Proposed Syllabus

For

B.Tech. Program

in

Materials Science and Metallurgical Engineering

By

C.S.J.M.University,Kanpur

Proposed Syllabus by C.S.J.M.University,Kanpur.

Materials Science & Metallurgical Engineering.

Semester – wise breakup of courses

Semester – I

		L	T	P	Credits
MTH – S101	Mathematics – I	3	1	0	4
PHY - S101T	Physics – I	3	1	0	3
PHY - S101P	Physics Lab-I	0	0	3	2
TCA– S102T	Workshop Concept	1	1	0	2
TCA– S102P	Workshop Practice	0	0	3	3
ESC – S101T	Basic Electrical & Electronics Engineering	3	1	0	3
ESC – S101P	Basic Electrical & Electronics Engineering	0	0	3	2
CHM – S101T	Chemistry – I	3	0	0	3
CHM – S101P	Chemistry Lab – I	0	0	3	2

Semester – II

MTH – S102	Mathematics – II	3	1	0	4
PHY - S102T	Physics – II	3	1	0	3
PHY - S102P	Physics Lab-II	0	0	3	2
ISC – S101T	Programming & Computing (C & UNIX)	3	0	0	3
ISC – S101P	Programming Lab (C & UNIX)	0	0	3	2
TCA – S101	Engineering Drawing	0	2	4	5
HSS – S101	Communicative English	3	1	0	4

Semester – III

MTH – S201	Mathematics – III	3	1	0	4
ESC – S201	Engineering Mechanics	3	1	0	4
ESC – S203	Physics of Materials	3	1	0	4
MSE – S201	Thermodynamics and Kinetics of Materials	3	1	0	4
MSE – S202T	Nature and Properties of Materials	3	1	0	3
MSE – S202P	Nature and Properties of Materials Lab	0	0	3	2
EVS - S101	**Environmental Science**	**2**	**0**	**0**	**2**
SST – S201	**Summer Internship**	**0**	**0**	**2**	**1**

Semester – IV

HSS – S201 Industrial Management	3	1	0	4
MSE – S203T Phase Equilibria in Materials	3	1	0	3
MSE – S203P Phase Equilibria in Materials Lab	0	0	3	2
MSE – S204 Mechanical Behaviour of Materials	3	1	0	4
MSE – S205T Materials Characterization -I	3	1	0	3
MSE – S205P Materials Characterization Lab-I	0	0	3	2
MSE – S206 Iron and Steel Making	3	1	0	4

Semester – V

MSE – S301 Fundamentals of Materials Processing	3	1	0	4
MSE – S302 Manufacturing Processes: Selection and Design	3	1	0	4
MSE – S303 Electronic and Optical Materials	3	1	0	4
MSE – S304T Phase Transformation in Metals	3	1	0	3
MSE – S304P Phase Transformation in Metals Lab	0	0	3	2
MSE – S305 Heat Treatment of Metals	3	1	0	4
SST – S301 Summer Internship	**0**	**0**	**2**	**1**

Semester – VI

MSE – S306 Principles of Metal Extraction and Refining	3	1	0	4
MSE – S307T Principles of Powder Processing	3	1	0	3
MSE – S307P Principles of Powder Processing Lab	0	0	3	2
MSE – S308 Diffusion in Solids	3	1	0	4
MSE – S309 Corrosion and Degradation of Materials	3	1	0	4
MSE – S310 Materials Characterization - II	3	1	0	4
HSS – S301 Professional Communication	1	1	1	2
SSM – S301 Student Seminar	**0**	**0**	**3**	**2**

Semester – VII

HSS – S401 Industrial Economics	3	0	0	4
MSE – S401 Composite Materials	3	1	0	4
MSE – S402 Fuel, Refractories and Furnaces	3	1	0	4
MSE – S403 Elective – I	3	1	0	4
SST – S401 Summer Training	0	0	3	2
PRT- S401 B.Tech. Project- I	0	0	6	4

Semester – VIII					
MSE – S404	Electronic Materials for Industry	3	1	0	4
MSE – S405	Heat and Mass Transfer	3	1	0	4
MSE – S406	Computing Methods in (Lab)	3	1	2	4
	Materials Engineering				
MSE – S407	Elective – II	3	1	0	4
PRT – S402	B.Tech Project-II	0	0	6	4
Humanities Elective		----------			
List of Departmental Elective Courses					
MSE – S501	Electrochemical Technology	3	1	0	4
	in Materials Processing				
MSE – S502	Application of Transport	3	1	0	4
	Phenomenon in metal processing				
MSE – S503	Engineering Polymers	3	1	0	4
MSE – S504	Vacuum Technology and Devices	3	1	0	4
MSE – S505	Ceramic Materials	3	1	0	4
MSE – S506	**Materials Engineering**	**3**	**1**	**0**	**4**
MSE – S507	**Modern steel making and alloying**	**3**	**1**	**0**	**4**

Note:

1. Total No. of Lectures in each course should in the range of 40 to 45 per semester if per week three lectures are allotted.

Department of Materials Science & Metallurgical Engineering

Detailed Syllabus of courses

Course Code: MTH-S101 **Breakup: 3 – 1 – 0 – 4**

Course Name: Mathematics-I

Course Details:

Unit I

Applications of Integrals : Areas between curves, Methods of finding volume : Slicing, Solids of revolution, Cylindrical shell, Lengths of plane curves, Areas of surface of revolution, Moments and Center of mass, Improper integrals .

Unit II

Sequences: Definition, Monotonic sequences, Bounded sequences, Convergent and Divergent Sequences**.**

Series: Infinite series, Oscillating and Geometric series, their Convergence, Divergence. Tests of Convergence: n^{th} Term test of divergence, Integral test, Comparison Test, Limit Comparison test, Ratio test, n^{th} root test (Cauchy root test), Alternating series, Absolute and Conditional convergence.

Power Series: Power series and its convergence, Radius and interval of convergence, Term by term differentiation, Term by term integration, Product of power series, Taylor and Maclaurin series, Convergence of Taylor series, Error estimates, Taylor's Theorem with remainder .

Unit III

Vector Calculus: Vector valued functions, Arc length and Unit Tangent vector, Curvature, Torsion and TNB frame **.**

Partial Derivatives: Function of two or more variables (Limit, Continuity, Differentiability , Taylors Theorem) , Partial derivatives, Chain Rule, Partial Derivatives of higher orders, , Maxima and Minima and Saddle Point, Lagrange Multipliers, Exact differential, Leibniz Theorem.

Directional derivatives, Gradient Vectors, Divergence and Curl, Tangent planes .

Unit III

Multiple Integrals: Double and triple integral, Change of order, Jacobian, Change of variables, Application to area and volume, Dirichlet integral and Applications.

Line, surface integrals , Path independence, Statement and problems of Green's, Stoke's and Gauss divergence theorems (without proof).

Text Books and Reference :

1. G.B.Thomas and R.L.Finney : Calculus and Analytical Geometry, 9^{th} edition, Pearson Educaion
1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 2005.

Course Code: PHY-S101T **Breakup: 3 – 1 – 0 – 3**

Course Name: Physics-I

Course Details:

Unit-I: Newton's laws and their applications, Friction, conservative forces and potentials, Work energy theorem, conservation of energy and linear momentum, variable mass system (rocket), impulse, system of particles and collision, Elementary rigid body kinematics, rotation motion, moment of inertia, and Gyroscopic motion.

Unit-II: Rigid body motion, angular momentum, fundamental of classical mechanics, Lagrangian and Hamiltonian formulation.

Unit-III: Motion in non-inertial frames, fractious forces, special theory of relativity, central forces, Gravitation motion under central forces and Kepler's Laws.

Unit-IV: Simple harmonic motion (SHM), small oscillations and resonance; Wave particle duality, de-Broglie matter's waves, Phase and group velocities, Davisson-Germer experiment, Heisenberg uncertainty principle and its applications.

Unit-V: Wave function and its significance, Schrödinger equations (time dependent and independent), Schrödinger's wave equation for particle in one dimensional box, diffraction of X-rays by crystal planes, Bragg's spectrometer, Compton's effect.

Text Books and References:

1. Mechanics: D. S. Mathur
2. A textbook of Mechanics: J. C. Upadhyay
3. Concept of physics (I & II): H. C. Verma
4. Introduction to Mechanics: R. D. Kleppner and J. Kolenkow
5. Physics: Resnick, Halliday and Krane
6. Vector analysis: M. R. Spiegel
7. Classical Mechanics: Goldstien
8. Modern Physics: Author Beiser

Course Code: PHY-S101P **Breakup: 0 – 0 – 3 – 2**

Course Name: Physics Lab-I

Course Details:

1. Graphical Analysis (Ref. UIET Laboratory Manual)
2. Trajectory of projectile (Ref. UIET Laboratory Manual)

Apparatus Used (Trajectory Apparatus, Metal Balls, Channels, Vernier Callipers, Carbon & Graph Paper)

3. Moment of Inertia of Bicycle wheel (Ref. Book by K. K. Dey, B. N. Dutta)

Apparatus Used (Bicycle Wheel, Masses, Thread, Stopwatch, Meter Scale, Vernier Callipers) 4. Spring Oscillations (Ref. UIET Laboratory Manual)

Apparatus Used (Spring Oscillation Apparatus, Stop Watch, Masses)

5. Coupled Pendulum (Ref. UIET Laboratory Manual)

Apparatus Used (Coupled Pendulum Setup, Stop Watch, Scale)

6. Bifilar Suspension System (Ref. UIET Laboratory Manual) Apparatus Used (Bifilar Suspension System Setup, Stop Watch, Masses)

7. Frequency of AC Mains by Melde's Method (Ref. Book by K. K. Dey, B. N. Dutta)

Apparatus Used (Electrical Vibrator, String, Pulley, Small Pan, Weight Box & Physical Balance)

8. Kater's(Reversible) Pendulum (Ref. Book by K. K. Dey, B. N. Dutta)

Apparatus Used (Kater's Pendulum, Stop Watch)

9. Inertia Table (Ref. Book by K. K. Dey, B. N. Dutta)

Apparatus Used (Inertia Table, Stop Watch, Vernier Callipers, Split Disc, Balancing Weights, and Given Body(Disc))

Course Code: TCA-S101 Breakup: 0 –2 – 4 – 5

Course Name: Engineering Drawing

Course Details:

Introduction- Drawing instruments and their uses, BIS conventions, lettering dimensioning and free hand practicing.

Orthographic projections: Lines, planes and surfaces of objects, Sectional views, Auxiliary views, Space geometry: lines and planes, True lengths and shapes, Properties of parallelism, Perpendicularity and intersections of lines and planes, Simple intersections of solids and development of lateral simple solids**.**

Isometric Projections: Introduction , isometric scale, isometric projection of simple plane figures, isometric projection of tetrahedron, hexahedron (cube), right regular prisms , pyramids, cylinders, cones, spheres, cut spheres and combinations of solids.

Introduction to computer graphics: Some problems on above topics on computer graphics.

Text Books and References:

1. Narayana,K.L. & Kannaiah,P. “Engg.Graphics”. Tata McGraw Hill, New Delhi.
2. Bhatt,N.D. “Elementary Engg. Drawing” Charotar Book stall. Anand.
3. Lakshminarayanan ,V and Vaish Wannar , R. S. “Engg.Graphics”.Jain Brothers , New Delhi.
4. Chandra, A.M. & Chandra Satish, “Engg.Graphics”.Narosa.
5. French & Vireck, “The Fundamental Of Engg. Drawing & Graphic Tech.”. McGraw Hill.
6. Gill, P.S. “A Text Book Of Machine Drawing” Katson Publishing House , Ludhiana.

Course Code: ESC-S101T Breakup: 3 –1 – 0 – 3

Course Name: Basic Electrical & Electronics Engineering

Course Details:

Unit – I

Sinusoidal steady state circuit analysis, voltage, current, sinusoidal & phaser presentation single phase AC circuit – behavior of resistance, inductance & capacitance & their combination, impedance concept of power, power factor. Series & parallel resonance – band width & quality factor. Three phase circuits – phase voltage & current, line & phase quantities, phasor diagram, balanced & unbalanced loads, Measurement of R, L, and C.

Unit –II

Network Theory: Network theorems – Thevenin's, Norton, maximum power transfer theorem, star delta transformation, circuit theory concept – mesh & nodal analysis.

Unit – III

Magnetic circuit concepts: self inductance , magnetic coupling analysis of single tuned & double tuned circuit involving mutual inductance , introduction to transformer.

Unit – IV

Basic Instruments, electrical measurement – measurement of voltage , current , power & energy, voltmeters & ammeter , wattmeter , energy meter , three phase power measurement , electronics instrument – multimeter, CRO(analog & digital),An overview of voltage regulator.

Unit – V

Introduction to basic electronics devices – junction diode, BJT, amplifier, op-amps & instrumentation amplifier with mathematical operation.

Number System: Introduction to binary, octal, decimal & hexadecimal systems, representation of negative numbers, 1's, 2's, 9's, 10's complement and their arithmetic.

Text Books and References:

1. W.H.Hayt & J.E. Kemmerly : Engg. Circuit Analysis , Mc Graw Hill.
2. N.N. Bhargava : 'Basic Electronics',Tata McGraw Hill.
3. Malvino, A.P. / "Electronics Principles" / Tata McGraw-Hill / 6th Ed.
4. Morris Mano, "Digital Computer Design" PHI
5 Del Toro : Principles of Electrical Engg. – PHI
6 Boylstad & Neshishkey, "Electronic devices & circuits" , PHI
7. Malvino & Leech "Digital Principle and application", TMH

Course Code: ESC-S101P **Breakup: 0 –0 – 3 – 2**

Course Name: Basic Electrical & Electronics Engineering Lab

Course Details:

1. Familiarization with the Electronic Instruments.
2. Familiarization with electronic components and Bread board.
3. To verify the Thevenin theorem.
4. To verify the Superposition theorem.
5. Measurement of voltage and frequency with CRO.
6. To study half wave rectifier.
7. To study full wave bridge rectifier.
8. To study full wave bridge rectifier with filter.
9. To study and verify the truth table of different logic gates using digital IC.
10. To study different type of transformer and there operation.
11. To study basic wiring and design a switchboard/extension board.
12. To study the polarity test of a single phase transformer.
13. To study the open & short circuit test of a transformer and calibration losses.
14. To study the load test and efficiency of a single phase transformer.

Course Code: HSS-S101 Breakup: 3 –1 – 0 – 4

Course Name: Communicative English

Course Details:

Unit 1: Basics of Technical Communication: Technical Communication: features; Distinction between General and Technical communication; Language as a tool of communication; Levels of communication: Interpersonal, Organizational, Mass communication; The flow of Communication: Downward, Upward, Lateral or Horizontal (Peer group); Barriers to Communication.

Unit 2: Constituents of Technical Written Communication: Word formation, Prefix and Suffix; Synonyms and Antonyms; Homophones; One Word Substitution; Technical Terms; Paragraph Development: Techniques and Methods -Inductive, Deductive, Spatial, Linear, Chronological etc; The Art of Condensation- various steps.

Unit 3: Forms of Technical Communication: Business Letters: Sales and Credit letters; Letter of Enquiry; Letter of Quotation, Order, Claim and Adjustment Letters; Memos, Notices, Circulars; Job application and Resumes. Reports: Types; Significance; Structure, Style & Writing of Reports. Technical Proposal; Parts; Types; Writing of Proposal; Significance.

Unit 4: Presentation Strategies: Defining Purpose; Audience & Locale; Organizing Contents; Preparing Outline; Audio-visual Aids; Nuances of Delivery; Body Language; Space; Setting Nuances of Voice Dynamics; Time- Dimension.

Unit 5: Value- Based Text Readings: Following essays form the suggested text book with emphasis on Mechanics of writing,

(i) The Language of Literature and Science by A.Huxley
(ii) Man and Nature by J.Bronowski
(iii) The Mother of the Sciences by A.J.Bahm
(iv) Humanistic and Scientific Approaches to Human Activity by Moody E. Prior
(v) The Effect of Scientific Temper on Man by Bertrand Russell.

Text Books and References:

1. Improve Your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, New Delhi.
2. Technical Communication – Principles and Practices by Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press 2007, New Delhi.
3. Effective Technical Communication by Barun K. Mitra, Oxford Univ. Press, 2006, New Delhi
4. Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., New Delhi.
5. How to Build Better Vocabulary by M.Rosen Blum, Bloomsbury Pub. London.
6. Word Power Made Easy by Norman Lewis, W.R.Goyal Pub. & Distributors; Delhi.
7. Developing Communication Skills by Krishna Mohan, Meera Banerji- Macmillan India Ltd. Delhi.
8. Manual of Practical Communication by L.U.B. Pandey & R.P. Singh; A.I.T.B.S. Publications India Ltd.; Krishan Nagar, Delhi.

Course Code: MTH-S102 Breakup: 3 – 1 – 0 – 4

Course Name: Mathematics-II

Course Details:

Unit-I

Linear Algebra

Matrices, Elementary row and Column operations, Echelon form, Determinants, Rank of matrix, Vector spaces, Linear dependence and Independence, Linear transforms and matrices, Consistency of linear system of equations and their solution, Special Matrices : Symmetric, Hermition etc, Characteristic equation, Cayley-Hamilton theorem(statement only), Eigen values and Eigen vectors, Diagonalization .

Unit-II

Differential Equations : Separable, Exact Differential Equation , Integrating Factors, Linear differential equations with constant coefficients, Homogeneous Linear differential equations, Bernoulli Equation, Simultaneous linear differential equations, Clairaut's equation, Homogeneous linear differential equations of second order with constant coefficients, Complex root case, Differential operators, Euler-Cauchy equation , Wronskian, Nonhomogeneous equations,

Solution by undetermined coefficients, solution by variation of parameters.

Series solution: Ordinary differential equations of 2^{nd} order with variable coefficients (Frobenius Method).

Unit-III: Laplace Transform

Laplace transform, Existence Theorem, Laplace transform of derivatives and integrals, Inverse Laplace transform, Unit step function, Dirac Delta function, Laplace transform of periodic functions, Convolution Theorem, Applications to solve simple linear and simultaneous differential equations.

Text Books and Reference :

1. E. Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 2005.
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 2005.
3. C. Ray Wylie & Louis C. Barrett, Advanced Engineering Mathematics, Tata McGraw-Hill Publishing Company Ltd. 2003.
4. G.F. Simmons, Differential Equations, Tata McGraw-Hill Publishing Company Ltd. 1981.

Course Code: PHY-S102T Breakup: 3 – 1 – 0 – 3

Course Name: Physics-II

Course Details:

Unit-I: Vector analysis: scalars, vectors, vector differentiation, gradient, divergence and curl, vector, integration, Gauss divergence and Stoke's theorem, co-ordinate systems (spherical polar & cylindrical), Electrostatics: electric fields, potentials, Gauss's law, electric dipoles and multipoles, polarization, bound charges, linear dielectrics and force on dielectrics, electric displacement, boundary condition of E and D, work and energy of electrostatics, Laplace's equation and uniqueness theorem, image theory.

Unit-II: Motion of charge in electric and magnetic field, Magnetostatics: current density, magnetic fields, Ampére's law, Faraday's law, magnetic potential, magnetic polarization, bound current, magnetic properties of materials (para, dia and ferro), boundary condition of B and H, basic idea of superconductor.

Unit-III: Displacement current, Maxwell's equations for free space and matter (dielectric and conductor), Electromagnetic waves, Poynting vector.

Unit-IV: Origin the refractive index, Interference: division of wave-front and division of amplitude; diffraction: Fraunhoffer, Grating, Resolving power (grating, prism, telescope and microscope); polarization: Phenomena of double refraction, Nicol prism, optical activity Production and analysis of plane, circular and elliptical polarized light, Frenels theory of optical activities and Polarimeters.

Unit-V: Fiber optics and photonics: Fundamental ideas about optical fiber, types of fibers, Total Internal Reflection (TIR), critical angle, acceptance angle and application, basic principal of Laser and Holography and fundamental ideas about photonics.

Text Books and References

1. Optics: Ajoy Ghatak
2. A textbook of OPTICS: Subrahmanyam, Brijlal and Avadhanulu
3. Electrodynamics: David J. Griffith
4. Classical electrodynamics: J. D. Jackson
5. Modern Physics: Author Beiser
6. Photonic Crystals: J. D. Joannopoulos, R. D. Meade, and R. D. Winn

Course Code: PHY-S102P **Breakup: 0 – 0 – 3 – 2**

Course Name: Physics Lab-II

Course Details:

1. Newton's Ring (Ref. Book by K. K. Dey, B. N. Dutta)

Apparatus Used (Traveling Microscope, Support for Glass Plate inclined at 45^0 to the Vertical, Short Focus Convex Lens, Sodium Lamp, Plano Convex Lens, An Optically Plane Glass Plate)

2. Prism Spectrometer (Ref. Book by K. K. Dey, B. N. Dutta)

Apparatus Used (Spectrometer, Glass Prism, Reading Lens, Mercury Lamp)

3. Plane Transmission Grating (Ref. Book by K. K. Dey, B. N. Dutta)

Apparatus Used (Spectrometer, Diffraction Grating, Mercury Lamp)

4. Ballistic Galvanometer (Ref. Book by K. K. Dey, B. N. Dutta)

Apparatus Used (Ballistic Galvanometer, Morse key, Damping key, Condenser, Rheostat, Volt Meter, Storage Battery, Connection Wires)

5. Carey Foster's Bridge (Ref. Book by K. K. Dey, B. N. Dutta)

Apparatus Used (Carey Foster's Bridge, Laclanche cell, Resistance Box, Galvanometer, Plug Key, Copper Strip)

6. Fresnel's Biprism (Ref. Book by K. K. Dey, B. N. Dutta)

Apparatus Used (Sodium Lamp, Biprism, Convex Lens, Optical Bench with Four Uprights)

7. Variation of Magnetic Field (Ref. Book by K. K. Dey, B. N. Dutta) Apparatus Used (Stewart and Gee type Tangent Galvanometer, Storage Battery, Commutator, Ammeter, Rheostat, One way Plug Key, Connection Wires)

8. Polarimeter (Ref. Book by K. K. Dey, B. N. Dutta)

Apparatus Used (Sodium Lamp, Polarimeter, Physical Balance)

Course Code: ISC – S101T Breakup: 3 – 0 – 0 – 3

Course Name: Programming & Computing(C & UNIX)

Course Details:

Basic concepts of Computers, Basic UNIX Concepts and Vi - Editor

Introduction to C: Basic Programming concepts, Program structure in C, Variables and Constants, Data types, Conditional statements, control statements, Functions, Arrays, Structures, Introduction to pointers, Introduction to File Systems.

Text Books and References:

1. Programming in C, Schaum Series
2. The 'C' Programming, Denis Ritchi (PHI)
3. Programming in C, Venugopal (TMH)
4. Let us C, Yashant Kanetkar (BPB)
5. Programming in C, Balaguruswami (TMH)

Course Code: ISC – S101P Breakup: 0 – 0 – 3 – 2

Course Name: Computer Programming Lab:

Course Details:

Learning OS Commands

Practice of all Internal and External DOS Commands, Writing simple batch programs, Exposure to Windows environment, Practice of UNIX commands and Vi editor, Writing simple shell script

C Programming:

Practicing programs to get exposure to basic data types, algebraic expressions, Conditional statements, Input Output Formatting, Control structures, arrays, functions, structures, pointers and basic file handling.

Course Code: TCA – S102T **Breakup: 1 – 1 – 0 – 2**

Course Name: Workshop Concepts

Course Details:

Historical perspectives; Classification of Manufacturing process.

Machining: Basic principles of lathe machine & operations performed on it. Basic description of machines & operations of shaper-planer, drilling, milling, grinding.Unconventional machining processes , Machine tools.

Casting processes:pattern & allowances. Moulding sands & its desirable properties. Mould making with the use of a core. Gating system. Casting defects & remedies. Cupola furnace. Die-casting & its uses.

Metal forming: Basic metal forming operations & uses of such as-forging, rolling, wire& tube drawing/making & extrusion, & its products/applications, press work & die & punch assembly, cutting & forming, its application. Hot working vs Cold working. Powder metallurgy: powder metallurgy process & its applications, plastic-products manufacturing, galvanizing & electroplating.

Welding: Importance & basics concepts of welding, classification of welding processes. Gas welding, types of flames, Electric arc welding. Resistance welding. Soldering & brazing and its uses. Modern trends in manufacturing, Automation. Introduction to NC/CNC/DNC,FMS,CAD/CAM,CIM and factory of future.

Text Books and References:

1. Chapman,W A J & Arnold ,E “Workshop Technology ; vol. I,II&III” Viva Low Priced Student Edition.
2. Raghuwanshi,B S “Workshop Technology ; vol. I&II” Dhanpat Rai & Sons
3. Chaudhary, Hajra “Elements of Workshop Technology ; vol. I&II” Media Promoters & Publishers.

Course code: TCA – S102P **Breakup: 0 – 0 – 3 – 3**

Course Name: Workshop Practice

Course Details:

1. Foundry (1 turn)
2. Welding (3 turns)
   a. Gas Welding (1 turn)
   b. Arc Welding (2 turns)
      (i). Lap Joint (1 turn)
      (ii) Butt Joint (1 turn)
3. M/C Shop (4 Turns)
4. Fitting & Sheet Metal Work (1 turn+1 turn)
5. Carpentry Shop(1 turn)
6. Black-smithy shop(1 turn)

Text Books and References:

1. Chapman,W A J & Arnold ,E "Workshop Technology ; vol. I,II&III" Viva Low Priced Student Edition.
2. Raghuwanshi,B S "Workshop Technology ; vol. I&II" Dhanpat Rai & Sons .
3. Chaudhary, Hajra "Elements of Workshop Technology ; vol. I&II" Media Promoters & Publishers.

Course Code: CHM – S101T Breakup: 3 – 0 – 0 – 3

Course Name: Chemistry - I

Course Details:

UNIT-I - Atoms and Molecules:

1. Need for wave mechanical picture of atomic structure [Photoelectric effect, de Broglie concept of matter waves], Derivation of schrodinger wave equation [as an example particle moving in unidimensional potential well]
2. Chemical Bonding- Orbital concepts in bonding, V.B. and M.O. theory, M.O. diagrams, Intermolecular interactions.

UNIT-II - Reaction Dynamics:

Order, Molecularity, Rate law, Integrated rate equations, Methods of determining of order of reaction, Complex reaction kinetics- chain reactions and reversible reactions in detail, Catalysis and enzyme catalysis

UNIT-III - Electrochemistry:

Arrhenius theory of electrolytic dissociation, Transport number, Kohlrausch's law, Solubility product, Redox reaction, Electrochemical and concentration cells.

UNIT-IV- Stereochemistry:

Introduction, Chirality, Enantiomers, Diastereomers, Projection formula of a tetrahedral carbon, Geometrical isomerism, Conformers

UNIT- V- Spectroscopic Techniques:

General introduction to IR, NMR and Mass spectroscopy

UNIT-VI - Organic Reactions:

Introduction, Electron displacement effects, Organic intermediates, Types of reactions [addition, elimination and substitution reactions]

UNIT-VII - Photochemistry:

Photoexcitation of organic molecules, Jablonski diagram, Laws of photochemistry and quantum yield, Some examples of photochemical reactions, Chemistry of vision and other applications of photochemistry.

UNIT-VIII - Transition Metal Chemistry:

Stucture of coordination compounds corresponding to coordination number up to 6, Tpes of ligands, Isomerism [geometrical, optical, ionization, linkage and coordination], Theories of bonding in coordination compounds- crystal field theory, Valence bond theory, Chelation.

UNIT-IX - Laboratory Practical Classes:

Text Books and References:

4.
5. 1. P.W. ***Physical Chemistry***-
6. 2. Puri &
7. 1. Morisson &
Organic Chemistry-
8. 2. Bahl and
9. 1. ***Chemistry-***
Inorganic
10. 2. R.P.

Engineering Chemistry- Shashi Chawla

Course Code: CHM – S101P **Breakup: 0 – 0 – 3 – 2**

Course Name: Chemistry Lab- I

Course Details:

Exp. 01. To estimate the strength of the given unknown solution of Mohr's salt (Ferrous ammonium sulphate ($FeSO_4(NH_4)_2SO_4.6H_2O$) using $KMnO_4$ solution as an intermediate.

Exp. 02. To prepare a sample of p-nitroacetanilide.

Exp. 03. To prepare a sample of Aspirin.

Exp. 04. Preparation of Tris (Thiourea) Copper (I) sulphate.

Exp. 05. Preparation of Hexamine Nickel (II) chloride $[Ni(NH_3)_6]Cl_2$.

Exp. 06. Estimation of commercial caustic soda: Determination of the amounts of sodium carbonate and sodium hydroxide present together in the given commercial caustic soda.

Exp. 07. Estimation of calcium ions present in tap water.

Exp. 08. To determine the partition coefficient of acetic acid between n-butanol and water.

Exp. 09. To study the photochemical reduction of a ferric salt (Blue printing).

Exp. 10. To determine the viscosity of a given liquid (30% sugar solution) at room temperature using Ostwald's viscometer.

Exp. 11. To separate Ag(I), Hg (I) and Pb (II) ions by paper chromatography and calculate their RF values.

Exp. 12. Understanding reaction kinetics and calculating the rate and order of a reaction.

Exp.13. To study the kinetics of methyl acetate hydrolysis catalyzed by 0.5N HCl solution.

Course Code: MTH-S201 Breakup: 3 – 1 – 0 – 4

Course Name: Mathematics - III

Course Details:

Unit – I : Function of a Complex variable

Complex numbers- power and roots, limits, continuity and derivative of functions of complex variable, Analytic functions, Cauchy-Reimann equations, Harmonic function, Harmonic conjugate of analytic function and methods of finding it, Complex Exponential, Trigonometric, Hyperbolic and Logarithm function.

Unit – II : Complex Integration

Line integral in complex plane(definite and indefinite), Cauchy's Integral theorem, Cauchy's Integral formula, Derivatives of analytic functions, Cauchy's Inequality, Liouville's theorem, Morera's theorem, Power series representation of analytic function and radius of convergence,Taylor's and Laurent's series, singularities, Residue theorem, Evaluation of real integrals, Improper Integrals of rational functions, Fourier integrals.

Unit – III : Fourier Series

Periodic functions, Trignometric series, Fourier series of period 2π , Eulers formulae, Functions having arbitrary period, Change of interval, Even and odd functions, Half range sine and cosine series, Complex fourier series.

Unit – IV : Partial Differential Equations

Linear partial differential equations with constant coefficients of second order and their classifications - parabolic, elliptic and hyperbolic with illustrative examples. Methods of finding solutions using separation of variables method. Wave and Heat equations up to two dimension (finite length)

Unit – V : Probability and Statistics

Basics of probability, Bayes theorem, Random variables, Probability and density fuctions, Binomial, Poisson and Normal distributions.

Text Books and Reference :

1. E. Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 2005. 2.
B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 2005.

Course Code: ESC-S201 **Breakup: 3 – 1 – 0 – 4**

Course Name: Engineering Mechanics

Course Details:

General Coplanar force systems : Basis concepts, Law of motions, principle of transmissibility of forces, Transfer of a force to parallel position, Resultant of a force system, simplest resultant of two dimensional concurrent & non concurrent force systems, free body diagrams, equilibrium & its equations, applications.

Trusses & Cables : Introductions, simple truss & solutions of simple truss, method of joints & method of sections.

Friction : Introductin , Laws of coulomb friction, equilibrium of bodies involving dry friction, belt friction, applications.

Centre of gravity , centroid, Moment of Inertia : Centroid of plane, curve, area ,volume & composite bodies, moment of inertia of plane area, parallel axis theorem, perpendicular axis theorem, principal moment inertia, mass moment of inertia of circular ring, disc, cylinder, sphere and cone about their axis of symmetry.

Beams: Introductions, shear force and bending moment , differential equations for equilibrium, shear force & bending moments diagrams for statically determinate beams.

Kinematics of rigid body: Introduction, plane motion of rigid bodies, velocity & acceleration under translation & rotational motion, Relative velocity, projectile motion.

Kinetics of rigid bodies: Introduction, force, mass & acceleration, work & energy, impulse & momentum, D'Alembert principles & dynamic equilibrium. Virtual work.

Text Books and Reference :

1. Beer F.P. & Johnston ,F.R. " Mechanics For Engineers", McGraw Hill.
2. Shames, I.H. " Engg. Mechanics" , P H I.
3. Meriam , J. L. " Statics" , J. Wiley.

Course Code: ESC-S203 Breakup: 3 – 1 – 0 – 4

Course Name: Physics of Materials

Course Details:

Failure of classical physics, black body radiation, Planck postulate, early experiments exhibiting quantum effects, Photoelectric effect, Davisson-Garmcr results, Compton shift, Pair production, Wave particle duality, de-Broglie postulate and Einstein relation, Wave description & localization, Uncertainty principle, probability density, expectation value, energy & momentum operations, Schroedinger equation, Solution for step, Barrier & well potentials, Periodic well potentials, Block Functions, Kronig-penny model, Energy hands in metals & semiconductors, Brillouin zones, Bravais lattices & crystal Structure. Miller indices of crystal direction & planes, crystal symmetry, reciprocal space lattices. Lave equation & Bragg relation, Block waves & diffraction.

Text Books and Reference:

1. The Science and Engineering of Materials, Donald R. Askeland (Chapman & Hall)
2. Materials Science and Engineering, V. Raghvan

Course Code: MSE-S201 Breakup: 3 – 1 – 0 – 4

Course Name: Thermodynamics and Kinetics of Materials

Course Details:

Heterogeneous & homogeneous systems, Extensive & intensive properties, Simple equilibrium. First law of thermodynamics, constant volume & constant pressure processes, Spontaneous process, Entropy quantification of irreversibility, Properties of heat engines, Second law of thermodynamics, Criterion for equilibrium, Entropy & disorder, most probable microstate. configurationally entropy & thermal entropy, Auxiliary functions, Maxwell's relations, Gibbs Helmholtz equation, Third law of thermodynamics, Variation of Gibbs energy with temperature & pressure, Clausius-Clapeyron equation, Thermodynamic properties of mixtures of ideal & imperfect gases, Ellingham diagrams, Raoults & Henry's laws, activity of a component, Gibbs

— Duhem equation, Non-ideal solutions, Regular solutions, Quasi-chemical model of solution, activity & alternative standard states, Gibbs phase rule, Binary systems involving compound formation, Solubility of gases in metals, Formation of oxide phases of variable composition, relation between chemical & electrical driving forces, Nernst equation, Thermodynamics of point defects.

Text Books and Reference:

1. Introduction to Thermodynamics, Y. V. C. Rao
2. Textbook of Materials and Metallurgical Thermodynamics, A. Ghosh (PHI)

Course Code: MSE-S202T Breakup: 3 – 1 – 0 – 4

Course Name: Nature and Properties of Materials

Course Details:

Atomic structure & bonding in solids, Crystal structures, Imperfection in solids, Linear defects, Slip & plastic deformation, Planar defects, Volume defects, Volume defects, Strengthening mechanisms, Diffusion, Mechanical properties of metals, Phase diagram & phase transformation, Phase equilibria involving solid to solid reactions, Structure & properties of ceramics & polymers Corrosion & degradation of materials, Thermal properties, Magnetic properties, Electrical properties & Optical properties of materials, Material Selection, Synthesis & Design.

Text Books and Reference:

1. Materials Science and Engineering: An Introduction, W. D. Callister, (WILEY)
2. Materials Science and Engineering, V. Raghvan

Course Code: MSE-S202P Breakup: 0 – 0 – 3 – 2

Course Name: Nature and Properties of Materials Lab

Course Details:

Basic crystal structures, Crystal planes & directions, Atomic packing ,
Determination of crystal structures (cubic), Mechanical testing.

Course Code: EVS-S101 Breakup: 2 –0 – 0 – 2

Course Name: Environmental Science

Course Details:

UNIT-I

Scope and Importance of environmental studies, Need for public awareness, Segments of environment, biodiversities: Genetic diversity, Species diversity, Ecosystem diversity, Landscape diversity, Causes of pollution and detrimental effects.

UNIT-II

Eco systems- Types of systems, energy flow in an ecosystem, Balanced ecosystem,
Human activities- Food, shelter, economic and social security, Effects of human activities on environment- Agriculture, housing, Industry, mining and transportation activities, Basics of Environmental Impact Assessment, Sustainable Development.

UNIT-III

Types of natural resources: Water resources-Availability and quality aspects, Water borne diseases, Fluoride problems in portable water, Mineral resources, Food resources, Land resources, Forest Wealth, Material cycles- Carbon, Nitrogen and Sulphur cycle.

UNIT-IV

Energy- Different types of energy (Renewable and Non-renewable), Convectional and non-conventional energy-sources.Electromagnetic radiation, Hydro Electric, Fossil fuel based, Nuclear, Solar, Biomass and Bio-gas, Hydrogen as an alternative future source of energy.

UNIT-V

Environmental pollution and their effects, Water pollution, Land pollution, Noise pollution, public Health aspects, Air pollution. Current environmental issues of importance and their impact on environment: Population Growth, Climate change and global warming effect, Urbanization, Automobile pollution, Acid rain, Ozone layer depletion.

UNIT-VI

Preventive measures and control of pollution, Air and Water pollution control, Sold waste management, Case studies.

UNIT-VII

Role of Government in environment protection, Legal Aspects, Initiatives and protection Acts, public awareness, Initiatives by Non-governmental Organizations (NGOs), Role of IT services, Disaster management.

UNIT-VIII

Field work/ Activities/ Visit.

Text and References Books:

1. Environmental Studies- Benny Joseph, TATA Mcgaw Hill publication.
2. Environmental Studies- Dr. D.L. Manjunath, pearson Education.
3. Environmental Studies- R. Rajgopalan, Oxford publication.
4. Environmental Science and Technology- M. Anji Reddy, BS publication.
5. Principles of Environmental Science and Engineering- P. VenugopalanRao, Prentice Hall of India.
6. Environmental Science and Engineering- Meenakshi, Prentice Hall of India.

Course Code: HSS-S201 **Breakup: 3 – 0 – 0 –4**

Course Name: Industrial Management

Course Details:

Introduction to Industrial management, Brief history of industries in India, Brief definition of management, organization and administration. Characteristics of management, Principle of management, Function of management like, planning, organization, direction, co-ordination etc.

Level of management, skills of management, inter relation between skills and levels of management, scientific management, Introduction to Schools of Management thoughts, introduction to organization, study of basic type of organization for ex. Line and staff organization, project organization, metrics organization, Informal organization, Introduction to industrial Psychology, Motivation theory and study of Maxlow, Need, Hierarchy Theory, Planned Location, Planned Layout. Study of different forms of layout like line layout, process layout, product layout, combinational layout, sixth position layout etc.

Objective of planned layout, introduction to material management, scope of material management, study of inventory control method, introduction to different types of inventory control techniques, introduction to work study, motion study etc, introduction to conflict management.

Text Book and References:

1. Khanna O.P. : Industrial Engineering
2. T.R. Banga : Industrial Engineering and Management
3. Mahajan : Industrial and Process Management

Course Code: MSE-S203T Breakup: 3 – 1 – 0 – 3

Course Name: Phase Equilibria in Materials

Course Details:

Phase rule, Lever rule & free energy of phase mixtures, Binary isomorphous system equilibrium phase rule, Lever rule & free solidification, non-equilibrium solidification, dendritic growth, coring, CuNi alloys & zone refining. Binary eutectic & hypoeutectic systems - solidification of eutectic, hypoeutectic & hypereutectic alloys. Solidification of peritectic, hypoperitectic & hyperperitectic alloys, Morphologies of eutectic systems Binary monotectic & syntectic systems, Stability of regular solution & miscibility gap, intrinsic stability of solution & spinodal, Hume-Rothery rules & intermediate phases, e.g., laves, sigma, electron compounds, binary eutectoid, peritectoid, metatectic & monotectic systems, Iron carbon phase diagram & microstructures of plain carbon steel & cast iron, Non-equilibrium structrures, Binary ceramic systems, Ternary phase diagrams Gibbs triangle isothermal & vertical sections polythermal projections, two-phase equilibrium, concept of tie-lines, rules for construction of tie-lines, three-phase equilibrium, concept of tie-triangle four-phase equlibria multi-component alloy systems stainless steels, high speed steels, Hadfield steels, super alloys, light metal alloys, refactor systems.

Text Books and Reference:

1. Physical Metallurgy, V. Raghvan (PHI)
2. Materials Science and Engineering, V. Raghvan
3. Phase Diagrams in Metallurgy, Frederic N. Rhines (Mc Graw Hill)
4. Introduction to Physical Metallurgy, Sidney H Avner (TMH)

Course Code: MSE-S203P Breakup: 0 – 0 – 3 – 2

Course Name: Phase Equilibria in Materials Lab

Course Details:

Metallographic Sample Preparation of common metals & Observation of Microstructure.

Course Code: MSE-S204 Breakup: 3 – 1 – 0 – 4

Course Name: Mechanical Behaviour of Materials

Course Details:

Stress tensor & stress transformation. equations, Principle stresses, Strain tensor & strain transformation equations, Isotropic & anisotropic elasticity, elastic strain energy, Yield criteria & constitutive relationships, work hardening, plastic instability & its significance, Crystallographic aspects of deformation, dislocation theory edge, screw & mixed dislocations, resistance to dislocation motion & elastic properties of dislocations, dislocation interactions, multiplication of dislocations, Strengthening mechanisms, Creep characteristics of creep curve & steady state creep. mechanisms & creep mechanism maps, creep under complex stress-states, prediction of long time properties, Fracture toughness & fatigue— Griffith's crack theory energy release rate analysis, modes of loading stress analysis of cracks fracture toughness, Low & high cycle fatigue, Fatigue crack initiation & propagation, Structural aspects of fatigue, fatigue under complex stress-states, environmental assisted cracking & fatigue, some case studies related to design, effect of stricture on strength, ductility & toughness, mechanical behaviour of metals, ceramics, polymers & composites.

Text Books and Reference:

1. Mechanical Metallurgy, G. E. Dieter (McGraw-Hill)
2. Mechanical Behavior of Materials, Meyers & Chawala (Prentice Hall)

Course Code: MSE-S205T Breakup: 3 – 1 – 0 – 3

Course Name: Materials Characterization -I

Course Details:

Chemical bonding, fundamentals of crystallography, reciprocal lattice, structures in metals, inorganic compounds, polymers, sib ates & glasses, stereographic projections X ray diffraction, diffraction theory' atomic scattering factor, integrated intensity of diffracted beams, temperature factor, line broadening. Techniques: Laue, powder & rotating crystal technique; for studying bent crystal, texture, order-disorder changes, elemental compound & alloy crystals, mode of bonding, crystal types, density of packing, atomic stacking, inter-atomic voids, coordination polyhdra, Paulings rules, symmetry elements, space & point groups, group theoretical formulation. Electron & neutron diffraction techniques; Optical principles of microscopy — resolution, magnification, depth of focus electron diffraction, imaging (various contrasts), determination of crystal structure, Burgers vector, electron-beam – specimen interactions & other applications of transmission electron microscopy, applications of scanning electron microscopy & electron probe microanalyser, Principles of quantitativ4e microscopy, volume density, surface density, length density, numerical density, particle & grain size.

Text Books and Reference:

1. Elements of X-Ray Diffraction, B. D. Culity (Addison Wesley)
2. Physical Methods for Metal Characterization, Pej Flewitt (Institutue of Physics Pub.)

Course Code: MSE-S205P Breakup: 0 – 0 – 3 – 2

Course Name: Materials Characterization Lab-I

Course Details:

Electrical, magnetic and dielectric properties of materials. Thermal characterization of materials.

Course Code: MSE-S206 Breakup: 3 – 1 – 0 – 4

Course Name: Iron and Steel Making

Course Details:

Refractories for iron & steel; design & profile of an iron blast furnace and its auxiliaries; performance evaluation of blast furnace -iron ore reduction, fuel rate calculations, BF aerodynamics & hot metal quality control; physical chemistry of steel making & secondary steel making deoxidation; continuous casting of steel; vacuum degassing; sponge iron making.

Text Books and Reference:

1. Modern Iron Making , V. R. Tuppari
2. Introduction to Modern Steel Making, V. R. Tuppari

Course Code: MSE-S301 Breakup: 3 – 1 – 0 – 4

Course Name: Fundamentals of Materials Processing

Course Details:

Overview of various processing methods for materials, Solidification processing, moulding methods, heat flow, microstructural evolution during solidification & effect of cooling rate on cast microstructures, micro macro segregation in alloys, directional solidification, rapid solidification, mold design, solidification shrinkage & riser design, fluid flow fundamental & metal fluidity, fundamentals of deformation processing -state of stress during various metal working operations, friction & its role in bulk metal forming operations , microstructural evolution during deformation processing, workability of metals, superplastic forming, metal flow & aspects of design during bulk forming operations, elementary load calculations during various bulk metal working operations Sheet metal forming state of stress during sheet metal forming processes, forming limit diagram, enhancement of sheet metal formability ,Thin films & coatings, growth of thin films from liquids, Physical vapour deposition (evaporation, sputtering), Chemical vapour deposition (thermal & plasma CVD)

Text Books and Reference:

1. The Science and Engineering of Materials, Donald R. Askeland (Chapman & Hall)

Course Code: MSE-S302 Breakup: 3 – 1 – 0 – 4

Course Name: Manufacturing Processes: Selection and Design

Course Details:

Overview of manufacturing systems, Role of traditional & near-net shape processes in manufacturing industry, Basic attributes of manufactured products -size & shape complexity, machining requirement & machining losses, dimensional tolerance &, surface condition, mechanical properties & manufacture costs expendable mold & permanent mold shape casting processes, open die & closed die forging processes & design consideration, manufacturing process for making products such as sheets, round/sectioned bars, seamless tube /rings & wires, criteria for selection of metal & ceramic powder production processes for a given application, powder processing equipment & their selection. Joining processes, selection & design, case studies with CAD/CAM aspect.

Text Books and Reference:

1. Fundamentals of Manufacturing Processes, Lal & Choudhary (Narosa)

Course Code: MSE-S303 Breakup: 3 – 1 – 0 – 4

Course Name: Electronic and Optical Materials

Course Details:

Electron dynamics and concept of holes, conductivity in relation to band structure, direct and indirect band gap, Degenerate and non-degene. ate semiconductor, lntrinsic and extrinsic semiconductor, application of semiconductor, DC and AC conductivity of metals, Hall effect and Magnetoresistance, Thermal conductivity and specific heat of material, thermo power of meals. Ionic conduction-review of defect equilibrium and diffusion mechanism, theory of ionic conduction, conduction in glasses, application in sensors and batteries, conducting polymers and organic semiconductors, piezoelectric materials, optical materials, electron-hole recombination, solid state LED's, Laser and IR-detector, band gap engineering, light interaction with materials—transparency, translucency, opacity, refraction and refractive index, reflection, absorption and transmission.

Course Code: MSE-S304T Breakup: 3 – 1 – 0 – 3

Course Name: Phase Transformation in Metals

Course Details:

Thermodynamic order of transformations, theory of nucleation -kinetics of homogeneous, transient & heterogeneous nucleation, Theory of thermally activated growth, interface controlled growth diffusion controlled growth, interface instability & Widmanstatten growth, Eutectoid growth, Discontinuous

precipitation, massive transformation, transformation kinetics: Johnson-Mehl equation, Avrami model, Transformation kinetics in diffusion controlled transformations, Isothermal & continuous cooling transformation diagrams, Precipitation & particle coarsening, Kinetics of recrystallization, theory of grain growth, Effect of second phase particles Solidiflcation- nature & growth of solid liquid interfaces rapid solidification, glass transition, metallic glasses.

Text Books and Reference:

1. Materials Science and Engineering, V. Raghvan
2. Phase Transformation in Metals and Alloys, D. A. Porter & K. E. Easterling

Course Code: MSE-S304P Breakup: 0 – 0 – 3 – 2

Course Name: Phase Transformation in Metals Lab

Course Details:

Heat Treatment of Steels, Metallographic sample preparation to study phase changes

Course Code: MSE-S305 Breakup: 3 – 1 – 0 – 4

Course Name: Heat Treatment of Metals

Course Details:

Iron-carbon phase diagram, heat treatment of steel, hardenability of steels. TTT diagrams, CCT diagrams in steels, quench hardening & tempering of martensite Martensitic transformation nature of martensitic transformation, ham distortion, nucleation & growth of martensite, athermal, isothermal & burst transformations Spinodal decomposition Surface hardening processes, tool steels & their heat treatments, heat treatment of cast iron Thermochemical & thermo mechanical treatments Heat treatment of Ni-base superalloys & Ti alloys,

Text Books and Reference:

1. Physical Metallurgy, Lakhtin

Course Code: MSE-S306 Breakup: 3 – 1 – 0 – 4

Course Name: Principles of Metal Extraction and Refining

Course Details:

Sources of raw material. Introduction of mineral dressing: Communication, tabling, jigging & flotation. Principles of pyrometallurgy – roasting, agglomeration, smelting, refining & secondary refining Principles of hydrometallurgy, electrometallurgy Extractive metallurgy of aluminum, copper and zinc

Text Books and Reference:

1. Principles of Extractive Metallurgy, H. S. Ray & A. Ghosh

Course Code: MSE-S307T Breakup: 3 – 1 – 0 – 3

Course Name: Principles of Powder Processing

Course Details:

The particulate state- attributes & morphology of particles, distribution of particles in a single attribute, inspectation as a measure of global properties of particular ensembles, analysis of static & dynamic particulate systems by transformation attributes and measures, production of particles, particulates in suspension, stability, morphology and setting, size analysis, consolidation of powders, Sintering.

Text Books and Reference:

1. Powder Metallurgy, Erhard Klar (American Society of Metals)
2. Introduction to Particulate Technology, Martin Rhodes (Jhon- Wiley)
3. Powder Metallurgy Technology, G. S. Upadhayaya

Course Code: MSE-S307P Breakup: 0 – 0 – 3 – 2

Course Name: Principles of Powder Processing Lab

Course Details:

Powder Fabrication, Powder Characterization and Powder Processing.

Course Code: MSE-S308 Breakup: 3 – 1 – 0 – 4

Course Name: Diffusion in Solids

Course Details:

Diffusion equations and mathematical solutions Phenomenological diffusion theories Atomic theory of diffusion, theoretical and experimental investigation of diffusion in ionic solids and semiconductors Grain boundary and surface diffusion, thermal & electric-diffusion.

Text Books and Reference:

1. Diffusion in Solids, Paul G. Shewmon (McGraw Hill)

Course Code: MSE-S309 Breakup: 3 – 1 – 0 – 4

Course Name: Corrosion and Degradation of Materials

Course Details:

Thermodynamics and kinetics of materials corrosion., Oxidation, common forms of corrosion, stress corrosion, corrosion fatigue, radiation damages, corrosion effects, corrosion susceptibility tests, electrochemical measurements of corrosion rates, corrosion prevention and economic consideration, high temperature oxidation and sulphidation, corrosion case history, physical aging in polymers, degradation of polymers and their effect on mechanical properties

Text Books and Reference:

1. Corrosion, M. G. Fontana

Course Code: MSE-S310 Breakup: 3 – 1 – 0 – 4

Course Name: Materials Characterization - II

Course Details:

Thermal analysis tools, Thermometry and dilatomentrt, calorimetry, differential scanning calorimetry (DSC), DTA, Temperature modulates alorimetry, Thermomechanical analysis, DMA and DETA, Therrnogravimetry, X-ray fluorescence, photoluminescence, UV photoelectron spectroscopy, Fourier transform JR spectroscopy, Laser Raman spectroscopy, photoelectron spectroscopy, Auger electron spectroscopy, secondary ion mass spectroscopy, electron energy loss spectioscopy, solid state NMR, scanning tunneling microscopy, atomic force microscopy, Rutherford bac1 scattering spectroscopy, Particles induced x-ray emission, neutron activation analysis, Mossbauer spectroscopy, positron annihilation spectroscopy.

Course Code: HSS – S301 Breakup: 1 – 1 – 1 – 2

Course Name: Professional Communication

Course Details:

Unit 1- Presentation Techniques

- Meaning and importance of presentation technique
- Use of presentation techniques in everyday life
- Presentation skills required for business organization
- Types of business presentations-meetings, seminars, Conferences

Unit 2-Oral presentations

- Effective oral presentation techniques
- Tips for good oral delivery; debates, elocution, impromptu speeches
- Levels and models of organizational Communication
- Interviews-types of interviews
- Group discussions

Unit 3- Written communication

- Style and tone of writing business messages and Documents.
- Writing for websites, internet e-mails and short messages
- Applications, letters, memos
- Proposals and report writing

Unit 4 - Nonverbal presentations

- Nonverbal communication techniques
- Business manners, ethics and personality development
- Audio/visual presentations, power point presentations
- Art of delivery

Unit 5- Literary concepts

- Stories, essays, comprehension
- Reading techniques-skimming and scanning methods
- Listening skills

Text Books and Reference:

1. "Business Communication Today", Bove'e, Thill and Schatzman: Pearson Education(Singapore),2003
2. "Business Communication-a framework of success", H.Dan O'Hair, James S.O'Rourke and Mary John O' Hair: South Western College Publishing 2001.
3. "Basic Business Communication", Raymond V.Lesikar, Marie E.Flatley: Tata McGraw Hill Publishing Company Ltd., 2002.

Course Code: HSS-S401 Breakup: 3 – 1 – 0 – 4

Course Name: Industrial Economics

Course Details:

Unit -I

Definition and scope of engineering economics
Concept of supply and demand
Price elasticity and cross elasticity of demand
Production
Engineering costs and cost estimation
Concept of time value of money
Cash flow analysis

Unit-II

Perfect competition
Monopoly
Monopolistic competition

Unit-III

National Income, GDP
Inflation, Deflation and treatment

Unit-IV

Functions of RBI
Indian Tax System

Text Books and Reference:

1. Henderson, M. James and Quandt, E. Richards, "Microeconomic Theory: A Mathematical Approach".
2. Koutsoyiannis, A., "Modern micro economics".ardwick, Philip., Khan Bahadure., Langmeed, John, "An Introduction to modern economics".
3. Samuelson, A. Paul, "Economics".
4. Shapiro, Edward. "Macro economics".
5. Newnan, G. Donald, Eschenbach, G.Ted, Lavelle, P. Jerome, "Engineering Economic Analysis".

Course Code: MSE-S401 Breakup: 3 – 1 – 0 –4

Course Name: Composite Materials

Course Details:

Classification of composite materials, dispersion strengthened, particle reinforced and fiber reinforced composite laminates properties of matrix and reinforcement materials. Micromchenics and principles of strengthening, elastic properties, stress-strain relations, fracture behaviour, fabrication methods and structural applications of different types of composite materials.

Text Books and Reference:

1. Composite Materials: Science & Engineering, K. K. Chawla (springer)

Course Code: MSE-S402 Breakup: 3 – 1 – 0 –4

Course Name: Fuel, Refractories and Furnaces

Course Details:

Conventional and newer sources of energy management, problems in metallurgical industries, role of high temperature systems and materials. Deposits manufacturing, properties and testing of solid, liquid and gaseous fuels, Principles of combustion and burner design, classification of refractories, manufacturing and properties of common refratories such as silica, fire clay, high alumina, dolomite, magnesite and chrome refractories, design of, high temperature furnaces, waste heat utilization, heat recuperators and regenerators, stac.: design, gas cleaning, heat balance diagrams, furnace dynamics, fluid and heat flow calculations, fuel fired furnaces, electric arc furnaces, vacuum, electron beam, plasma, laser furnaces.

Text Books and Reference:

1. Refractories and furnaces, Francis Thompson Havard (Mc-Graw Hill)

Course Code: MSE-S404 Breakup: 3 – 1 – 0 –4

Course Name: Electronic Materials for Industry

Course Details:

Dielectric Materials-dielectric constant and polarization, polarization mechanism, linear and nonline dielectric, pyro-piezo,and ferroelectric properties, application magnetization-diamagnctisn paramagnelism, polypararnagnetism, ferro, antiferro, and ferri magntism. Soft and hard magnet materials, permanent magnet and transformers. Carrier statistics in semiconductor, semiconductor materials purification, and crystals growth, epitaxy, CVD and, MBE, Physical vapor deposition (sputtering, evaporation, etc), P-N junction, Schottky & MaS device structures, doping by implantaik and diffusion, ion implantation, patterning, etchlithography, empirical rule, alloy design, very large sea integration (VLSI).

Text Books and Reference:

1. Elements of Materials Science and Engineering, L. H. Van Vlack (Addison-Wesley)
2. Materials Science and Engineering: An Introduction, W. D. Callister, (WILEY)
3. The Science and Engineering of Materials, Donald R. Askeland (Chapman & Hall)
4. Solid State electronic Devices, B.G. Streetman (PHI)

Course Code: MSE-S405 Breakup: 3 – 1 – 0 –4

Course Name: Heat and Mass Transfer

Course Details:

Review of basic concepts in heat, mass and momentum transfer, advanced topics in convective heat transfer, radiative heat transmission, simultaneous heat and mass transfer, selected topics in materials processing.

Text Books and Reference:

1. Kinetics of Metallurgical Reactions, Hem Shanker Ray (Oxford & IBH)
2. Heat & Mass Transfer, H. S. Ray

Course Code: MSE-S406 **Breakup: 3 – 1 – 0 –4**

Course Name: Computing Methods in Materials Engineering

Course Details:

Introduction to programming language, differentiation, integration, finding roots of equation and solving linear algebraic equations, Interpolation, extrapolation, application of regression analysis and curve fitting techniques, computer calculation of phase diagrams, numerical solution of partial differential equation pertinent to heat, mass and momentum transfer, computer application in solidification, potential energy diagrams, mass balancing, data reconciliation problem solving with material balance software package quantitative description of mineral processing units and its computer implementation, introduction to a general purpose modular, simulation for process analysis.

Departmental Elective Courses

Course Code: MSE-S501 **Breakup: 3 – 1 – 0 –4**

Course Name: Electrochemical Technology in Materials Processing

Course Details:

Thermodynamics of electrolyte, electrochemical potential, conduction of ions in solution, over potential. absorption, phase formation, economics of an electrolyte process, principles of cell design. electrochemical technology, electrowinning, electrorefining, metal electro forming Electrochemical machining, electroplating, anodizing, pickling, electrophoretic painting. Electrochemical treatment of minerals, batteries and cells, water treatment and environmental protection.

Course Code: MSE-S502 **Breakup: 3 – 1 – 0 –4**

Course Name: Application of Transport Phenomenon in metal processing

Course Details:

Review of heat, mass and momentum transfer, fundamentals of turbulence phenomena, turbuleny flows. dimensional analysis and reactor design, free convection phenomena and bubble/gas driven systems, applications of transport phenomena to (I) gas stirred ladle system (2) desulphurization of pig iron using Mg vapour (3) alloy addition kinetics (4) soaking & soaking furnaces.

Course Code: MSE-S503 **Breakup: 3 – 1 – 0 –4**

Course Name: Engineering Polymers

Course Details:

Classification & structure of polymers, polymer synthesis, copolymers,' Molecular structures & architecture, molecular weight distribution, rotational' isomeric states, chain configuration in dilute solution & condensed states, characterization of molecular weight & distribution, light scattering, Osmometry, Intrinsic viscositye1 permeation chromatography, solidification, glass formation, glass, spherulites, alloys, multicomponent metals, processing effects thermal effects of rheological behaviour, Time tempeure equivalence, WLF equation, Arrhenius behaiour, Mechanical behavior of solids, Viscoelasticity, Boltzmann superposition principle, failure behavior & criteria Glass transition, liner viscoelasticity, stress relaxation and dynamic experiment mechanical morals, superposition principle effect or structure on mechanical properties, rubber is elasticity, yield & fracture polymer working process such a extrusion, forming shaping injection molding, blow molding, sheet forming, film forming, thermoforming and callendering, advances in polymer working technology, effect of processes in structure and properties, material selection & design consideration.

Course Code: MSE-S504 Breakup: 3 – 1 – 0 –4

Course Name: Vacuum Technology and Devices

Course Details:

Course Code: MSE-S505 Breakup: 3 – 1 – 0 –4

Course Name: Ceramic Materials

Course Details:

Crystal chemistry — structure and bonding in materials, ceramic raw materials, production of powders by chemical and physical mean, powder consolidation, addition in ceramic processing, sintering and sintering theory, cold and hot isostatic pressing, processing of electronic ceramic, sol-gel processing.

Text Books and Reference:

1. Introduction to Ceramics, W. D. Kingry (Jhon-Wiley)
2. Introduction to Ceramics, M. N. Rahman

Course Code: MSE-S506 Breakup: 3 – 1 – 0 –4

Course Name: Materials Engineering

Course Details:

Crystal growth, Heat treatment, Nondestructive evolution, Processing of glasses and polymers, Novel processing methods, Thin films, Materials selection for different engineering applications.

Course Code: MSE-S507 Breakup: 3 – 1 – 0 –4

Course Name: Modern Steel Making and Alloying

Course Details:

Alloy steel making processes – special reference to stainless steel, high speed steel, manganese steel other special steels. Thermodynamics and kinetics of alloy steel making. Defects and remedies. Post solidification treatments. Secondary alloy steel making technologies. Problems. Overview of Indian ferro alloy sector and alloy steel sector. Basics of ferro alloys production – concept: thermodynamic principles and techniques. Existing production processes of important ferro alloys, Fe–Cr, Fe–Mn, Fe–Si. Recent advances in ferro alloy technology. Production of other ferro alloys – Fe–V, Fe–Ti, Fe–W, Fe–Ni, Fe–Mo, Fe–Zr, Fe–B, etc.