finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties.

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, Conformal mappings, Mobius transformations and their properties. (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, 9^{th} Edition, Pearson Publications.
3. A first course in complex analysis, D Zill,.

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, 8^{th} Edition, Pearson Educations
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, LaxmiPublications, Reprint, 2010.
4. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., Mc-Graw Hill, 2004.

Course Outcomes:

After learning the contents of this paper the student must be able to

1. Formulate and solve problems involving random variables and apply statistical methods for analysing experimental data.
2. Apply concept of estimation and testing of hypothesis to some case studies.
3. Analyse the complex function with reference to their analyticity, integration using Cauchy's integral and residue theorems.
4. Taylor's and Laurent's series expansions of complex function

BASIC ELECTRICAL ENGINEERING

II Year B.Tech. I-Sem

L	T	P	C
3	0	0	3

Pre- Requisites: Nil

Course Objectives:

1. To introduce the concepts of electrical circuits and its components.
2. To understand magnetic circuits, DC circuits and AC single phase & three phase circuits.
3. To study and understand the different types of DC/AC machines and Transformers.
4. To import the knowledge of various electrical installations.
5. To introduce the concept of power, power factor and its improvement.

UNIT-I

D.C. Circuits:

Electrical circuit elements (R, L and C), voltage and current sources, KVL & KCL, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems.

Time-domain analysis of first-order RL and RC circuits.

UNIT-II

A.C. Circuits:

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance in series R-L-C circuit.

Three-phase balanced circuits, voltage and current relations in star and delta connections.

UNIT-III

Transformers:

Ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

UNIT-IV

Electrical Machines:

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor.

Construction and working of synchronous generators.

UNIT-V

Electrical Installations:

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

Text Books:

1. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010.
2. D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.

Reference Books:

1. L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.
2. E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.
3. V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.

Course Outcomes:

1. To analyze and solve electrical circuits using network laws and theorems.
2. To understand and analyze basic Electric and Magnetic circuits.
3. To study the working principles of Electrical Machines.
4. To introduce components of Low Voltage Electrical Installations.

MINERAL DRESSING

II Year B.Tech. I-Sem

L	T	P	C
4	0	0	4

Pre- Requisites: Nil

Course Objectives:

1. Introduce students to the principles of ore comminution, liberation and particle size analysis and the different equipments used in the processes.
2. Teach the students about various methods of concentration/ separation and the processes suitable to the liberated ore and equipments used.
3. Acquaint the students about quantifying concentration processes and selection of proper mineral dressing cycles for an ore/mineral.

UNIT–I

Scope, objectives and advantages of ore dressing. Sampling of ores by different methods. Theory of liberation of minerals. Crushers: - Jaw, Gyratory, Cone, Rolls and toothed roll crushers. Types of grinding operations- batch and continuous, dry and wet grinding and open circuit and closed circuit grinding. Grinding Mills: Ball mills, rod, tube mills and theory of ball mill operation. Comminution laws: - Rittinger's laws, Kick's law and Bond's law.

UNIT–II

Sizing Techniques: Laboratory and industry practices- Study of laboratory sizing techniques and reporting of sizing data. Types of screens, Movement of solids in fluids: Stokes and Newton's laws. Terminal velocity and its relation with size. Relation between time and velocity. Relation between distance traveled and velocity. Equal settling ratio, Free and hindered settling ratio. Quantifying concentrating operations: Ratio of concentration, recovery, selectivity index and economic recovery.

UNIT–III

Classification and types of classifiers**:** Study of settling cones, rake classifier, spiral classifier and cyclones. Heavy media separation: Principles, flow chart, different media used. Heavy media separation using heavy liquids and heavy suspensions. Washability curves of coal. Jigging: Theory of jigging and Jigging machines**:** Harz, Baum, Denver jig. Design considerations in a jig.

UNIT-IV

Tabling- Basic principle, study of stratification on a table, Wilfred Table. Humphrey's spiral classifier. Basic principles of Magnetic separation processes and electrostatic separation process. Brief description about the working of belt and drum magnetic separator, high tension separator.

UNIT–V

Floatation: Principles of floatation. Factors affecting floatation. Classification of collectors and frothers. Regulators, factors affecting their efficiency. Floatation machines: Pneumatic and mechanical floatation cells. Application of floatation process to Cu, Pb and Zn ores.

Text Books:

1. Mineral processing technology - A. Wills, Published by Butterworth-Heinemann, 2015.
2. Principles of Mineral Dressing by A.M. Gaudin, McGraw-Hill Inc., US, 1939.

References Books:

1. Text book of Mineral processing by D.V. Subba Rao, Scientific Publishers, 2007.
2. Ore dressing practices - S. K. Jain, Rotterdam: A.A. Balkema, 1987.
3. Elements of Ore Dressing by A.F. Taggart, John Wiley & Sons,1st Edition ,1951.

Course Outcomes:

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

1. Recognition of the need of the mineral dressing prior to extraction of metals.
2. Describe the working and construction details of various equipments used in mineral dressing.
3. Assess the efficiency of concentration processes.
4. Select and describe a particular concentration process suitable to the liberated ore.
5. To make a logical link between mineral processing and economics of metal production.
6. Apply the knowledge learned so as to being capable of understanding advance courses in mineral processing operations and modeling.

METALLURGICAL ANALYSIS

II Year B.Tech. I-Sem

L	T	P	C
3	0	0	3

Pre-Requisites: Nil

Course Objectives:

1. To know the principles of qualitative and quantitative analysis of ores, metals, alloys, and refractory materials.
2. To know the principles and working of the various instruments utilized in instrumental analysis.
3. To know the importance of metallurgical analysis in the field of metallurgy.

UNIT-I

Importance of chemical analysis, scope of metallurgical analysis, classification of various methods used in metallurgical analysis. Solution preparations: Normality, Molarity, Molality, Equivalent weight. Dissolution of ores in general, metals and alloys.

UNIT-II

Chemical Analysis - Basic Principles - theory of indicators.
Estimation of C, S, Si, Mn and P in cast iron and steel.

UNIT-III

Estimation of Cr, Ni, Mo, W and V in alloy steels.
Determination of iron in iron ore, manganese in manganese ores, lime in limestone, fire-assay of precious metals.

UNIT-IV

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

UNIT-V

Spectroscopy, potentiometry, polarography conductometry, electro - analysis and flame photometry.

Text Books:

1. Metallurgical analysis - S.P. Jain, B.C. Agarwal, 8th Edition, 1996.
2. A Text Book of Metallurgical Analysis, Agarwal, B.C. and Jain S.P., Khanna Publishers, Delhi -1963.

Reference Books:

1. Metallurgical Analysis: Iyer, V. Gopalam, BHU Press, Varanasi. 2nd Edition, 1947.
2. Commercial methods of analysis : Snell Foster D and Frank M Biffen / Che. Publishing Co.,1964.
3. A Text Book of Quantitative Inorganic Analysis, Vogel Al., Longman ELBS 1962.
4. Instrumental Methods of analysis, Willard H.H, Merritt, Van Nostrand, 6th edition, 1989.

Course Outcomes:

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

1. Know the importance of chemical analysis and how it is related to metallurgical engineering.
2. Distinguish between qualitative and quantitative measurements and compare them. Can also suggest a method for analyzing different materials.
3. Interpret and identify the elements through analysis, explain about analysis of precious metals through assaying.
4. Understand the theoretical principles behind modern analytical instrumentation. Apply theory and operational principles of analytical instruments. Select and apply appropriate instrumental methods of analysis to problems in any of the sciences.
5. Develop a range of knowledge relating to instrument operation, observation, measurement and interpretation of results. Convert between wavelength, energy and frequency for light and understand the relationship between absorbed light and color.
6. Assess and choose different methods to identify the nature of the material given.

THERMODYNAMICS AND KINETICS

II Year B.Tech. I-Sem

L	T	P	C
3	1	0	4

Pre-Requisites: Nil

Course Objectives:

1. The prime aim of this course is to apply thermodynamics and kinetics to various metallurgical aspects like Solutions, Phase diagrams, Diffusion, and Ellingham Diagrams.
2. The course is also intended to correlate electrochemical principles with thermodynamics.
3. To provide a consistent picture of thermodynamic concepts when applied to various topics.

UNIT-I

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

UNIT-II

First Law of thermodynamics: Relationship between heat and work, internal energy and the first law of thermodynamics, calculations of work, Heat capacity, reversible adiabatic processes, reversible isothermal pressure or volume changes, of an ideal gas, Joules experiment, Joule- Thompson experiment, Joule-Thompson co-efficient, Enthalpy change with temperature, Kirchhoff's equation. Efficiency of a cyclic process, Carnot cycle, Carnot theorem, Second law of thermodynamics, concept of entropy, Quantification of irreversibility.

UNIT-III

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

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

UNIT-IV

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

Claussius – Clapeyron equation: Introduction, derivation of the Claussius – Clapeyron equation for single substance, Duhring rule for the estimation of the vapour pressures of an element, Integration of Claussius – Clapeyron equation.

UNIT-V

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

Text Books:

1. Introduction to Metallurgical Thermodynamics – D.R. Gaskell, hemisphere Publishing Corporation, 1981.
2. Chemical and Metallurgical Thermodynamics (Vol I &II) - M.L. Kapoor, Nemchand& Bros Publishers, 1984.

Reference Books:

1. Physical chemistry for Metallurgists – J. Mackowiak, Allen & Unwin, 2nd edition, 1967.
2. Thermodynamics of solids- R.S. Swalin, John Wiley Publisher, 1972.
3. Physical chemistry of metals- L.S. Darken & Gurry, CBS publishers & Distributors 2002.
4. Problems in Metallurgical Thermodynamics: G.S Upadhyaya, R.K. Dubey, Elsevier Science, 2013.

Course Outcomes:

At the end of the course the student would be able to:

1. Knowledge of the type of variable that affects heterogeneous reaction rates nucleation, interfacial energy, interface equilibrium and diffusion.
2. Relate 1st and 2nd Law of thermodynamics.
3. Knowledge of enthalpy, entropy and free energy.
4. Understand the principles of kinetics and thermodynamics as applied to rates and equilibrium positions of chemical reactions.
5. Calculate the temperature dependence of rate constants and relate this calculation to activity and fugacity.
6. Determine order of reaction. Explain the central concepts of chemical kinetics. Formulate and solve rate equations for various reactions.

BASIC ELECTRICAL ENGINEERING LAB

II Year B.Tech. I-Sem

L	T	P	C
0	0	2	1

Pre-Requisites: Basic Electrical Engineering

Course Objectives:

1. To analyze a given network by applying various electrical laws and network theorems.
2. To know the response of electrical circuits for different excitations.
3. To calculate, measure and know the relation between basic electrical parameters.
4. To analyze the performance characteristics of DC and AC electrical machines

List of Experiments/Demonstrations:

1. Verification of Ohms Law.
2. Verification of KVL and KCL.
3. Transient Response of Series RL and RC circuits for DC excitation.
4. Transient Response of RLC Series circuit for DC excitation.
5. Resonance in series RLC circuit.
6. Calculations and Verification of Impedance and Current of RL, RC and RLC series circuits.
7. Measurement of Voltage, Current and Real Power in primary and Secondary Circuits of a Single Phase Transformer.
8. Load Test on Single Phase Transformer (Calculate Efficiency and Regulation).
9. Three Phase Transformer: Verification of Relationship between Voltages and Currents (Star-Delta, Delta-Delta, Delta-star, Star-Star).
10. Measurement of Active and Reactive Power in a balanced Three-phase circuit.
11. Performance Characteristics of a Separately/Self Excited DC Shunt/Compound Motor.
12. Torque-Speed Characteristics of a Separately/Self Excited DC Shunt/Compound Motor.
13. Performance Characteristics of a Three-phase Induction Motor.
14. Torque-Speed Characteristics of a Three-phase Induction Motor.
15. No-Load Characteristics of a Three-phase Alternator.

Text Books:

1. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010.
2. D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.

Reference Books:

1. L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.
2. E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.
3. V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.

Course Outcomes:

1. Get an exposure to basic electrical laws.
2. Understand the response of different types of electrical circuits to different excitations.
3. Understand the measurement, calculation and relation between the basic electrical parameters
4. Understand the basic characteristics of transformers and electrical machines.

MINERAL DRESSING LAB

II Year B.Tech. I-Sem

L	T	P	C
0	0	2	1

Pre- Requisites: Mineral Dressing

Course Objectives:

This laboratory course is designed to

1. To teach the student how to conduct sampling and sieve analysis.
2. Make the student to learn and demonstrate the usage of crushers and grinders.
3. Learn to conduct concentration methods at laboratory scale.
4. Teach the students how to note down the observations and results obtained in the experiments.

List of Experiments:

1. Sampling of an ore from the bulk by
   (i) Coning and quartering method.
   (ii) Riffle sampler.
2. Determination of average particle size of a given material by sieve analysis.
3. Verification of Stoke's Law.
4. Size reduction of the given material using Jaw Crusher and determining the reduction ratio.
5. Size reduction of the given material using Roll Crusher and determining the reduction ratio.
6. Size reduction of the given material using Ball Mill and determining the reduction ratio.
7. Determine the grindability index of coal using hard groove grindability machine.
8. Separation of the given material into magnetic and non magnetic particles using magnetic separator.
9. Determination of recovery percentage of the concentrate by Froth- Floatation process.
10. Study of a jigging machine.

Course Outcomes:

At the end of the laboratory course the student will be able to:

1. Pick or take a representative amount of sample and conduct experiments / tests.
2. Determine the reduction ratio in crushing and grinding of different materials using various types of size reduction units.
3. Analyze the grindability of different coals.
4. Separate or concentrate the given materials using magnetic separation and froth flotation processes.
5. Prepare formal laboratory reports.

METALLURGICAL ANALYSIS LAB

II Year B.Tech. I-Sem

L	T	P	C
0	0	2	1

Pre- Requisites: Metallurgical Analysis

Course Objectives:

1. This course introduces chemical analysis of metallic alloys using laboratory practice.
2. This course gives knowledge on principles and working of various instruments used in analysis.

List of Experiments:

1. Estimation of Iron in Iron ore by $KMnO_4$ method.
2. Estimation of Iron in scrap by $KMnO_4$ method.
3. Estimation of Iron in Iron ore by $K_2Cr_2O_7$ method.
4. Estimation of Iron in scrap by $K_2Cr_2O_7$ method.
5. Estimation of lime in Limestone.
6. Estimation of Silicon in Cast Iron.
7. Estimation of manganese in cast iron.
8. Estimation of Sulphur and Phosphorus in cast irons.
9. Estimation of Chromium in Steel.
10. Estimation of Sodium and Potassium in Chloride Salts by Flame Photometry.

Course Outcomes:

At the end of this laboratory course, the student will be able to:

1. Identify the major elements in a metallic alloy using chemical methods.
2. Quantify specific elements in ferrous and non-ferrous alloys using titration.
3. Identify certain elements in salts by flame photometry.
4. Interpret the results from different spectroscopy instruments to determine chemical composition.
5. Learn operating techniques of different instruments used in analysis.
6. Prepare formal laboratory reports.

ENVIRONMENTAL SCIENCE

II Year B.Tech. I-Sem

L	T	P	C
2	0	0	0

Pre-Requisites: NIL

Course Objectives:

1. Understanding the importance of ecological balance for sustainabledevelopment.
2. Understanding the impacts of developmental activities and mitigationmeasures.
3. Understanding the environmental policies andregulations

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. Structural features, Biotic structure, Abiotic structure, Ecological succession, Types of Ecosystems, Field visits.

UNIT–II:

Natural Resources: Classification of Resources: Living and Non-Living resources, **water resources:** use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problems. **Mineral resources:** use and exploitation, environmental effects of extracting and using mineral resources, **Land resources:** Forest resources, **Energy resources:** growing energy needs, renewable and non renewable energy sources, use of alternate energy source, casestudies. **Food recourses**: Desertification, Equitable use of resource for sustainable use style.

UNIT–III:

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

UNIT–IV:

Environmental Pollution and Control Technologies: Environmental Pollution: Classification of pollution, **Air Pollution:** Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards. **Water pollution:** Sources and types of pollution, drinking water quality standards. **Soil Pollution:** Sources and types, Impacts of modern agriculture, degradation of soil. Landslides, floods, cyclones. **Noise Pollution:** Sources and Health hazards, standards, **Thermal pollution:** Introduction, causes and consequences. **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: C**limate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS). Deforestation and desertification. International conventions / Protocols: Earth summit, Kyoto protocol, and Montréal Protocol. NAPCC-GoI Initiatives.

UNIT–V:

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

Text Books:

1 Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University GrantsCommission.
2 Environmental Studies by R. Rajagopalan, Oxford UniversityPress.

Reference Books:

1. Environmental Science: towards a sustainable future by Richard T. Wright. 2008 PHL Learning Private Ltd. NewDelhi.
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.

Course Outcomes:

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

ECONOMICS AND FINANCIAL ANALYSIS

II Year B.Tech. II-Sem

L	T	P	C
3	0	0	3

Course Objective:

To prepare engineering students to analyze cost/ revenue/ financial data and to make economic and financial analysis in decision making process and to examine the performance of companies engaged in engineering.

Unit- I:

MacroEconomic Concepts: Economics- Micro & Macroeconomics-National Income Accounting - Methods of Estimation- Various Concepts of National Income - Inflation – Causes of Inflation and Measures to Control Inflation - New Economic Policy -Industrial policy, Trade policy, and Fiscal policy and its Impact on Industry-Types of companies-Features.

Unit- II:

Introduction to Business Economics- Basic Principles of Economics– Fundamental Concepts- Demand – Demand Determinants - Law of Demand- Demand Forecasting and Methods- Elasticity of Demand– Supply- Elasticity of Supply- Theory of Firm.

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UNIT- III:

Production, Cost, Market Structures & Pricing:

Production Analysis: Factors of Production, Production Function, Production Function with one variable input, two variable inputs, Returns to Scale, Different Types of Production Functions. Cost analysis: Types of Costs, Short run and Long run Cost Functions.Market Structures: Nature of Competition, Features of Perfect competition, Monopoly, Oligopoly, and Monopolistic Competition.Pricing: Types of Pricing, Product Life Cycle based Pricing, Break Even Analysis, Cost Volume Profit Analysis (simple problems).

Unit- IV:

Introduction to Accounting: Accounting Principles (GAPP), concepts, conventions- - Double entry system of Book keeping–Accounting rules- Journal- ledger- Trial balance-Trading and Profit and Loss account- Balance Sheet. (Simple Problems).

Unit- V:

Capital Budgeting Techniques: Significance of Capital Budgeting - cash flows-Time Value of Money- Choosing between alternative investment proposals- Methods of Appraisal Techniques- Pay Back Period - Average Rate of Return – Net Present Value-Internal Rate of Return – Profitability Index(simple problems).

Suggested Readings:

1. Henry Malcom Steinar-Engineering Economics, Principles, McGraw Hill Pub.
2. D.D.Chaturvedi, S.L.Gupta, Business Economics - Theory and Applications, International Book House Pvt. Ltd. 2013.
3. Jain and Narang" Accounting, Kalyani Publishers.
4. Arora, M.N." Cost Accounting, Vikas Publication.
5. S.N.Maheshwari, Financial Management, Vikas Publishing House.

Course Outcome:

To perform and evaluate present and future worth of the alternate projects and to appraise projects by using traditional and DCF Methods. To carry out cost benefit analysis of projects and to calculate BEP of different alternative projects.

PHYSICAL METALLURGY

II Year B.Tech. II-Sem

L	T	P	C
3	1	0	4

Pre-Requisites: Engineering Physics & Engineering Chemistry

Course Objectives:

1. Give basic concepts of material science.
2. 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.
3. The course also critically focuses on the crystallography, phase transformations that occur in several ferrous and nonferrous metallurgical systems as a function of temperature and composition through phase equilibrium diagrams.

UNIT–I

Structure of Metals, Types of chemical bonding, crystal systems, plane and directional indices, transformation of indices, coordination number, relationship between lattice parameter and atomic radius, packing factor and density calculations, interstitial voids.

UNIT–II

Microscopy: Metallurgical Microscope, principle and construction, types of objectives and eyepieces, common defects of lenses. Introduction to electron Microscopy-Principle and operation of SEM, TEM.

UNIT–III

Constitution of Alloys: Necessity of alloying, types of solid solutions, Hume-Rothery's rules. Intermediate alloy phases, electron-chemical compounds and electron phases.

Equilibrium Diagrams: Construction, phase rule. Types of Phase diagrams: Binary Isomorphous alloy systems, non- equilibrium cooling, binary eutectic system, peritectic and monotectic reactions. Phase diagrams with intermediate phases and compounds

UNIT–IV

Types of nucleation, determination of the size of critical nucleus, equilibrium cooling and heating of alloys, lever rule, miscibility gaps.Study of Fe-Fe_3 C phase diagram, Transformation in solid state: allotropy, eutectoid, peritectoid reactions and order-disorder transformations

UNIT–V

Study of other important binary phase diagrams: Al-Cu, Cu-Zn, Cu-Sn, Pb-Sn, and complex phase diagrams. Strengthening mechanisms: strengthening of grain boundary, work hardening, solid solution strengthening, precipitation hardening and dispersion strengthening.

Text Books:

1. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.
2. Introduction to Physical Metallurgy – SH Avner, TATA Mc GRAW HILL,1997.

Reference Books:

1. Physical Metallurgy Principles- R.E. Reed Hill, Affiliated East-West Press, 2008.
2. Physical Metallurgy - V. Raghavan, PHI Learning; 3rd edition, 2015.
3. Physical Metallurgy - Vijendra Singh, Standard Publishers Distributors, 2020.
4. Foundations of Materials Science and Engineering – WF Smith McGraw-Hill Education, 5^{th} edition 2009.
5. Metallurgy for Engineers- Clark and Varney, Van Nostrand Reinhold Company, 2^{nd} Revised edition ,1962.

Course Outcomes:

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

1. Analyze the structure of crystalline materials and calculate the various crystals parameters.
2. Explain the working of metallurgical microscope and its different parts.
3. Explain the necessity of alloys, will identify the different types of alloy phases.
4. Explain the construction and identification of phase diagrams and reactions.
5. Explain the Fe-Fe_3C diagram with invariant reactions.
6. Explain the Cu-Zn and other binary diagrams and complex phase diagrams etc.

PRINCIPLES OF EXTRACTIVE METALLURGY

II Year B.Tech. II-Sem

L	T	P	C
3	1	0	4

Pre-Requisites: Mineral Dressing and Thermodynamics and Kinetics

Course Objectives:

1. To learn and emphasize the principles of pyrometallurgy, hydrometallurgy and electrometallurgy.
2. To learn scientific concepts of extraction and refining.
3. Obtain knowledge of equipment used in pyrometallurgy, hydrometallurgy and electrometallurgy.
4. Gain basic knowledge about pelletisation and Sintering.

UNIT-I

Introduction: Classification of ores. Basics of Pyrometallurgy, Calcination, Roasting and types of roasting, Oxidising, sulphatising, and chloridizing. Roasting furnaces: Multiple hearth roaster, flash roasting, fluidized bed roasting and blast roasting.

UNIT-II

Pelletisation and Sintering, Smelting: Principles of reduction and matte smelting with examples. Smelting furnaces: Reverberatory, Blast Furnace and electric smelting. Flash smelting.

Slags: Classification, properties, Application of Ellingham diagrams for oxides and sulphides.

UNIT-III

Hydrometallurgy: Flowchart, Principles and types of leaching, Advantages and limitations, Solution purification by ion and solvent exchange methods, Metal recovery from leach solution by cementation.

UNIT-IV

Classification of electrometallurgy, Principles of electrometallurgy, Advantages and limitations of electrometallurgy, Electro winning and Electro refining with typical examples.

UNIT-V

Principles of Refining: Fire refining, Distillation, liquation, electro-refining and zone refining with some examples.

Text Books:

1. Non-ferrous extractive metallurgy: H.S.Ray, K.P.Abraham and R.Sreedhar, Affiliated East West Private Limited, 2008.
2. Principles of extractive metallurgy - H.S. Ray & A. Ghosh, New - Age International Publisher, 3rd Edition, 2018.

Reference Books:

1. Extractive Metallurgy: Process and Applications: Sujay Kumar Dutta, Avinash B. Lele and Yakshil B. Chokshi, PHI Learning Pvt. Ltd., 2018.
2. A text book of metallurgy - A. R. Bailey, Macmillan & Co, 1st edition, 1960.
3. Principles of extractive metallurgy - Terkel Rosenqvist, Tapir Academic Press, 2004.

Course Outcomes:

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

1. Classify the different ores and describe the various units operating like pyro metallurgy, hydrometallurgy and electrometallurgy.
2. Differentiate the various types of slags, properties and their applications.
3. Illustrate with the help of flow sheet of process taking place in pyro metallurgy, hydrometallurgy and electrometallurgical extractions of metal/matte.
4. Choose the type of refining process according purity required.
5. Understand the impact of extractive process on health environment society and will be able to suggest suitable techniques to recycle the byproducts or to decrease energy consumptions.
6. Design the suitable process for extraction.

METALLURGICAL THERMODYNAMICS

II Year B.Tech. II-Sem

L	T	P	C
3	1	0	4

Pre-Requisites: Nil

Course Objectives:

This course is mainly intended to deals with

1. The laws of diffusion.
2. Interpret Ellingham diagrams
3. Identify metallurgical thermodynamics principles to be applied in phase diagrams.

UNIT-I

Diffusion: Fick's laws of diffusion and its applications, Kirkendall effect, Darken's equations, the Matano Method. Determination of intrinsic diffusivities, self diffusion in pure metals, Temperature dependence of the diffusion coefficient, diffusion along the grain boundaries and surfaces.

UNIT-II

Ellingham Diagrams: Introduction, calculation of equilibrium constants from standard free energy changes, general description of Ellingham diagrams, Interpretation of free energy changes Vs. temperature lines, Richardson's diagrams.

UNIT-III

Thermal Properties: Specific heats of solids, classical theory, Einstein and Debye's models of the lattice.

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

UNIT-IV

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

Application to phase diagrams: Concept of chemical potential, equality of chemical potentials in equilibrated phases, Derivation of Gibbs phase rule, solidus and liquidus lines for an ideal solution, calculation of liquidus line for eutectic systems.

UNIT-V

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

Text Books:

1. Physical Chemistry for Metallurgist by J. Mackowick, Allen and Unwin publisher, 1966.
2. Physical Chemistry of Metals by LS Darken and Gurry, CBS publisher and Distributor, 2002.

Reference Books:

1. Thermodynamics of solids by RA Swalin,Wiley VCH; 2nd edition, 1973.
2. Essentials of Metallurgical Thermodynamics – R.H. Tupkary, Khanna Book Publishing Co. (P) Ltd. 2016.
3. Principles of Metallurgical Thermodynamics: Subir Kumar Bose, Sanat Kumar Roy, Universities Press, 2014.

Course Outcomes:

Obtain the skill to use Metallurgical Thermodynamics concept for

1. Understand and able to use Fick's I and II law.
2. Interpret Ellingham Diagram for oxides.
3. Understand the thermal properties of solids, specifically, specific heat and some models for specific heat calculation.
4. Knowledge of ideal and regular solutions and free energy of mixing.
5. Apply the phase rule on the metallurgical systems.
6. Understanding of the nature of polarized electrochemical reactions and an introduction of their application in corrosion behavior of metals.

FUELS, FURNACES & REFRACTORIES

II Year B.Tech. II-Sem

L	T	P	C
3	0	0	3

Pre-Requisites: Nil

Course Objectives:

1. Relate the properties and applications of solid, liquid and gaseous fuels.
2. Broad knowledge on modes of heat transfer.
3. Describe the different types of refractories and pyrometers and their properties and uses.
4. Have a basic knowledge on working of different types of furnaces.

UNIT–I

Introduction to Fuels technology: Classification of fuels, Origin and classification of coal, Proximate and ultimate analysis of coal and its applications. Properties and uses of Pulverized coal, Carbonization of coal and types of Carbonization. Properties, uses and testing of Metallurgical Coke.

Liquid fuels: Properties and applications.

UNIT –II

Manufacture, properties and uses of Producer gas and Water gas.

Modes of heat transfer, Importance of heat transfer. Steady State Heat Transfer: Conduction through plane, cylindrical, Spherical and compound walls. Convection: Free and Forced conventions. Heat transfer by combined effect of conduction and convection between two fluids separated by a plane wall and cylindrical wall.

UNIT-III

Furnaces: Classification and uses of furnaces, characteristic features of Vertical Shaftfurnaces, Reverberatory furnaces, Arc and Induction furnaces, Tube and Muffle type Resistance furnaces, Continuous furnaces. Heat losses in furnaces and heat balance.

UNIT-IV

Pyrometry: Thermo electric pyrometer - Peltier and Thomsone.m.f. Thermo-electric power of thermocouples. Required properties of thermocouples. Noble and base metal thermocouples.

Principle, operation and applications of Thermometer, Optical and Radiation pyrometers.

UNIT – V

Refractories: Classification and desirable properties of refractories, modes of failure of refractories in service and their prevention. Manufacturing methods and properties of Fireclay, Silica, Magnesite, Dolomite, Chromite andCarbon refractories. Testing of Refractories, Applications of refractories in the metallurgical industries.

Text Books:

1. Fuels, Furnaces and Refractories – O.P.Gupta, 6th edition, Khanna Publishers, 1989.
2. Metallurgical furnaces – Krivadan and Markov, MIR publishers, 1980.

Reference Books:

1. Elements of fuel technology – HIMUS, TBS The Book Service Ltd; 2nd Revised edition 1958.
2. Furnaces - J. D. Gilchrist, PergamonPr; 2nd edition, 1977.
3. Pyrometry -W.P. wood & J. M. Corck.
4. Elements of heat transfer - Jakob&Hawikns, John Wiley & Sons, 3rd edition, 1957.
5. Elements of thermodynamics & heat transfer - Obert & Young, McGraw-Hill Inc., US, 3rd edition,1962.
6. Control systems & Instrumentation – S. Bhasker.

Course Outcomes:

At the end of the course the student would be able to:

1. Know about a fuel, classify them and compare different types of fuels and describe their testing methods. Explain the coke making process, list out the properties and its by-products recovery and suggest methods for decreasing environmental pollution and energy consumption.
2. Apply principles of heat and mass transfer to basic engineering systems and understand the basic concepts and laws of the three modes of heat transfer and apply analytical techniques to the solution of conduction heat-transfer problems.
3. Classify and explain construction and working of different furnaces. Analyze the causes of heat losses in furnaces and suggest methods of minimization of heat loss and waste heat recovery.
4. Describe the operation of a thermocouple. Describe various temperature-measuring devices - thermometers and pyrometers. Discuss the principles that govern noncontact thermal measurements and describe the operation of optical and radiation pyrometers.
5. Explain various manufacturing and testing processes of refractories. Itemize many examples of metallurgical refractories under different categories, their main properties and applications. Link inherent properties of the refractory mineral and how it affects the production technology and the application.
6. Select the relevant fuel, furnace and refractory material for the metallurgical operations and can justify the interpretation.

PHYSICAL METALLURGY LAB

II Year B.Tech. II-Sem	**L**	**T**	**P**	**C**
	0	**0**	**2**	**1**

Pre-Requisites: Physical Metallurgy

Course Objectives:

The laboratory course helps to:

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

List of Experiments:

1. Preparation and study of Crystal models.
2. Study of various microscopes (Optical microscope, SEM, TEM) and specimen preparation techniques for metallurgical microscope.
3. Metallographic preparation and microstructure evaluation of low carbon steel.
4. Metallographic preparation and microstructure evaluation of medium carbon steel.
5. Metallographic preparation and microstructure evaluation of high carbon steel.
6. Metallographic preparation and microstructure evaluation of different cast irons (grey cast iron, white cast iron, malleable cast iron, spheroidal graphite iron).
7. Metallographic preparation and microstructure evaluation of Copper.
8. Metallographic preparation and microstructure evaluation of Brass.
9. Determination of phase fraction and grain size using Image analyzer.
10. Drawing of the Binary phase diagrams of Isomorphous (Cu-Ni), Eutectic (Pb-Sn, Al-Si) and partial solubility diagram (Al-Cu) with interpretation.
11. Drawing of complex binary phase diagrams (Al_2O_3-SiO_2, MgO-Al_2O_3) and identification of points, lines and areas in them.
12. Experiments to obtain cooling curves for pure metals and alloys and to establish binary phase diagram.

Course Outcomes:

By completing this laboratory course, students:

1. Can describe the metallurgical microscope, sample preparation, mounting and use/choosing of different etching reagents.
2. Can identify and report the microstructural features of ferrous and nonferrous samples observed.
3. Can operate optical microscope with an ease.
4. Characterize microstructures of engineering alloys using optical microscopy and image analyzer.
5. Prepare formal laboratory reports.

PRINCIPLES OF EXTRACTIVE METALLURGY LAB

II Year B.Tech. II-Sem	**L**	**T**	**P**	**C**
	0	**0**	**2**	**1**

Pre-Requisites: Principles of Extractive Metallurgy

Course Objectives:

1. This is course is design to give knowledge about different types of extraction processes.
2. Know the importance of EMF series.

List of Experiments

1. Important flow sheets for Metal Extraction.
2. Electro Cleaning of a given material by using electrolysis principle.
3. Electro Etching of a given material by using electrolytic cell.
4. Electro polishing of a given material by using electrolytic cell.
5. Importance of EMF series.
6. Calculate cathode current efficiency electro plating of Copper.
7. Calculate cathode current efficiency electroplating of Nickel.
8. Galvanization of Zinc on mild steel.
9. Electrowinning of Copper by using aqueous electrolyte.
10. Electrowinning of Copper by using prepared electrolyte from raw materials.

Course Outcomes:

1. To study the importance of EMF series.
2. Understand different types of electro cleaning, electro etching, electro polishing techniques.
3. Study the concepts of metal extraction processes.
4. To calculate cathode current efficiency of electroplating of metals.
5. To perform electrowinning of Cu by different electrolytes.
6. To perform galvanisation of Zinc

FUELS, FURNACES AND REFRACTORIES LAB

II Year B.Tech. II-Sem

L	T	P	C
0	0	2	1

Pre-Requisites: Nil

Course Objectives:

This laboratory course deals with:

1. Analysis of fuels and their importance.
2. Characterization of refractories.
3. Use different types of fuel testing equipment.

List of Experiments:

1. Proximate analysis of Coal (percentage of moisture, volatile matter, ash content & Fixed Carbon).
2. Ultimate analysis of Coal (Carbon, hydrogen, sulfur and oxygen).
3. Determination of Flash and Fire points of diesel using PENSKY MARTINS open and closed cup apparatus.
4. Determination of Flash and Fire points of kerosene using PENSKY MARTINS open and closed cup apparatus.
5. Determination of Flash and Fire points of diesel using ABEL's apparatus.
6. Determination of Flash and Fire points of kerosene using ABEL's apparatus.
7. Determine the effect of kinematic viscosity of lubricant oil by using Red-wood Viscometer-I.
8. Determine the effect of kinematic viscosity of lubricant oil by using Red-wood Viscometer-II.
9. Determine the calorific value of coal by using "Bomb Calorimeter".
10. Determination of apparent density of refractories.

Course Outcomes:

At the end of the course the student would be able to:

1. Gain hands-on experience on the equipment that facilitate property evaluation of fuels, and refractories.
2. Choose the fuels and refractories for specific use in construction and operation of different furnaces.
3. Select fuels, refractories to minimize overall cost of production for given applications.
4. Operate various types of fuel testing equipment and analyze the observations recorded.

CONSTITUTION OF INDIA

II Year B.Tech. II-Sem

L	T	P	C
2	0	0	0

Course Objectives: Students will be able to:

1. Understand the premises informing the twin themes of liberty and freedom from a civil rightsperspective.
2. To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indiannationalism.
3. To address the role of socialism in India after the commencement of theBolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution

UNIT – I

History of Making of the Indian Constitution- History of Drafting Committee - Philosophy of the Indian Constitution- Preamble Salient Features.

UNIT – II

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 – III

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 – IV

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 – V

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.

Text Books:

1. The Constitution of India, 1950 (Bare Act), GovernmentPublication.
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.

Course Outcomes:

Students will be able to:

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indianpolitics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution inIndia.
3. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the IndianConstitution.
4. Discuss the passage of the Hindu Code Bill of1956.