MAHATMA GANDHI INSTITUTE OF TECHNOLOGY (Autonomous)

B.Tech. in Metallurgical and Materials Engineering
Scheme of Instruction and Examination
(Choice Based Credit System)
Applicable from the Academic Year 2022-23

I SEMESTER

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

II SEMESTER

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

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

B.Tech. I - Semester

L	T	P	C
3	1	0	4

MA101BS: Matrices and Calculus
(Common to all Branches)

Course Objectives

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

Course Outcomes

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

UNIT-I: Matrices

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

UNIT-II: Eigen values and Eigen vectors

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

UNIT-III: Calculus

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

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

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

UNIT-V: Multivariable Calculus (Integration)

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

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

Suggested Readings:

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

Reference Books:

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

L	T	P	C
3	1	0	4

PH101BS: APPLIED PHYSICS
(Common to all branches)

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

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

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

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

UNIT - I: QUANTUM PHYSICS

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

UNIT - II: SEMICONDUCTORS AND DEVICES

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

UNIT - III: DIELECTRIC AND MAGNETIC MATERIALS

Dielectric Materials: Types of polarizations – Electronic & Ionic polarizabilities - Internal field in Dielectrics and Clausius-Mossotti Relation – Ferroelectric - Piezoelectric and Pyroelectric materials – Applications: liquid crystal displays (LCD) and crystal oscillators.

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

UNIT - IV: NANOTECHNOLOGY

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

L	T	P	C
3	1	0	4

B.Tech. II Semester

MA201BS: Ordinary Differential Equations and Vector Calculus

(Common to all Branches)

Course Objectives

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

Course Outcomes

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

UNIT-I: First Order Ordinary Differential Equations

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

UNIT-II: Ordinary Differential Equations of Higher Order

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

UNIT-III: Laplace transforms

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

UNIT-IV: Vector Differentiation

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

UNIT-V: Vector Integration

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

Suggested Readings:

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

Reference Books:

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

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B.Tech. I/II semester
CH101BS/ CH201BS

L	T	P	C
3	1	0	4

Engineering Chemistry
(Common to all branches)

Course Objectives:

To bring adaptability to the concepts of chemistry and to acquire the required skills to become a perfect engineer:
- To bring adaptability to new developments in Engineering Chemistry and to acquire the skillsrequired to become a perfect engineer.
- To include the importance of water in industrial usage, fundamental aspects of batterychemistry, significance of corrosion it's control to protect the structures.
- To imbibe the basic concepts of petroleum and its products.
- To acquire required knowledge about engineering materials like smart materials, Refractories ,Lubricants and Nanomaterials

Course Outcomes:

After completing the course , the student will be able to acquire:
- Students will acquire the basic knowledge of electrochemical procedures related to corrosionand its control.
- The students are able to understand the basic properties of water and its usage in domesticand industrial purposes.
- They can learn the fundamentals and general properties of polymers and other engineeringmaterials.
- They can predict potential applications of chemistry and practical utility in order to become goodengineers and entrepreneurs.

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

Introduction to hardness of water – Expression of hardness, Units and related numerical problems. Potable water and its specifications - Steps involved in the treatment of potable water - Disinfection of potable water by chlorination and breakpoint chlorination.
Boiler troubles: Sludge, Scale, Boiler corrosion and Caustic embrtillement. Internal treatment of Boiler feed water - Calgon conditioning - Phosphate conditioning - Colloidal conditioning, External treatment methods - Softening of water by ion- exchange processes. Desalination of water – Reverse osmosis.

UNIT – II Battery Chemistry & Corrosion [8]

Introduction - Classification of batteries- primary, secondary and reserve batteries with examples. Basic requirements for commercial batteries. Construction, working and applications of: Zn-air and Lithium ion battery, Applications of Li-ion battery. Fuel Cells-

Differences between battery and a fuel cell, Construction and applications of Methanol Oxygen fuel cell and Solid oxide fuel cell. Solar cells - Introduction and applications of Solar cells.

Corrosion: Causes and effects of corrosion – theories of chemical and electrochemical corrosion – mechanism of electrochemical corrosion, Types of corrosion: Galvanic, water-line and pitting corrosion.Factors affecting rate of corrosion, Corrosion control methods- Cathodic protection – Sacrificial anodic method, Metallic coating-Electroplating.

UNIT - III: Polymeric materials: [8]
Definition – Classification of polymers with examples – Types of polymerization – addition and condensation polymerization with examples.

Plastics: Definition and characteristics- thermoplastic and thermosetting plastics, Preparation,Properties and engineering applications of PVC and Bakelite, Teflon

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

Elastomers: Characteristics –preparation – properties and applications of Buna-S, Butyl and Thiokolrubber.

Conducting polymers: Characteristics and Classification with examples-mechanism of conduction intrans-polyacetylene and applications of conducting polymers.

Biodegradable polymers: Concept and advantages - Polylacticacid and polyvinyl alcohol and their applications.

UNIT - IV: Energy Sources: [8]
Introduction, Calorific value of fuel – HCV, LCV- Dulong's formula. Classification- solid fuels: coal – analysis of coal – proximate and ultimate analysis and their significance. Liquid fuels – petroleum and its refining, cracking types – moving bed catalytic cracking. Knocking – octane and cetane rating, synthetic petrol - Fischer-Tropsch's process; Gaseous fuels – composition and uses of natural gas, LPG and CNG, Biodiesel – Transesterification, advantages.

UNIT - V: Engineering Materials: [8]
Smart materials and their engineering applications: Shape memory materials- Poly L-Lactic acid. Thermoresponse materials- Polyacryl amides, Poly vinylamides.

Lubricants: Classification of lubricants with examples-characteristics of a good lubricants - properties of lubricants: viscosity, cloud point,pour point, flash point and fire point.

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

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

REFERENCE BOOKS:
1. Engineering Chemistry by Shikha Agarwal, Cambridge University Press, Delhi (2015)
2. Engineering Chemistry by Shashi Chawla, Dhanpatrai and Company (P) Ltd. Delhi (2011)
3.

Metallurgical and Materials Engineering

L	T	P	C
1	0	4	3

B.Tech. in Mechanical Engineering
II Semester Syllabus
ME201ES: ENGINEERING GRAPHICS

Course Objectives:

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

Course Outcomes:

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

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

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

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

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

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

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

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

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

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

L	T	P	C
3	0	0	3

Metallurgical and Materials Engineering

B.Tech. in Mechanical Engineering
II Semester Syllabus
ME202ES: ENGINEERING MECHANICS

Course Objectives: The objectives of this course are to

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

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

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

UNIT-I

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

UNIT-II

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

UNIT-III

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

UNIT-IV

Moment of Inertia – Definition; Theorems of moment of inertia; Area Moment of inertia of plane sections from first principles, Area Moment of inertia of composite sections;
Mass Moment of Inertia - Transfer Formula, Mass moment of inertia of simple bodies and composite bodies.

UNIT-V

Kinematics - Rectilinear motion; Plane curvilinear motion;
Kinetics - D'Alembert's principle - its applications in translation and motion of connected bodies; Work Energy principle - its application in motion of connected bodies; Impulse-momentum principle.

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

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

L	T	P	C
3	0	0	3

B.Tech in Metallurgical and Materials Engineering
II Semester Syllabus
MM201PC: Principles of Material Science and Engineering

Course Objective:

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

Course Outcomes:

At the end of the course, the student will be able to
- List various advanced materials and their need for building modern industry.
- Illustrate crystal systems and relevant calculations.
- Categorise imperfections in solids.
- Examine the types of solid solutions and their formation.
- Summarize properties of engineering materials

Unit - I: Introduction to Materials Engineering

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

Unit - II: The Structure of Crystalline Solids

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

Unit - III: Imperfections in Solids

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

Unit - IV: Introduction to constitution of alloys

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

Unit - V: Properties of Materials

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

Suggested Readings:

1. Materials Science and Engineering-An Introduction, William D. Callister, Jr., John Wiley & Sons, Inc., 2007, 7th Edition.
2. The Science and Engineering of Materials, Donald R. Askeland, Pradeep P. Phule, Thomson Learning, 2007, 5th Edition.
3. An introduction to materials engineering and science: for chemical and materials engineers, Brian S. Mitchell, John Wiley & Sons, Inc., 2004

4. Materials Science and Engineering – A First Course, V. Raghavan, Prentice Hall of India Private Limited, 2015, 6th Edition.
5. Materials Science and Engineering, G. S. Upadhyaya and Anish Upadhyaya, Viva Books Private Limited, 2006

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B.Tech. I/II Semester Syllabus
CH151BS/ CH251BS

L	T	P	C
0	0	3	1

Engineering Chemistry Lab
(Common to all branches)

Course Objectives:

> The course consists of experiments related to the principles of chemistry required for an Engineering student and the student will learn the following:
> - Estimation of hardness of water to check its suitability for industrial and drinking purpose and estimation procedures through volumetric analysis.
> - Estimation procedures using conductometry and potentiometry.
> - Preparation of polymers such as Bakelite and Polystyrene in the laboratory.
> - Understand the lubricant properties such as saponification value and viscosity of oils.
> - Understand the corrosion of metals in a corrosive medium.

Course Outcomes:

> After completing the course, the student will gain practical knowledge on:
> - Determination of parameters like hardness of water and estimations through volumetric analysis.
> - Performance of experiments of conductometry and potentiometry and estimation procedures using them.
> - Preparation of polymers like Bakelite and Polystyrene.
> - Performing experiments related to estimation of saponification value and viscosity of lubricating oils.
> - Performing experiments to know rate of corrosion of mild steel in various conditions.

List of Experiments:

I. **Volumetric Analysis:** Estimation of hardness of water by EDTA - Complexometry method.
II. **Volumetric Analysis:** Estimation of Fe^{+2} by Dichrometry.
III. **Conductometry:** Estimation of the concentration of an acid by Conductometry.
IV. **Potentiometry:** Estimation of the amount of Fe^{+2} by Potentiometry.
V. **Potentiometry:** Determination of an acid concentration using Potentiometer.
VI. **Preparations:**
     1. Preparation of Bakelite.
     2. Preparation Polystyrene

VII. Lubricants:

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

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

IX. Virtual lab experiments

a. Construction of Fuel cell and its working.

b. Smart materials for Biomedical applications

c. Batteries for Electrical vehicles.

d. Functioning of Solar cell and its applications.

REFERENCE BOOKS:

1. Lab manual for Engineering chemistry by B. Ramadevi and P. Aparna - S Chand Publications, New Delhi (2022)

2. Vogel's text book of practical organic chemistry - 5th edition

3. Inorganic Quantitative analysis by A.I. Vogel - ELBS Publications.

4. College Practical Chemistry by V.K. Ahluwalia - Narosa Publications Ltd., New Delhi (2007).

B.Tech. II - Semester

L	T	P	C
0	1	2	2

CS251ES: PYTHON PROGRAMMING LABORATORY

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

Course Outcomes: After completion of the course, the student should be able to
- Develop the application specific codes using python.
- Understand Strings, Lists, Tuples and Dictionaries in Python
- Verify programs using modular approach, file I/O, Python standard library
- Implement Digital Systems using Python

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

Week -1:
1. i) Use a web browser to go to the Python website http://python.org. This page contains information about Python and links to Python-related pages, and it gives you the ability to search the Python documentation.
   ii) Start the Python interpreter and type help() to start the online help utility.
2. Start a Python interpreter and use it as a Calculator.
3.
   i) Write a program to calculate compound interest when principal, rate and number of periods are given.
   ii) Given coordinates (x1, y1), (x2, y2) find the distance between two points
4. Read name, address, email and phone number of a person through keyboard and print the details.

Week - 2:
1. Print the below triangle using for loop.

   5
   4 4
   3 3 3
   2 2 2 2
   1 1 1 1 1
2. Write a program to check whether the given input is digit or lowercase character or uppercase character or a special character (use 'if-else-if' ladder)
3. Python Program to Print the Fibonacci sequence using while loop
4. Python program to print all prime numbers in a given interval (use break)

Week - 3:
1. i) Write a program to convert a list and tuple into arrays.
   ii) Write a program to find common values between two arrays.
2. Write a function called gcd that takes parameters a and b and returns their greatest common divisor.
3. Write a function called palindrome that takes a string argument and returns True if it is a palindrome and False otherwise. Remember that you can use the built-in function len to check the length of a string.

Week - 4:
1. Write a function called is_sorted that takes a list as a parameter and returns True if the list is sorted in ascending order and False otherwise.
2. Write a function called has_duplicates that takes a list and returns True if there is any element that appears more than once. It should not modify the original list.

i). Write a function called remove_duplicates that takes a list and returns a new list with only the unique elements from the original. Hint: they don't have to be in the same order.

ii). The wordlist I provided, words.txt, doesn't contain single letter words. So you might want to add "I", "a", and the empty string.

iii). Write a python code to read dictionary values from the user. Construct a function to invert its content. i.e., keys should be values and values should be keys.

3. i) Add a comma between the characters. If the given word is 'Apple', it should become 'A,p,p,l,e'

ii) Remove the given word in all the places in a string?

iii) Write a function that takes a sentence as an input parameter and replaces the first letter of every word with the corresponding upper case letter and the rest of the letters in the word by corresponding letters in lower case without using a built-in function?

4. Writes a recursive function that generates all binary strings of n-bit length

Week - 5:

1. i) Write a python program that defines a matrix and prints

ii) Write a python program to perform addition of two square matrices

iii) Write a python program to perform multiplication of two square matrices

2. How do you make a module? Give an example of construction of a module using different geometrical shapes and operations on them as its functions.

3. Use the structure of exception handling all general purpose exceptions.

Week-6:

1. a. Write a function called draw rectangle that takes a Canvas and a Rectangle as arguments and draws a representation of the Rectangle on the Canvas.

b. Add an attribute named color to your Rectangle objects and modify draw_rectangle so that it uses the color attribute as the fill color.

c. Write a function called draw point that takes a Canvas and a Point as arguments and draws a representation of the Point on the Canvas.

d. Define a new class called Circle with appropriate attributes and instantiate a few Circle objects. Write a function called draw circle that draws circles on the canvas.

2. Write a Python program to demonstrate the usage of Method Resolution Order (MRO) in multiple levels of Inheritances.

3. Write a python code to read a phone number and email-id from the user and validate it for Correctness.

Week- 7

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

2. Write a Python code to open a given file and construct a function to check for given words present in it and display on found.

3. Write a Python code to Read text from a text file, find the word with most number of occurrences

4. Write a function that reads a file *file1* and displays the number of words, number of vowels, blank spaces, lower case letters and uppercase letters.

Week - 8:

1. Import numpy, Plotpy and Scipy and explore their functionalities.

2. a) Install NumPy package with pip and explore it.

3. Write a program to implement Digital Logic Gates – AND, OR, NOT, EX-OR

4. Write a program to implement Half Adder, Full Adder, and Parallel Adder

5. Write a GUI program to create a window wizard having two text labels, two text fields and two buttons as Submit and Reset.

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

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

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B.Tech in Metallurgical and Materials Engineering
II Semester Syllabus
MM251PC: Principles of Materials Science and Engineering Lab

Course Objective:

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

Course Outcomes:

At the end of the course student will be able to
- Gain knowledge on atomic arrangements in different crystal
- Understand the testing procedure of various physical properties of materials
- Understand the testing procedure of various physical properties of Fuels
- CO4: Understand the testing procedure of various physical properties of Fuels

List of Experiments:

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

MAHATMA GANDHI INSTITUTE OF TECHNOLOGY (Autonomous)
Chaitanya Bharathi (P.O.), Gandipet, Hyderabad - 500 075

B.Tech. I/II - Semester Syllabus
MC101BS / MC201BS

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Environmental Science

(Common to all branches)

Course Objectives:

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

Course Outcomes:

After completing the course, the student will be able to:
- Learn about different types of natural resources and take up the measures to protect the resources.
- Get the information about ecosystem, biodiversity and their usage and conservation.
- Get the information about the types of pollution, understand their effects and controlling measures.
- Gain the knowledge about current global environmental issues and initiations to be taken to protect the environment.
- Gain the knowledge about environmental acts, EIA, sustainable development and follow the rules and regulations.

UNIT - I
Ecosystems: Definition, Scope, and Importance of ecosystem. Classification, structure, and function of an ecosystem, Food chains, food webs, and ecological pyramids. Flow of energy, Biogeochemical cycles, Bioaccumulation, Biomagnification, ecosystem value, services and carrying capacity.
UNIT - II
Natural Resources: Classification of Resources: Living and Non-Living resources, **water resources:** use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problems. **Mineral resources:** use and exploitation, environmental effects of extracting and using mineral resources, **Land resources:** Forest resources, **Energy resources:** growing energy needs, renewable and non-renewable energy sources, use of alternate energy source, case studies.

UNIT - III

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

UNIT - IV

Environmental Pollution and Control Technologies: Environmental Pollution: Classification of pollution, **Air Pollution:** Primary and secondary pollutants, causes and effects, Ambient air quality standards. **Soil Pollution:** Sources and types, Impacts of modern agriculture, degradation of soil. **Solid waste:** Municipal Solid Waste management, composition and characteristics of e-Waste and its management. **Pollution control technologies:** Wastewater Treatment methods: Primary, secondary and Tertiary.

Global Environmental Issues and Global Efforts: Climate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS). International conventions / Protocols: Earth summit, Kyoto protocol, and Montréal Protocol. NAPCC-GoI Initiatives.

UNIT - V

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

Environmental Impact of Assessment (EIA): structure, methods of baseline data acquisition. Concepts of Environmental Management Plan (EMP).

Towards Sustainable Future: Concept of Sustainable Development Goals, Population and its explosion, Environmental Education, Human health, Environmental Ethics, Concept of Green Building, Green chemistry principles, Ecological Foot Print, Life Cycle assessment (LCA), Low carbon life style.

TEXT BOOKS:
1. Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha forUniversity Grants Commission.
2. Environmental Studies by Anubha Kaushik, 4th Edition, New age international publishers.

REFERENCE BOOKS:
1. Environmental Science: towards a sustainable future by Richard T. Wright. 2008 PHLLearning Private Ltd. New Delhi.
2. Environmental Engineering and science by Gilbert M. Masters and Wendell P. Ela. 2008 PHILearning Pvt. Ltd.
3. Environmental Studies by R. Rajagopalan, Oxford University Press.
4. Environmental Science by Daniel B. Botkin & Edward A. Keller, Wiley INDIA edition.
5. Text book of Environmental Science and Technology - Dr. M. Anji Reddy 2007, BSPublications.
6. Introduction to Environmental Science by Y. Anjaneyulu, BS. Publications.