CURRICULUM

COURSE CODE & TITLE

MY-102: INTRODUCTION TO METALLURGICAL ENGINEERING

Credit Hours: 2+0

COURSE CONTENTS

Introduction to Metallurgy: Definition, scope, and importance, overview of materials: metals, ceramics, polymers, and composites, historical development, and current trends. Classification of Metallurgy.
Structure of Metals: Atomic structure, crystal structures (BCC, FCC, HCP), crystallographic planes and directions, crystal imperfections and dislocations. Properties of Metals and alloys. Introduction to Phase Diagrams. Corrosion and Degradation: Basic corrosion mechanisms, Corrosion prevention methods, and environmental degradation. Foundry and Forming Techniques: Introduction to casting, forging, rolling, types of molds, and casting defects. Overview of Characterization Techniques: Optical microscopy, SEM, XRD, and Microstructure-property relationship.

COURSE CODE & TITLE

AU-112: ENGINEERING DRAWING & COMPUTER GRAPHICS

Credit Hours: 2+1

COURSE CONTENTS

Engineering Drawing: Drawing equipment and the use of instruments; basic drafting techniques and standards; freehand sketching of machine and engine components; geometrical curves including plane curves: cycloid, hypocycloid, and the involutes. Intersections and development of surfaces of geometrical bodies such as prism, pyramids, cylinders and cones. Concept of working drawing of component parts of machines and engines: size, description, dimensions, and specification; limit dimensioning and geometric tolerances; limits; fits and tolerances; conventional symbols. Computer Aided Graphics: Introduction, application of computers in drafting and designing, methods for creating drawing entities, common editing features, dimensioning with variable setting, printing and plotting. The Software configuration of a graphics system; functions of a graphics package; constructing the geometry; Introduction to wire framing and solid modelling.

CURRICULUM

COURSE CODE & TITLE

EA-128: FUNCTIONAL ENGLISH

Credit Hours: 3+0

COURSE CONTENTS

Listening skills and subskills Effective listening techniques: listening for gist, details, and specific information in a range of situations (AV lectures, interviews, documentaries etc.)

Speaking skills Speaking with fluency and accuracy in a variety of situations including conversations, group discussion, academic and social interaction, public speaking, presentation skills, and interviews Pronunciation improvement exercises (through websites, apps, and in class worksheets)

Reading and subskills Reading strategies: Skimming, scanning, and detailed reading, identifying main ideas, supporting details, and inferences (multiple genres including newspapers, books, stories, documentaries etc). Reading Practice: Reading comprehension tasks. Reading output tasks (notes, summary, discussion, counter argument etc.)

Study skills Effective note-taking strategies for lectures, meetings, and reading texts. Taking in varied forms paragraph, lists, infographics etc.) Interpreting instructions oral and written. Effective examination taking technique (comprehending instructions, planning, and writing answers ensuring relevance and precise

Writing skills Writing process, Pre-writing strategies (Mindmapping, cubing, outlining, clustering etc.) Writing to describe, argue, compare and contrast, persuade through writing prompts. Writing academic and professional genres: emails, letters, short report, resume, cover letter, building profiles on various job portal. Writing accuracy: Identifying and overcoming grammatical problems.

Vocabulary and grammar development Vocabulary Development strategies. Exposure and practice to develop everyday and academic vocabulary for formal contexts.

COURSE CODE & TITLE

PF-101: IT FUNDAMENTALS AND APPLICATION

Credit Hours: 2+1

COURSE CONTENTS

Fundamentals of IT: Introduction to Information and Communication Technologies (ICT), Components and scope of ICT, ICT productivity tools, Emerging technologies and future trends, Ethical Considerations in Use of ICT Platforms and Tools, Applications of ICT in education, healthcare and finance. Digital citizenship. Data Representation and Number Systems: Binary, octal, decimal, hexadecimal systems, data representation: characters, numbers, multimedia. Databases: Fundamentals of databases, organization and storage, introduction to Information Systems (IS) and Management Information Systems (MIS), real world IS and MIS applications. Data Communication and Computer Networking: Network topologies, Types of networks Programming Languages: Evolution and structures: syntax, semantics, special purpose vs. general-purpose languages, comparative study of data types, control structures and algorithms, basics of coding, practical problem solving.

CURRICULUM

COURSE CODE & TITLE

MT-116: CALCULUS & ANALYTICAL GEOMETRY

Credit Hours: 3+0

COURSE CONTENTS

Set and Functions: Define rational, irrational and real numbers; rounding off a numerical value to specified value to specified number of decimal places or significant figures; solving quadratic, and rational inequalities in involving modulus with graphical representation; Definition of set, set operations, Venn diagrams, De Morgan's laws, Cartesian product, Relation, Function and their types (Absolute value, greatest integer and combining functions). Graph of some well-known functions. Limit of functions and continuous and discontinuous functions with graphical representation.

Differential Calculus: Differentiation and Successive differentiation and its application: Leibnitz theorem. Taylor and Maclaurin theorems with remainders in Cauchy and Lagrange form, power series. Taylor and Maclaurin series,L Hopitals rule, extreme values of a function of one variable using first and second derivative test, asymptotes of a function, curvature and radius of curvature of a curve, partial differentiation,
extreme values of a function of two variables with and without constraints. Solution of non-linear equation, using Newton Raphson method.

Integral Calculus: Indefinite integrals and their computational techniques, reduction formulae, definite integrals and their convergence. Beta and Gamma functions and their identities, applications of integration relevant to the field.

Sequence & Series: Sequence, Infinite Series, Application of convergence tests such as comparison, Root, Ratio, Raabe's and Gauss tests on the behavior of series.

Analytical Geometry:
Review of vectors, scalars and vector products, Three-dimensional coordinate system and equation of straight line and plane and sphere, curve tracing of a function of two and three variables, surface revolutions, coordinate transformation.

Complex Number: Argand diagram, De Moivre formula, root of polynomial equations, curve and regions in the complex plane, standard functions and their inverses (exponential, circular and Hyperbolic functions).

COURSE CODE & TITLE

ME-228: WORKSHOP PRACTICE

Credit Hours: 0+1

COURSE CONTENTS

Use of carpenter's tools, Exercise in preparing simple joints, Bench fitting practice, Exercise in marking and fittings.

CURRICULUM

COURSE CODE & TITLE

EE-124: BASIC ELECTRICITY & ELECTRONICS

Credit Hours: 2+1

COURSE CONTENTS

Analysis: Series and Parallel electric circuit: kirshhoffs voltage low (ICVL) and kirshhoffs current low (KCL), voltage divider and current divider rules; series parallel circuit; Y-Delta conversion; methods of circuits analysis: mesh analysis and nodal analysis; network theorem; superposition. Theremean's Norton and Magzimum power transfer; magnetic circuits; magnetic fields, flux density, permeability, reluctance, magnetizing force, hysteresis, and ampere's circuital low; capacitor and inductors; electric field and dielectric strength; charging and discharging face of! Capacitor; capacitor types; Faraday's low of electromagnetic induction; Lent's low; charging and discharging face of an inductor. AC Analysis Poly Phase Systems: General format sinusoidal voltage and current, phase relation: average power and power factor, frequency response of basic elenients (R. L,C) rectangular and polar form conversions: series- parallel circuits with phase or diagram; mesh analysis and nodal analysis; network theorems; passive filters: law pass, high pass, pass band, stop band filters, resonance: series resonant and parallel resonate circuits, poly phase systems. Electrical Machines: Introduction to electrical machines; Transformer: basic construction, operation and types; DC Motors and Generators: construction of DC motors and generators, working principles, equivalent circuits, losses and efficiency calculations; AC motors and generators: construction of AC motors and generators, working principles, equivalent circuits, losses and efficiency calculations, power and torque curves in generators. Basic Electronics: Introduction to electronics engineering; P-N Junction: Semiconductor theory, doping and energy bands, diode models, diode data sheet understanding, diode applications (half wave, full wave and bridge rectifier, clipper and clamper); BJT and FET construction, operation and characteristic curves, introduction to Digital electronics; Comparison with Analogue electronics.

CURRICULUM

COURSE CODE & TITLE

ME-101 ENGINEERING MECHANICS

Credit Hours: 3+1

COURSE CONTENTS

Statics of Particles: Forces in a plane; Newton's First Law, Free body diagram; Forces in space (rectangular components); Equilibrium of a particle in space. Kinematics of Particles: Rectilinear and curvilinear motion of particles; Components of velocity and acceleration; Motion relative to a frame in translation. Kinetics of Particles: Newton's Second Law; Dynamic equilibrium; Rectilinear and curvilinear motion; Work and energy; Kinetic energy of particle; Principle of Work and Energy; Conservation of energy; Impulse and momentum; Impulsive forces and conservation of momentum; Impact, direct and oblique; Conservation of angular momentum. Rigid Bodies: Equivalent systems of forces; Principle of transmissibility; Moment of a force; Couple; Varignons Theorem. Centre of gravity of a three-dimensional body and centroid of a volume. Moments of inertia, radius of gyration, parallel axis theorem. Equilibrium of Rigid Bodies: Free-body diagram; Equilibrium in two and three dimensions; Reaction of supports and connections; Equilibrium of two-force and three-force bodies. Kinematics of Rigid Bodies: General Plane motions; Absolute and relative velocity and acceleration. Plane Motion of Rigid Bodies: Forces and acceleration; Energy & momentum; Conservation of linear and angular momentum. Friction: Laws of dry friction; Angles of friction; Wedges; Square-threaded screws; Journal & thrust bearings; Belt friction. Analysis of Structures: Internal forces & Newton's Third Law; Simple & space trusses; Joints & sections; Frames & machines. Forces in cables.

COURSE CODE & TITLE

CY-110: APPLIED CHEMISTRY FOR ENGINEERS

Credit Hours: 2+1

COURSE CONTENTS

Laws of Electrolysis, E.M.F series, Corrosion, Types and theories of corrosion, Factors affecting rate of corrosion, Inhibition & protection, Corrosion of ceramics. Water & Sewage: Sources of water, Impurities, Hardness, Water softening, Purification of water for potable and industrial purposes, Electro dialysis, Introduction to environmental pollution, Main sources and effects, Sewage treatment. Fuels: Types of fuels, Classification of fossil fuels.Metals & Alloys: Purification and general composition of metals and alloys such as Iron, Copper, Aluminum, Chromium, Zinc used in the engineering field. Engineering materials: Inorganic Engineering materials: Cement, Glass, Organic Engineering materials: Polymers, Rubbers, Plastics and Paints, Semiconductors and Dielectric materials.

CURRICULUM

COURSE CODE & TITLE

ES-105: PAKISTAN STUDIES

Credit Hours: 2+0

COURSE CONTENTS

Historical and Ideological Perspective of Pakistan Movement, Two-Nation Theory, Factors leading to the creation of Pakistan, Jinnah and demand for Pakistan. Land of Pakistan, Geophysical conditions of Pakistan, Geopolitical and strategic importance of Pakistan, Natural resources (mineral, water, and power). Constitutional Process, Early efforts to make a constitution (1947–1956), Salient features of the Constitutions of 1956, 1962, 1971, Political and Constitutional crisis, Constitution of 1973 and its salient features, Constitutional amendments from 1973 to date, Contemporary Issues of Pakistan, Brief survey of Pakistan's economy, current economic situation, problems and issues, future perspective. Social issues, society and culture, literacy and education (problems and issues), scientific and technical development. Environmental issues: pollution, hazards, citizenship, national and international environmental issues, national policy, international treaties, conventions, and protocols. Pakistan's Foreign Policy, Foreign policy from 1947 to present, relations with neighbors, major powers, and the Muslim world, Human Rights, Conceptual foundations, Western and Islamic perspectives, and Human Rights in the Constitution of 1973.

CURRICULUM

COURSE CODE & TITLE

MY-215: ENGINEERING CERAMICS AND REFRACTORIES

Credit Hours: 2+0

COURSE CONTENTS

Definition and classification of ceramics, Types and classification of engineering ceramics. Common ceramic materials (oxides, carbides, nitrides, borides). Applications of engineering ceramics. Atomic structure and bonding (ionic, covalent), Crystalline and amorphous ceramics. Silica and silicate structures, mullite and spinels, glass and glass processing, glass ceramics. Fracture toughness, micro crack formation, and high temperature application of ceramics, processing of ceramics, shaping and binding, molding, firing, sintering. Thermal conductivity and thermal expansion, Thermal shock resistance, Electrical properties (dielectric, piezoelectric, and superconducting ceramics), Ceramic matrix composites (CMC), Bioceramics and biomedical applications, Magnetic ceramics. Refractories: Raw materials for refectories such as fire clay, china clay, silica materials, alumina, magnesite, dolomite, chromite, graphite, carbon materials, Zirconia, classification of refractories. Manufacturing, testing, and use of basic, neutral, acid, and specialty refractories. Relationship between physical properties of various refractories. Selection and use of refractories in the materials and metallurgical industry.

COURSE CODE & TITLE

ES-206 ISLAMIC STUDIES OR

ES-209: ETHICAL BEHAVIOUR

Credit Hours: 2+0

COURSE CONTENTS

Fundamentals of Islam, including Tauheed, its impact on human life, the place of man in the universe, and the purpose of creation, with references to Quranic verses such as Al-Ambiya-22, Al-Baqarah-163-164, and Al-Israa-70. It addresses Prophethood, the need and characteristics of prophets, finality of Prophethood (Al-Imran-79, Al-Hashr-7, Al-Maidah-3), and the concept of the Hereafter. Topics on Ibadah include Salat, Zakat, Hajj, and Jihad (Al-Hajj-5, Al-Baqarah-48, Al-Mu'minun-1-11, Al-Anfaal-60). The Basic Sources of Shariah include the Quran, Hadith, Ijmaa, and Qiyas. Moral and Social Philosophy of Islam covers good vs. evil, Akhlaq-e-Hasna (Al Imran-110, Al Nahl-125), and professional ethics with verses from Surah Al-Hujrat (10-13), Al-Taha-81, and Al-Baqarah-188. The Seerat of the Holy Prophet (PBUH) is explored through moral teachings (Hajjat-ul-Wida, political and economic aspects), personal traits like honesty, humility, mercy, and engagement with others through events like the Charter of Madina and the Treaty of Hudaibya. It highlights social values (peace, tolerance, inclusivity) and leadership skills (vision, empathy, communication, justice). The course also includes the Teaching of the Holy Quran, focusing on tafseer of Surah Fatiha, parts of Surah Al-Furqan (63-77), and Surah Luqman (12-19), as well as Nazirah and Tajweed of Surah Fatiha, Ayatul Kursi, and the last ten surahs with Tajweed rules like Ghunna, Qalqalah, and Noon Sakinah.

CURRICULUM

COURSE CODE & TITLE

MY-213: INSTRUMENTATION AND CONTROL

Credit Hours: 2+0

COURSE CONTENTS

Basic Concepts about Instrumentation and Process Control. Pressure Measurement: Pressure units, Manometers, Diaphragms, Bellows, Bourdon Tubes, and Secondary Transducers (strain gauge and LVDT). Temperature Measurement: Introduction and units. Liquid Expansion. hermometers (Mercury in Glass, Liquid in glass), Bimetallic strip Thermometers, Pressure-Spring thermometers, Resistance Temperature Detectors, thermistors, Thermocouples. Pyrometers. Level Measurement: Differential Pressure, Displacer, Bubbler, Capacitance, Conductance, Ultrasonic, Flow Measurement: Head-type flow meters (Orifice plate, Venturi tube, pilot tube), Rotameter, Anemometers, Electromagnetic flow meters, Mechanical Meter (turbine type), Ultrasonic type flowmeter. Weight, Force, stress, and strain measurement. Introduction to process control: Process Control, Definitions of the Elements in a Control Loop, Units and Standards, Instrument Parameters, Control types.

COURSE CODE & TITLE

MY-210: IRON MAKING PROCESSES

Credit Hours:

COURSE CONTENTS

Historical of Iron Making Processes. Iron Manufacture in Pakistan. Raw Materials for Iron Making, Iron Ores and Their Occurrence, Classification, Geological / Geographic Aspect, Valuation of Iron Ores. Iron ores and Iron bearing minerals. Iron making and its importance. Fluxes and Slags, their sources chemistry and uses. Agglomeration and testing of blast furnace burden. Sintering and roasting, blast furnace theory, construction, chemistry and the process. Factors affecting the reducibility and other metallurgical properties of burden. Wrought Iron and sponge Iron. Direct reduction processes of iron making. Blast Furnace Calculations Analytical Charge Calculations, Reducibility, Slags, Design Parameters, Material and Energy Balances etc. Applications of Computers in design and operation of iron making processes.

CURRICULUM

COURSE CODE & TITLE

MY-212: PHYSICAL METALLURGY

Credit Hours: 3+1

COURSE CONTENTS

Crystal structure of materials, Space lattice, Crystal system, Unit cell, Packing density, Coordination number, Allotropy, Solidification (Homogeneous and heterogeneous); Nucleation and growth; Grain-boundaries and grain structure; Cast structure, Segregation, Shrinkage defects; Diffusion in solids. Phase-rule; Solid solutions; Interstitial solid solution and Substitutional solid solution; limits of solid solubility; Solid state transformations; Phase transformations in metals; types of Compounds; different types of binary phase diagrams: Isomorphous system, Eutectic and eutectoid reactions, coherent/in-coherent precipitates, Peritectic and peritectoid reactions; Ordered and disordered solutions; Iron-Iron carbide system, Role of Metallurgical microscope in the analysis of microstructure; theory of etching and concept of grain boundary energy. Heat-treatment of steels, phase transformations in steels; microstructure and properties of plain carbon steels and cast-irons; microstructure of common copperbase and aluminum-base alloys.

COURSE CODE & TITLE

MY-311 MACHINE LEARNING IN METALLURGICAL ENGINEERING

Credit Hours: 2+1

COURSE CONTENTS

Introduction to Artificial Intelligence: Overview of Artificial Intelligence and its relevance in metallurgy. Introduction to Machine learning (Supervised, Unsupervised, and Reinforcement). Introduction to Deep learning (ANN, and CNN, Introduction to Materials databases (i.e. Pymatgen, RDkit, Matminer). Introduction to Python Libraries (NumPy, Pandas, Matplotlib, Scikit-Learn, Tensorflow). Data Preprocessing and Feature Engineering: Data cleaning, transformation, and normalization techniques, Feature selection and extraction methods for metallurgical data (I.e. Pearson correlation, LASSO, SISSO), Handling missing data and outliers in datasets (i.e. Imputation and its
types, , Min-Max, Z-scores), Dimensionality Reduction (PCA, t-SNE) for Visualizing Data. Supervised & Unsupervised Learning Algorithms: Regression Models (Linear Regression, Polynomial Regression, Logistic Regression) for Predictive modeling, Classification Models (Decision Trees, Random Forest, SVM) for Alloy Composition Analysis, Model evaluation measures (RMSE, R^2, Confusion Matrix, Precision, Recall), Clustering Techniques (K-Means, Hierarchical Clustering) for Microstructure Analysis, Anomaly detection methods in metallurgical data analysis, Image Processing for Microstructure Analysis using CNNs. AI Project Work and Applications: Implementation of AI algorithms to solve metallurgical engineering problems (strength prediction, band gap estimation, Materials designing, prediction of structures, etc.). Hands-on project applying machine learning and deep learning techniques to real-world metallurgical datasets (Machine Learning, Computer Vision, Time series).

CURRICULUM

COURSE CODE & TITLE

MY-208: MINERAL PROCESSING

Credit Hours: 2+1

COURSE CONTENTS

Introduction: Minerals of economic importance, Processing Approach and Basic mineral processing technology, Efficiency of operation in mineral dressing plant. Liberation and Comminution Theory and attributes of comminution, Primary Crushers, Secondary Crushers, special crushers, their operation and applications, , Grinding Mills, Autogenous and Semi-Autogenous Mills, their operation and applications Screening and Classification Screening Equipment's, Grizzly, Revolving Screen (Trommel), Moving Screens and different Industrial screening types and operating characteristics, Classification Equipment, Sedimentation and Hydraulic Classifiers, Spiral and Rake Classifiers, Hydro cyclones (Cyclones) The movement of solids in fluids. Stoke's, Newton-, Rettinger's Law. Reynolds number free setting ratio and hindered setting ratio Separation and Concentration Techniques Theory and techniques of concentration, palletizing, nodulizing and briquetting, Separation Methods: Sorting, Gravity, Dense-Medium Separation, Magnetic Separation and Froth Flotation, Separation of solids from fluids by thickening process Flow sheets and circuit diagrams of typical mills treating ore Case Studies and Simulation Case studies on Mineral Processing of non-metallic ores (i.e. Chromite, Corundum, Mica, Dolomite, Gypsum etc.) and Metallic ores (i.e. Sphalerite, Cassiterite etc.) Process analysis, simulation, optimisation, and control using software.

COURSE CODE & TITLE

MY-207: MECHANICAL BEHAVIOUR OF MATERIALS

Credit Hours: 2+1

COURSE CONTENTS

Mechanism of plastic deformation, Theory of dislocations, Theory of elasticity, Unsymmetrical bending and shearing. Horizontal shearing stresses, shear flow, flow deflection due to shear, photo elastic method. Plasticity, relationship between stress and deformation, moment of inertia along different axes. Ellipse of inertia, determination of principal axes. Introduction to stress strain diagram, working stresses strain energy in tension and compression. Analysis of bi-axial stresses, principal planes, principal of stress-strain curves, stresses in thin-walled pressure vessels. Mohr's circles of bi-axial stress. Torsion of circular shafts, strain energy in shear and torsion of thin-walled tubes, Thermal stresses, buckling.

CURRICULUM

COURSE CODE & TITLE

PF-201 CIVICS AND COMMUNITY ENGAGEMENT

Credit Hours: 2+0

COURSE CONTENTS

Introduction to Civics and Citizenship: Definition of civics, citizenship, and civic engagement, Historical evolution of civic participation, Types of citizenship: active, participatory, digital etc., The relationships between democracy and citizenship .Civics and Citizenship :Concepts of civics, citizenship, and civic engagement, Foundations of modern society and citizenship, Types of citizenship: active, participatory, digital, etc State, Government and Civil Society . Structure and functions of government in Pakistan, The relationship between democracy and civil society, Right to vote and importance of political participation and representation. Rights and Responsibilities Overview of fundamental rights and liberties of citizens under Constitution of Pakistan 1973, Civic responsibilities and duties, Ethical considerations in civic engagement (accountability, non-violence, peaceful dialogue, civility, etc.) Community Engagement : Concept, nature and characteristics of community, Community development and social cohesion, Approaches to effective community engagement, Case studies of successful community driven initiatives. Advocacy and Activism : Public discourse and public opinion, Role of advocacy in addressing social issues, Social action movements. Digital Citizenship and Technology : The use of digital platforms for civic engagement., Cyber ethics and responsible use of social media, Digital divides and disparities (access, usage, socioeconomic, geographic, etc.) and their impacts on citizenship. Diversity, Inclusion and Social Justice: Understanding diversity in society (ethnic, cultural, economic, political etc.), Youth, women and minorities' engagement in social development, Addressing social inequalities and injustices in Pakistan, Promoting inclusive citizenship and equal rights for societal harmony and peaceful co-existence.

COURSE CODE & TITLE

MY-211: METALLURGICAL THERMODYNAMICS & KINETICS

Credit Hours:

COURSE CONTENTS

Fundamentals of Thermodynamics: State functions, First law of thermodynamics, Enthalpy, Heat capacities, Second law of thermodynamics, Entropy, Gibbs and Hemholtz energies, Equilibrium conditions, Chemical potential, Maxwells relationships, Third law of thermodynamics, Enthalpy and entropy calculations, activity, Gibbs-Hemholt equation, Gibbs-Duhem equation, Measurement of heat reactions, Phase equilibrium single and multi- component systems. Behavior of solutions, non- ideal solutions, thermodynamics of phase diagrams. Experimental Methods: Evaluating thermodynamic functions, estimation &calculation of the values of thermodynamic functions, free energy of formation, free energy diagrams. Kinetics The Arrhenius equation, the activated complex theory, collision theory, calculation of reaction rates. Heterogeneous reactions, gas-solid reactions, liquid-solid reactions, liquid-liquid reactions at slag metal interface, gas-liquid reactions. Kinetics of phase transformations under non equilibrium conditions. Application: Application of the laws of thermodynamics to metallurgical processes, electrochemistry, interfacial phenomena, extraction and refining of metals, corrosion, and electrodeposition. Computational thermodynamics.

CURRICULUM

COURSE CODE & TITLE

MY-214: METAL FORMING AND SHAPING PROCESSES

Credit Hours: 3+1

COURSE CONTENTS

Introduction: Metal Shaping Processes, their classification and Structure-Property-Processing Relationship. Theory of plasticity:Material behavior under forming conditions, Stress and strain, Macroscopic plasticity and yield criteria, Work Hardening, Plastic instability, Ideal work, friction, redundant work, and mechanical efficiency, Flow stress, deformation resistance, Strain rate and temperature dependence of flow stress, workability, evolution of microstructure during metal working, Friction and surface integrity, Formability, bending, Plastic anisotropy. Principles of metal forming
processes, softening and hardening mechanisms, metal-working in the re-crystallization rolling
process and equipment, forces in rolling, metal flow, defects and their prevention, and numerical methods related to the rolling process. Forging, process and equipment, Forces in Forging, grain
flow, forging defects and their prevention, numerical methods related to the forging process. Extrusion, Processes and equipment, extrusion defects, numerical related to the extrusion process. Wire-drawing. Sheet-metal working, stretch forming, deep drawing, continuous roll forming, Wire, Rod, Tube, and Sheet Metal Forming Processes(cutting methods, forming operations), their mechanics and testing methods, numerical methods related to sheet metal working process. Design of Metalworking Equipment: Fundamentals of design of metal forming equipment, such as: Forging presses, Rolling Mills, and accessories.

COURSE CODE & TITLE

PF-301: PROFESSIONAL ETHICS

Credit Hours: 2+0

COURSE CONTENTS

Introduction to Ethics. Professional Ethics, Engineering Ethics, Business Ethics: Ethics and Professionalism. Need and Scope of Engineering and Professional Ethics, Development of Engineering Ethics, Major issues in Engineering & Professional Ethics. Ethical Dilemma. Resolving Ethical Dilemmas and Making Moral Choices, Techniques to resolve issues, Codes of Ethics, Codes of local and international professional bodies including PEC, Ethical Theories, Utilitarianism, Rights Ethics and Duty Ethics, Moral Theories: Virtue Ethics Self- Realization & Self Interest, Ethical Problem Solving Techniques: Line drawing, flow Charting, Conflict Problems, Professional Responsibilities, Risk and Safety as an Ethical Concern for Engineers, Workplace Responsibilities and Ethics: Teamwork. Confidentiality and Conflicts of Interest. Whistleblowing, Bribe and Gift, Risk and Cost-Benefit Analyses. Gender Discrimination and Sexual Harassment Environmental Ethics. Plagiarism. Hacking. Spamming. Academic and Research Integrity, Honesty: Truthfulness, Trustworthiness.

CURRICULUM

COURSE CODE & TITLE

MY-309: STEEL MAKING PROCESSES

Credit Hours: 2+0

COURSE CONTENTS

Introduction: History of steel making, principles of steel making reactions, Slag theories, Bessemer, Thomas and Open Hearth and steel making practices. L.D. Process: Design of converter and lance, chemical reactions involved, Catch Carbon technique. Recovery of waste heat. Electric arc furnace: Advantages charging melting and refining practices for plain carbon and alloy steel; uses of Direct Reduced Iron in arc furnace De-oxidation of liquid steel: Requirements of deoxidizers, de-oxidation practice. Inclusions and their influence on quality of steel. Killed, semi-killed and rimmed steel. Secondary refining of steel Continuous Casting of steel: Advantages; types of machines; mould lubrication and reciprocation.

COURSE CODE & TITLE

MT-221*: LINEAR ALGEBRA & ORDINARY DIFFERENTIAL EQUATIONS*

Credit Hours: 3+0

COURSE CONTENTS

Linear Algebra: Linearity and linear dependence of vectors, basis, dimension of a vector space, field matrix and type of matrices (singular, non- singular, symmetric, non- symmetric, upper, lower, diagonal), Rank of a matrix using row operations and special method, echelon and reduced echelon forms of a matrix, determination of consistency of a system of linear equation using rank, matrix of linear transformations, eigen value and eigen vectors of a matrix, Diagonalization. Applications of linear algebra in relevant engineering problem.1st Order Differential Equations: Basic concept: Formation of differential equations and solution of differential equations by direct integration and by separating the variables: Homogeneous equations and equations reducible to homogeneous from; Linear differential equations of the order and equations reducible to the linear form; Bernoulli's equations and orthogonal trajectories: Application in relevant Engineering. 2nd and Higher Orders Equations: Special types of IInd order differential equations with constant coefficients and their solutions: The operator D; Inverse operator I/D; Solution of differential by operator D methods; Special cases, Cauchy's differential equations; Simultaneous differential equations; simple application of differential equations in relevant Engineering. Partial Differential Equation: Basic concepts and formation of partial differential equations: Linear homogeneous partial differential equations and relations to ordinary differential equations: Solution of first order linear and special types of second and higher order differential equations; D' Alembert's solution of the wave equation and two dimensional wave equations: Lagrange's solution; Various standard forms. Fourier Series: Periodic functions and expansion of periodic functions in Fourier series and Fourier coefficients: Expansion of function with arbitrary periods. Odd and even functions and their Fourier series; Half range expansions of Fourier series.

CURRICULUM

COURSE CODE & TITLE

MY-308: POLYMER AND COMPOSITE MATERIALS

Credit Hours: 2+1

COURSE CONTENTS

Introduction to Polymeric materials, Classification of Polymers, Addition and Condensation Polymerization, Molecular weight, Molecular Shape, Structure of Polymers. Melting and Glass Transition Phenomena, Deformation and strengthening of plastics materials, Creep and Stress Relaxation. Structure, Properties and Applications of some selected Thermoplastics, Thermosets, and Elastomers. Processing of Plastic Materials (Extrusion, Injection Molding, Blow Molding, Compression Molding, Transfer Molding, Vulcanization, Processing, Properties and Applications of Elastomers. Composite Materials: Dispersion – Strengthened, Particulate Composites, Fiber – Reinforced Composites, The mechanics of fibre reinforcement, Metal-matrix composites, and Ceramic-matrix composites. Polymer-matrix composites, Processing of fibres and other reinforcements, Design of Ply and Laminate structures, and Sandwich structures. Manufacturing of composites.

COURSE CODE & TITLE

PF-401: ENTREPRENEURSHIP

Credit Hours: 2+0

COURSE CONTENTS

Definition and concept of entrepreneurship; Why to become an entrepreneur? Entrepreneurial process; Role of entrepreneurship in economic development. Characteristics and qualities of successful entrepreneurs (including stories of successes and failures); Areas of essential entrepreneurial skills and ability areas such as creative and critical thinking, innovation and risk taking. Opportunity identification, evaluation and exploitation; Idea generation techniques for entrepreneurial ventures. Target market identification and segmentation; Four P's of Marketing; Developing a marketing strategy; Branding. Concepts of income, savings and investments; Basic concepts of assets, liabilities and equity; Basic concepts of revenue and expenses; Overview of cashflows; Overview of banking products including Islamic modes of financing: Sources of funding for startups (angel financing, debt financing, equity financing etc.) Characteristics and features of effective teams; Team building and effective leadership for startups. Regulatory Requirements to Establish Enterprises in Pakistan: Types of enterprises (e.g., sole proprietorship; partnership; private limited companies etc.); Intellectual property rights and protection; Regulatory requirements to register an enterprise in Pakistan, with special emphasis on export firms; Taxation and financial reporting obligation.

CURRICULUM

COURSE CODE & TITLE

MT-441: ADVANCE MATHEMATICAL TECHNIQUES

Credit Hours: 3+0

COURSE CONTENTS

Complex Variable Limit, continuity, zeros and poles of a complex function. Cauchy-Reimann equations, conformal transformation, contour integration.

Error Analysis Types of errors (relative, Absolute, inherent, round off, truncation), significant digits and numerical instability, flow chart. Use any Computational tools to Analysis the Numerical Solutions.

Finite Difference Functions of operators, difference operators and the derivative operators, identities. Linear homogeneous and non-homogeneous difference equations. Numerical Differentiation, Forward Difference Method, Backward Difference Method, Central Difference Method. **Interpolation & Curve Fitting** Lagrange's, Newton, Hermit, Spline, least squares approximation. (Linear and non-linear curve). With numerical problem in engineering.

Numerical Integration & Differentiation Computation of integrals using simple Trapezoidal rule, 3 1 th Simpson's rule, 8 1 th Simpson's rule, Composite Simpson's and Trapezoidal rules, computation of solutions of differential equations using (Euler method, Euler modified method, Runge Kutta method of order 4).

Improper Integrals Definitions, Types of improper integral and their convergence.

Elliptic Integrals Introduction and identification of elementary elliptic integrals of first, second and third kinds. Simple applications.

COURSE CODE & TITLE

PF-205: Community Services

Credit Hours: NC

COURSE CONTENTS

Orientation to Community Service: Introduction to the concept and practice of community service. Need, objectives and benefits of community service. Foundational theories (educational, undergraduate curriculum, humanities, social science, corporate social responsibility etc.). Tools and skills needed in community service. Contextual examples in community service; case examples. Professional and ethical conduct during community service Community Service Attachment Completing 30-35 hours of formal assignment at an organization Community Service Experience Documentation Writing a report documenting the experience and submitting it on the prescribed format.

NOTE: Total contact hour for theory (thought component 8 + documentation activity 6) will be 14 hours.

CURRICULUM

COURSE CODE & TITLE

MM-303: INSPECTION AND TESTING OF MATERIALS

Credit Hours: 3+1

COURSE CONTENTS

Introduction to inspection and testing of materials, its scope and importance. The Brinell test, the Vicker test,the Rockwell test, the Knoop test, the Scleroscope test, conversion tables for various scales of hardness. Stress and strain, load extension diagrams, modules of elasticity, elastic limit, yield stress, proof stress, work hardening, tensile testing, (equipment and specimens). Compression testing, bend testing, and torsion testing. Impact testing. Toughness, brittleness and ductility, notched bar impact testing, the Charpy and Izod impact tests, brittle and ductile fractures. The fatigue test, different types of fatigue fractures, Goodman diagram, endurance limit-ultimate tensile strength. The Creep Test. Overview of the main NDT techniques of materials testing, Visual, Ultrasonic, Penetrant, Magnetic particles and x-ray, and eddy current techniques, Example in NDT of materials. Advanced techniques used for testing of plastics, rubbers, polymers and composite materials.

COURSE CODE & TITLE

ES-108 IDEOLOGY AND CONSTITUTION OF PAKISTAN

Credit Hours: 2+0

COURSE CONTENTS

Two-Nation Theory Nation and Nationalism in British India. Inclusive nationalism, Exclusive nationalism, Freedom movement in British India, Two-Nation Theory. Ideology: definition and its significance Difference between Philosophy, Ideology, and Theory. Evolution of Islamic ideology in British India. Pakistan movement: role of ideology. Ideological factors that shaped the Constitution(s) of Pakistan (Objectives Resolution 1949). Introduction to the Constitution of Pakistan Definition and importance of a constitution. First Constituent Assembly of Pakistan. Main issues that delayed the Constitution-making in Pakistan. Dissolution of the Constituent Assembly. Second Constituent Assembly of Pakistan. Third Constituent Assembly of Pakistan. Constitution and State Structure Federal form of State. Parliamentary form of government. Structure of Government (executive, legislature, and judiciary). Distribution of powers between federal and provincial governments. Fundamental Rights, Principles of Policy, and Responsibilities Duty of the citizens of Pakistan (Article 5). Overview of fundamental rights to citizens of Pakistan guaranteed by the Constitution 1973 (Articles 8-28). Overview of Principles of Policy (Articles 29-40). Constitutional Amendments Procedures for amending the Constitution. Notable constitutional amendments and their implications: 8th, 13th, 17th,, and 18th.

CURRICULUM

COURSE CODE & TITLE

MY-310: NON-FERROUS EXTRACTIVE METALLURGY

Credit Hours: 3+0

COURSE CONTENTS

Introduction: Non Ferrous metals and its ore deposits in Pakistan, Introduction to Non- Ferrous Extractive Metallurgy: Scope and importance in Pakistan. Principles of extractive metallurgy; The application of the principles of thermodynamics, kinetics, and heat and mass transfer to the extraction and refining of non-ferrous metals. Aluminum and its Alloys: Aluminum and its ores, Preparation of Alumina, Preparation of Cryolite, Production of metallic Aluminum, Thermal process of Aluminum, Alloys production, Recovery of other values from Aluminum ores, Aluminum and its alloys, Copper and its Alloys: Copper and its ores, Preparation of concentrate, Extraction of Copper ores by pyro-metallurgical methods, Matte smelting, Pier Smith converter, Top Blown Rotary Converter, Electrolyte and fire refining of Copper, Recovery of values such as Gold and Silver from Copper ores, Copper and its alloys. Zinc and its Alloys: Zinc and Zinc ores, General Preparation of extraction of Zinc, Roasting of Zinc concentrate, Leaching of roasted Zinc concentrate, Electrolysis of Zinc Sulphate solution, Melting of Cathodic Zinc, Production of Zinc retort and blast furnace method, Refining of Zinc, Zinc and its alloys. Lead and its Alloys: Lead and its ores, Extraction of lead, Blast roasting of lead concentrate, Blast furnace smelting of lead bullion, Recovery of Cadmium and other metals from lead concentrate, Lead and its alloys. Magnesium, Chromium, Titanium and its Alloys: Magnesium and its ores, Chromium and its ores, Extraction of magnesium and Chromium by Alumino-thermic and silico-thermic methods, Titanium and its ores, Treatment of its ores concentrate, Production of Titanium metals by reduction with Sodium and Magnesium, Titanium and its alloys.

COURSE CODE & TITLE

MM-304: HEAT TREATMENT OF MATERIALS

Credit Hours: 3+1

COURSE CONTENTS

Introduction and scope of the heat treatment processes used for materials. Review of the iron-carbon phase diagram, Effect of common alloying additions on the equilibrium diagram, annealing and its types, and Structures of slowly cooled steels. Specialized heat treatments include full annealing, normalizing, and process annealing. Oxidation and decarburization during heat treatment, Batch and continuous annealing. Quenching, tempering and hardening of steel, quenching rates and quenching media, martensitic transformation, time temperature transformation diagrams, effects of austenizing, grain size and alloying element on the transformation diagram, continuous cooling diagrams. Hardenability and its measurement, Jominy test. Aus-tempering, mar-tempering, retained austenite, tempering of martensitic steel. secondary hardening, heat treatment of dies and tool steel, Alloy steels, HSLA steels, and stainless steels, surface hardening, carburizing, nitriding, cyaniding, carbon-nitriding, induction and Flame hardening, heat treatment of cast iron heat treatment of nonferrous metal and alloys, age hardening/precipitation hardening, defects caused during heat treatment and their remedies, subzero treatment. Heat. Heat treatment of nonmetallic materials like polymers, plastics, rubbers and composites.

CURRICULUM

COURSE CODE & TITLE

MY-303: FOUNDRY PRINCIPLES, METHODS AND PRACTICE

Credit Hours: 3+1

COURSE CONTENTS

Introduction: Foundry Engineering and Practice, Scope and importance of the subject, Foundry plant layout, design and calculations, Tooling, equipment, machines. Advanced design techniques and calculation using personal computer, Pattern and Moulds: Types of pattern, pattern making, shrinkage and contraction allowances, Selection of suitable moulding and core materials, Properties of moulding and core materials, Analysis, testing and control of moulding and core materials requirements. Melting: Melting methods and practice and their effect upon metal quality. Melting furnaces and equipment, Gases in metal, their control and removal, Solidification, Nucleation and growth phenomenon, Microstructure of cast metal and alloys, Heat flow in solidification, Solidification of single phase systems, Solidification of multiphase systems, Structures of casting and segregation. Melting of Ferrous & Non-Ferrous Metals & Alloys. Casting Methods and Techniques: Casting process and procedures, Pouring & Feeding of Casting, Different casting techniques: sand casting, shell mould casting, plaster casting, investment casting, permanent mould casting, centrifugal casting, continuous casting, Gravity and pressure die casting methods, Selection of die casting alloys, Moulding materials and mould dressings, Metallurgy of die casting alloys, Shell moulding, Lost wax, Investment and Precision casting processes. Cast metal systems: non-ferrous alloys, cast irons, steels Casting techniques of Ferrous and Non- Ferrous metals. Defects and Quality: Inspection & Quality Control, Casting Defects: Identification, Causes of defects and their remedies. Fettling & Processing of Castings, Patterns, Sand Moulding, Gating & Risering, Computer applications in foundry processes

COURSE CODE & TITLE

EA-304: BUSINESS COMMUNICATION AND ETHICS

Credit Hours: 3+0

COURSE CONTENTS

Part-1 Communication Skills (Oral): Definitions and Conditions. Modes: verbal, non-verbal, vocal, non-vocal, sender, receiver, decoding, noise, context, emotional maturity, relationships, etc. Language, perception. Non-verbal, body language, physical appearance, cultural differences etc. Personal and interpersonal skills/perceptions. Communication dilemmas and problems. Public Speaking – speaking situation, persuasion. Part-II Written Communication: Formal / Business letters. Memos (brief revision). Notice and minutes of meetings. Contracts and agreements (basic theoretical knowledge and comprehension). Research / scientific reports. Tenders (basic theoretical knowledge and comprehension). Participating in seminars, interviews, writing and presenting conference papers, solving IELTS type papers. (Non- examination). Part-III Engineering / Business Ethics: Course objective. Need for code of ethics. Type of ethics, involvement in daily life. Problems/conflicts/dilemmas in application. Review of Pakistan Engineering Council Code of Conduct.

CURRICULUM

COURSE CODE & TITLE

MY-304: METALLURGY OF WELDING

Credit Hours: 2+1

COURSE CONTENTS

Introduction to welding and joining, Metallurgy of welding, the effect of heat on metals, preheating, stress, strain, weld-ability, weld defects, and selection of appropriate welding process.

Fusion Welding Processes: Overview of welding processes. Gas welding and equipment, fluxes, torch gases hoses and hose connection, torches, mixers, welding tips, regulators clamp outfits. Arc welding, power sources, DC and AC power sources, cables, electrodes, current and circuit polarity, electrode selection, weld deposit. TIG & MIG welding, Submerged arc and other shielded methods, equipment, current, flux, electrodes, atomic hydrogen welding, plasma arc welding, electro-slag welding, under water shielded metal arc welding, vapour shielded metal arc welding - CIG welding. Thermite welding, equipment techniques, process, ignition powder removing the mold inspection.

Non-Fusion Joining Processes: Joining processes in which the base materials are not melted. Brazing, Soldering, Diffusion bonding, Explosive bonding, and Adhesive bonding processes. Resistance welding, resistance spot welding, multiple spot welding, MIG spot welding, PIGME welding process, flash and upset welding.

Other welding processes include laser welding, electron beam welding, pressure welding, and ultrasonic welding. Solders principles, Equipment, fluxes

Design of Welded Structures and Assemblies: Introduction and concepts in welding structures and assemblies. Analytical practice of designing weldments. Welding codes and specifications. Estimation of welding costs.

Physics of Welding: Introduction to arc welding physics, fluid flow in the plasma, weld pool phenomena, thermal experience during welding, Quality of weld, Applications of Computers in welding processes.

Aluminum and aluminum alloys, magnesium and magnesium alloys, brazing, equipment, copper and copper alloys, aluminum brazing, dissimilar metals joining, plastic welding.

COURSE CODE & TITLE

MY-410: FRACTURE MECHANICS & FAILURE ANALYSIS

Credit Hours: 2+1

COURSE CONTENTS

Linear elastic fracture mechanics, Elastoplastic fracture mechanics, Ductile and Brittle fracture, Tensile fracture, Creep and Creep fracture, fatigue and Fatigue fracture, Fracture toughness theory ductile to brittle transition, the effect of temperature, Griffith's theory, micro-voids formation and ductile fracture, cleavage for brittle fracture, cleavage planes, crack opening displacement (COD), stress intensity factor, J integral, elastic-plastic fracture mechanics, , plane stress and plane strain fracture toughness, real-time fracture toughness, fracture re-enforcement mechanisms. Fractography, differentiation among different types of fracture surfaces Root cause analysis, and Case studies of failed components

CURRICULUM

COURSE CODE & TITLE

MY-413: CORROSION ENGINEERING

Credit Hours: 2+1

COURSE CONTENTS

Corrosion General concepts of corrosion applied to materials, corrosive environments, Electrochemical Theory, Polarization curves, Activation & Concentration polarization curves, general corrosion, galvanic corrosion, oxygen concentration cell, Oxidation of Metals, types of scale, Oxidation rates, localized corrosion, Pitting and Crevice corrosion. Stress corrosion cracking, hydrogen damage, Intergranular corrosion, Selective leaching, Protection and Prevention, Chemical inhibiters, environmental control, anodic and cathodic protection, mechanical protection, coatings, anodizing, painting, corrosion resistant materials, corrosion of carbon steels, stainless steel, aluminum alloys, case studies. Corrosion inhibitors: Paint; Modes of protection, inhibitive and metallic pigments, Metal coatings, methods of application, Anodizing of aluminum, Design and selection of materials.

CURRICULUM

COURSE CODE & TITLE

MY-416: HEALTH, SAFETY AND ENVIRONMENT

Credit Hours: 1+0

COURSE CONTENTS

Introduction to HSE in Metallurgical Engineering, Chemical Hazards and Safe Handling, High-Temperature and Mechanical Hazards, Nanomaterials and Particulate Safety, Environmental Impact of MaterialsProcessing, Risk Assessment and Emergency Preparedness, Global HSE Standards and Compliance, Final Assessment & Presentations.

COURSE CODE & TITLE

MY-417: COMPUTATIONAL MATERIALS SCIENCE

Credit Hours: 1+2

Introduction to Computational Materials Science: Basic concepts of atoms and molecules. Types of atomic structures in metals and alloys (crystal lattices). Visualizing atomic structures using simple software (like Jmol or online tools). Overview of computational methods in materials science. Basic linear algebra, numerical methods, and statistical analysis relevant to material simulations. Modeling and Simulation of Materials' Behavior/properties: Molecular dynamics simulations, Density functional theory (DFT), and calculations using Monte Carlo simulations, Finite Element Analysis (FEA). Stress-strain behavior in materials: elasticity, plasticity, and fracture. Computational techniques for studying phase transformations in metallurgical processes, Phase diagram calculations and phase transformation kinetics, Applications of computational methods in predicting phase changes. Hands-on Projects and Case Studies: Simulation projects using software tools e.g., Python/MATLAB, Solidworks/ Materials Studio/ Comsol/ ABAQUS/ANSYS, LAMMPS, Factsage, and others. Case studies on materials design and process optimization through computational methods.

CURRICULUM

COURSE CODE & TITLE

MY-415: DESIGN, SELECTION AND CHARACTERIZATION OF ENGINEERING MATERIALS

Credit Hours: 3+1

COURSE CONTENTS

Materials Design: Design philosophy and process, types of design, **design tools, and** materials **data.**Materials designed for specific applications, i.e., Structural, High temperature, corrosion, and wear-resistant applications. Materials Selection: The
selection procedure, Selection strategy, **material property/Ashby charts, attribute limits, and material index, selection with multiple constraints and conflicting objectives. Computer-aided selection. Correlation among process, material, structure, and environment/application.m**Characterization techniques: Overview of characterization techniques of engineering materials, **Quantitative metallography,** 1-Microscopic Techniques: Configuration/ construction, working principle, image formation, and **results interpretation of;** Optical microscope (OM), Scanning Electron Microscope (SEM), Transmission Electron Microscope (TEM), and **Scanning Probe Microscopes (SPM).** 2-X-ray Techniques: Production and absorption of X-rays; electrons-matter interactions, **X-ray Diffraction (XRD) and electron Diffraction (ED), Bragg's law, X-ray and electron Diffraction patterns and their Indexing**; 3-Spectroscopic Techniques & Chemical Analysis: Working principle and results interpretation of various Spectroscopic techniques **i.e. Fourier Transform Infrared Spectroscopy(FTIR), spark emission/absorption spectroscopy,** wavelength dispersive spectroscopy (WDS) and energy dispersive (EDS) spectroscopy, and X-ray fluorescence (XRF). 4-Thermal Analysis: Working principle and **results interpretation of various Thermal analytical techniques i.e**., Differential Scanning Calorimetry (DSC), Thermogravimetric Analysis (TGA), and Dilatometry etc.

COURSE CODE & TITLE

CY-100: ESSENTIALS OF CHEMISTRY (For Computer Science Students only)

Credit Hours: NC

COURSE CONTENTS

Stoichiometry: Significant figures, mole and Avogadro number, empirical and molecular formulas, stoichiometry yield (theoretical and practical)

Atomic Structure and Bonding: Subatomic particles, Rutherford's and Bohr's atomic models, quantum numbers, electronic configuration, chemical bond, theories of covalent bond, shapes of molecules.

States of Matter: Kinetic molecular theory, gas laws, liquid properties, types of solids, types of crystals

Acid, Base and Salt: Theories of acids and bases, buffer solutions

Solutions and Colloids: Properties and types of solutions, concentration units, colloids, and its classification

Electrical Conductance: Redox reaction with balancing concept, electrode, electrode potential, and electrochemical series, corrosion

Organic Chemistry: Organic compounds and their classification, homologous series, functional groups, nomenclature of organic Compounds.

Inorganic Chemistry: Periodic classification of elements, periodic laws, group trends of various properties of s and p block elements, general characteristics of transition elements, IUPAC nomenclature of complexes.

CURRICULUM

COURSE CODE & TITLE

MT-331 PROBABILITY AND STATISTICS

Credit Hours: 3+0

COURSE CONTENTS

Statistics: Introduction, Types of data & variables, presentation to data, object, classifications, Tabulation, Frequency distribution, Graphical representation, Simple & Multiple Bar diagrams, Pie-Diagram, Histogram, Frequency Polygon, Frequency Curves & their types.

Measures of Central Tendency and Dispersion: Statistics Averages, Median Mode, Quartiles, Range, Moments, Skew ness & Kurtosis, Quartile Deviation, Mean Deviation, Standard Deviation, Variance & its coefficient, Practical Significance in related problems.

Curve Fitting: Introduction, fitting of a first- and second-degree curve, fitting of exponential and logarithmic curves, related problems. Principle of least squares, Second order Statistics & Time series not in bit detail. **Simple Regression & Correlation** Introduction, Scatter diagrams, Correlation & its Coefficient, Regression lines, Rank Correlation & its Coefficient, Probable Error (P.E), Related problems.

Sampling and Sampling Distribution Introduction, Population, Parameter & Statistic, Objects of sampling, Sampling distribution of Mean, Standard errors, Sampling & Non-Sampling Errors, Random Sampling, Sampling with & without replacement, Sequential Sampling, Central limit theorem with practical significance in related problems.

Statistical Inference and Testing of Hypothesis Introduction, Estimation, Types of Estimates, Confidence interval, Tests of Hypothesis, Chi- Square distribution/test, one tails & two tails tests. Application in related problems.

Probability Basic concepts, Permutation & Combination, Definitions of probability, Laws of probability. Conditional probability, Bayes' rule. Related problems in practical significance.

Random variables Introduction, Discrete & Continuous random variables, Random Sequences and transformations. Probability distribution, Probability density function, Distribution function, Mathematical expectations, Moment Generating Function (M.G.F.), Markov random walks chain/ Related problems.

Probability Distributions Introduction, Discrete probability distributions, Binomial Poisson, Hyper geometric & Negative binomial distributions. Continuous probability distribution, Uniform, Exponential & Normal distributions & their practical significance.

CURRICULUM

COURSE CODE & TITLE

MY-411: VACUUM METALLURGY (Technical Elective III)

Credit Hours: 2+0

COURSE CONTENTS

Vacuum principles, their Importance, classification and application in the metallurgical field, Different units of measuring pressure vacuum regimes, mean free path, collision frequency. Vacuum pumps: Water pumps, positive displacement pumps, rotary and roots pump, vapor ejector and vapor entrainment pumps, diffusion pump, turbo-molecular pump, introduction to vacuum measuring devices, Vacuum degassing Plant and Different techniques, Electron Beam Melting and Casting, Production of Nickel-Titanium Alloys by Electron beam Technique, Vacuum arc Skull Melting and Casting, Button Melting, Drip Melting of Refractory metals, Continuous Flow Melting, Introduction to Vacuum in Scanning Electron Microscopy, Introduction to the Mass Spectrometer, Vacuum Sintering, Physical Vapor deposition, Chemical vapor deposition Synthesis of Graphene, Vacuum Heat treatment. Vacuum coating.

COURSE CODE & TITLE

MY-406: POWDER METALLURGY

Credit Hours: 2+1

COURSE CONTENTS

Introduction: General concepts of Powder Metallurgy, Techniques for Production of metallic powders: gas atomization, chemical processes, electrolysis, gaseous reduction, mechanical processes, spray deposition, powder characterization techniques, bulk, density, particle size, surface area, consolidation of powder. Compaction: Compaction of metallic powder, Types of presses, mechanical press, cold iso-static press, hot isostatic pressing, moulds and dies, consolidation mechanism, effect of lubricants, binders, compaction defects, Sintering and Finishing: Mechanism, theory of sintering, sintering defects, sintering environments, characterization of sintered components; finishing operations; structural and porous components; cutting tools. Application: Advantages and limitation of powder metallurgy, application of powder metallurgy, merits and demerits of powder metallurgy, applications of P/M parts. Case histories.

CURRICULUM

COURSE CODE & TITLE

MY-418: ADVANCED MATERIALS (Technical Elective- I)

Credit Hours: 2+0

COURSE CONTENTS

Introduction to advanced materials, the structure-property co-relationships of advanced materials, Characterization techniques for nanomaterials (TEM, XRD, etc.), Introduction to magnetic Materials and their Applications, Biomaterials: Basic chemical and physical properties of biomaterials, including metals, ceramics, and polymers. Role of microstructure properties in the choice of biomaterials and design of artificial organs, implants, and prostheses. High-Temperature Materials: Overview, Elevated-Temperature Characteristics of Materials, Mechanical Properties at Elevated Temperatures, Corrosion at Elevated Temperatures. Processing and Properties of Superalloys. Nanomaterials: Overview of Nanomaterials and Their Classification. Mechanically alloyed Nanomaterials, ODS alloys, Fuel cells and Materials, Materials for Hydrogen Storage, Ceramic and Ceramic matrix composites, and Metal-Matrix composites.

COURSE CODE & TITLE

MY-412: METALLURGY OF ADVANCED STEELS

Credit Hours: 2+0

COURSE CONTENTS

Ni steel, Cr steel, Ni-Cr steel , Mn- Steels, Steel containing, MO, V, W, B, Si, Cu, Reconstructive, Displacive and diffusion less transformation product in steel, characteristics and microstructural of phases, High strength low Alloy (HSLA) steels, Advanced High Strength Steels (AHSS), Dual Phase (DP), Transformation Induced Plasticity (TRIP), Twinning Induced Plasticity (TWIP), Ferrite Bainitic, Other HSLA-micro alloyed steels, stainless steels, duplex steels, Martensitic-Stainless steel, Maraging steels, Bainitic steel, Thermomechanical processing, advantages and limitations, TMT and Thermomechanical Controlled Processing (TMCP) and steels, IF (interstitial-free) and ultra-low carbon steels for structural and automotive applications, ultra-low-carbon bainitic steels (ULCB),orthopedic steels, duplex and super duplex, corrosion stainless steels, tool steels, die steels, Steels for low to moderate temperature applications for nuclear and thermal power plants, heat-resistance steels.

CURRICULUM

COURSE CODE & TITLE

MY-423 THIN FILMS AND COATING TECHNIOUES (Technical Elective- II)

Credit Hours: 2+0

COURSE CONTENTS

Introduction to thin film technology. Thin film deposition and growth mechanism by Physical vapor deposition (PVD) techniques like evaporation, sputtering, ion-plating, etc. Chemical coating methods such as chemical vapor deposition (CVD) and atomic layer deposition (ALD). Plasma-based methods for thin film deposition. Molecular Beam Epitaxial (MBE) growth. Different physical and chemical processes. Solution processing methods for coatings and thin film deposition, Substrate effects of coating deposition. Tribological and hard thin coatings. Functional coatings for devices. Models for nucleation and film growth. Morphology and texture. Applications of thin film materials and deposition technologies.

COURSE CODE & TITLE

MY-424 SURFACE ENGINEERING (Technical Elective- II)

Credit Hours: 2+0

Tribology of surfaces: surface integrity; surface roughness and waviness; measurement of surface roughness and texture; types of wear and their mechanisms; applications of lubrication in wear. Mechanical surface treatment: Propelling abrasive media; blasting techniques; selection of abrasive media; different peening techniques. Surface finishing methods: tumbling, vibratory finishing, belt Sanding, wire brushing, buffing, and electro-polishing. Chemical cleaning of surfaces: selection and applications; alkaline cleaning; solvent cleaning and vapor degreasing; molten salt bath cleaning; ultrasonic cleaning; acid cleaning; pickling and descaling. Coatings: Paints and organic coatings; powder coating; hot-dip coating; chemical conversion coatings; blackening; coloring of metals; electroplating, electrophoretic deposition; anodizing; electroless plating; mechanical plating. Coating techniques: PVD, CVD, Sputtering, Thermal, and cold spraying methods; Sputtering; sol-gel method. A brief overview of surface hardening methods. Cladding techniques: roll bonding; explosive welding; applications of cladding in nuclear, marine, and other technological fields.

CURRICULUM

COURSE CODE & TITLE

MY-420 NANOTECHNOLOGY (Technical Elective- I)

Credit Hours: 2+0

Fundamentals and evolution of nanomaterials and Nanotechnology, Scope of Nanotechnology, importance of nanotechnology in materials science and engineering, classification of nanomaterials; OD, 1D, 2D, 3D nanomaterials. Applications of nanotechnology & nanomaterials in Metallurgical Engineering (corrosion resistance, alloy and composites, thin film coatings). Properties of nanomaterials: Mechanical, electrical, optical, and magnetic properties, Size-dependent properties and quantum effects, Surface energy and reactivity of nanomaterials. Synthesis of nanomaterials; Top-down and bottom-up techniques, chemical synthesis (CVD, hydrothermal, sol-gel), physical synthesis (PVD, ball milling). Carbon, metal, ceramics, composite, and polymer-based nanomaterials. Environmental HSE aspects of nanotechnology.

COURSE CODE & TITLE

MY- 422 ELECTRONIC, MAGNETIC, AND OPTICAL MATERIALS (Technical Elective- I)

Credit Hours: 2+0

Classification and concept of Electrical and Electronic Materials. Metallic materials and their electrical properties. Semiconductor materials and their electrical properties. Semiconductor devices. Ceramic materials used in electronic applications. Magnetic materials. Classification of materials according to magnetic properties and applications. Paramagnetic, diamagnetic, ferromagnetic, antiferromagnetic, and ferrimagnetic materials. Soft and Hard magnetic materials, magnetic recording technology. Atomic and domain theory of magnetism. Basic terms: magnetic fields, flux density and magnetization, permeability, susceptibility, retentivity. Hysteresis loop. Types of magnetic behavior. Magnetic measurement techniques. Optical materials. Characteristics and types of optical materials. Applications of Optical materials.

COURSE CODE & TITLE

MY-421 FUNDAMENTALS OF BIOMATERIALS (Technical Elective- I)

Credit Hours: 2+0

COURSE CONTENTS

Introduction to biomaterials and biochemistry; biocompatibility and bioactivity, bioreabsorbable & bioerodible materials. Processing and applications of biomaterials. Hydrogels & smart polymers. Cell biology, surface properties of materials, and intermolecular forces in biology. Response of materials in a human body; effect of mechanical forces on cells & tissues; biomimetic materials; Importance of water in biomaterials. In-vivo and In-vitro testing. Biocompatible metals: Ti-based, Stainless Steels, Co-Cr-Mo alloys, nitinol; biomaterials surface & protein; textured & porous materials; Bioactive glasses; Bioresorable ceramics; adhesives & sealants. Applications (Orthopedic, Dental, cardiovascular, soft tissue replacement, hard tissue replacement); Drug delivery system (nano-carriers, polymerdrug conjugates, nucleic acids, etc.), Biomaterial corrosion; blood & Materials interaction; tumors associated with biomaterials.

CURRICULUM

COURSE CODE & TITLE

MY-419 HIGH-TEMPERATURE METALS AND ALLOYS (Technical Elective- I)

Credit Hours: 2+0

COURSE CONTENTS

Overview of Elevated-Temperature Characteristics of Engineering Materials, Mechanical Properties, and Corrosion. Industrial Applications of Heat-Resistant Materials. Properties of Superalloys, Metallurgy, Processing and Properties of Superalloys. Elevated- Temperature Corrosion of Materials. Microstructural Instabilities. Protective Coatings Properties of Nonferrous Heat-Resistant Materials. Refractory Metals and Alloys. Structural Intermetallic Ceramics Carbon-Carbon Composites. Analysis and Design Assessment of Creep-Rupture Data. Thermomechanical Fatigue of Structural Materials. Elevated-Temperature Crack Growth. Creep-Fatigue Interaction. Materials design for Elevated Temperature Applications. Design for Oxidation Resistance, Creep, thermal fatigue, oxidation, high temperature corrosion, erosion. Ageing, structural changes, material damage, Crack propagation, damage mechanics, life time analysis, Creep resistant steels, superalloys, ceramics, and polymers for high temperature applications, intermetallic, Usage of high strength steels. Spring materials. Fatigue, Evaluation of property data, and extrapolation. Plastics and composite materials for high temperature applications.

COURSE CODE & TITLE

MY-425 ADDITIVE MANUFACTURING (Technical Elective- II)

Credit Hours: 2+0

COURSE CONTENTS

An overview of additive manufacturing: how it is different from conventional manufacturing processes, and its history. Process fundamentals, structure shaping, and creation; applications of additive manufacturing. Role of CAD and laser scanning. Final component geometry. Different techniques used for 3D printing of metallic (SLM, EBM, LMD, powder DED, wire DED, binder jetting, BPE, etc.), polymeric (FDM, SLS, stereolithography, etc.), and other materials. Design implications: surface finish; microstructures, mechanical and other properties; residual stresses and effects on fatigue life.

CURRICULUM

COURSE CODE & TITLE

MY-426 PHASE TRANSFORMATIONS AND METALS AND ALLOYS (Technical Elective-III)

Credit Hours: 2+0

COURSE CONTENTS

Introduction to Phase Transformations: Definition and classification of phase transformations, Thermodynamic aspects: phase stability, and driving force. Nucleation and Growth Mechanisms: Homogeneous vs. heterogeneous nucleation, Growth kinetics, and interface movement. Diffusion in Solids: Atomic mechanisms of diffusion (vacancy, interstitial, dislocation), Fick's laws and diffusion kinetics, Role of diffusion in phase transformations, Diffusional Transformations: Fundamentals of diffusional transformations, characteristics, Eutectic and eutectoid reactions, Spinodal decomposition and precipitation processes. Displacive Transformations: Characteristics of displacive transformation products, Crystallographic features of martensite and bainite, Strain energy, and interface motion. Bainitic Transformation and Mechanisms. Thermodynamic and kinetic factors controlling bainitic transformation, upper and lower bainite formation mechanisms. Design of Bainitic Alloys: Role of phase transformation in Bainitic steel design, Industrial applications of Bainitic steels. Order-Disorder Transformations in Alloys: Atomic ordering in solid solutions, Examples: CuAu and Fe3Al systems: Advanced Topics and Case Studies: Phase transformations in highentropy alloys (HEAs), Case studies on bainitic and martensitic steel development, Discussion on research trends in phase transformation engineering.

COURSE CODE & TITLE

MY- 427 METALLURGICAL PLANTS AND QUALITY CONTROL (Technical Elective-III)

Credit Hours: 2+0

COURSE CONTENTS

Metallurgical Plant Location: Factors affecting location; Multi-plant location; Location analysis; Plant layout; Types of layout;Material handling consideration in layout; Internal and External balancing; product and process layout analysis; Layout comparison. Health and Safety: Occupational Health and Safety Impacts of Metallurgical Plants. Basic procedures and remedies. Quality control Introduction, Defining Quality & its Philosophies, defining SPC/SQC and its Tools/Techniques. Quality Control Tools: Flow Chart, Check Sheet, Histogram, Pareto Chart, box plot, Scatter Diagram, Cause and Effect Diagram, Variable & Attribute Control Charts. Acceptance Sampling: OC Curve, Consumer & Producer Risks, AQL & LTPD, Sampling Errors, Acceptance Sampling for Continuous Production, Acceptance by Variables, Single, Double, & Sequential Sampling. Process Capability: Cp/Cpk, Reliability: Introduction, Life History Curve, Taguchi Loss Function, Probability distribution, Total Quality Management. Familiarization with standards for testing of materials.

CURRICULUM

COURSE CODE & TITLE

MY- 428 NUCLEAR METALLURGY (Technical Elective-IV)

Credit Hours: 2+0

COURSE CONTENTS

Overview of Nuclear Systems, Nuclear energy, nuclear reactors. Introduction to nuclear power plant operation, nuclear fission and fusion reactions, neutron absorption cross section. Nuclear fuels: uranium, thorium, plutonium; Fuel cladding materials: Aluminum alloys, stainless steels, zirconium alloys; Reflecting materials: graphite, beryllium, moderators, light water, heavy water, graphite; Control rod materials: cadmium, boron. Overview of UO2, Irradiation hardening, and embrittlement. Structural materials in nuclear power plants: An overview of Materials used in nuclear power plants. Effect of radiation on the properties of materials. Radiation hazards and their safety, Radiation Damage, health physics. Disposal of radioactive waste.

COURSE CODE & TITLE

MY-429 OILFIELD METALLURGY (Technical Elective-IV)

Credit Hours: 2+0

COURSE CONTENTS

Introduction to the oilfield environment: fundamentals of oil and gas and their effect on materials. Special features of oilfield metallurgy. API Material classes. NACE MR0175/ ISO 15156. Basics of Metallurgy and Materials Science: Metallurgy and properties of low alloy steels, Hardenability of oil tool materials, Effect of alloying elements, Heat treatment, Weldability of oil tool materials, Factors affecting material selection. Corrosion-resistant alloys (CRA): Stainless steels, Nickel alloys, Material selection of CRA. API 6A CRA. Specifications: API 6A, API 17D, NACE standards, etc., applications, and key features of these alloys. Corrosion and Material Properties: Why is oil/gas corrosive? Sweet and Sour Environments. Typical corrosion problems, Stress corrosion cracking, etc. Sour Service: NACE MR0175. ISO 15156, Material selection and sour service. Effect on welding.

COURSE CODE & TITLE

MG-483 SUPPLY CHAIN MANAGEMENT (Management Science Elective)

Credit Hours: 2+0

COURSE CONTENTS

Introduction to Supply Chain Management, Historical perspective of Supply Chain, Objective and Importance of Supply Chain Decisions, Process views of Supply Chain. Financial measures of Supply Chain, Drivers of Supply Chain performance. Supply Chain designing, Network designing in supply chain, Global supply chain networks. Coordination in Supply Chain, Bullwhip effect. Transportation in Supply Chain.

CURRICULUM

COURSE CODE & TITLE

ME-434 TOTAL QUALITY MANAGEMENT(Management Science Elective)

Credit Hours: 2+0

COURSE CONTENTS

Introduction to Total Quality Management (TQM): Definition and scope of TQM, development and evolution, key elements and principles of TQM, quality philosophies and contributions of quality gurus. Organizational Culture and Leadership in TQM: Role of top management and leadership, leadership roles for quality professionals, organizational Vision, Mission, Quality Policy, building a quality culture, Change Management and TQM integration. Customer Focus and Satisfaction: Voice of the Customer (VOC), understanding customer needs and expectations, customer retention and loyalty, tools for measuring customer satisfaction. TQM Tools and Techniques: Seven Quality Tools, Root Cause Analysis, Statistical Process Control (SPC), Control Charts, Benchmarking and Quality Function Deployment (QFD), Failure Mode and Effect Analysis (FMEA), continuous improvement, Kaizen. Quality Management Systems and Standards: ISO 9000 Series and other international standards, implementation of Quality Management Systems, auditing and certification processes, documentation and record keeping. Relevant case studies.

COURSE CODE & TITLE

MG-228 SOCIOLOGY AND DEVELOPMENT (Social Science Elective)

Credit Hours: 2+0

COURSE CONTENTS

Introduction to Sociology: Importance and scope, study of social life, exploring the global village, Sociology as a science, relationship with other social sciences, the sociological imagination, development of sociology, pioneers of sociology, brief historical development of sociology, Society and community, social interaction processes. Social Groups & Social Institutions: Definition, functions and types of social groups, Structure and function of social institutions. Culture and Related Concepts: Definition, types and elements of culture, Role of culture in organization, socialization and personality. Social Stratification: Factors of social stratification, approaches to study social stratification, power, prestige, and authority, social mobility, migration. Social and Cultural Change: Definition and dynamics of social change, impact of globalization on society and culture, resistance to change. Sociology of Development: Significant sociological questions, measures of inequality and development, modernization theory and explanation of underdevelopment, education, industrialization & development.

CURRICULUM

COURSE CODE & TITLE

EA-321 LOGIC AND CRITICAL THINKING (Social Science Elective)

Credit Hours: 2+0

COURSE CONTENTS

Introduction to the Study of Logic: Definitions, Terminology, Concepts of Logic & Critical Thinking. Scope and Impact. Why study logic and critical Thinking- Intellectual Moral Virtues. Basic Principles of Logic: Structure of an Argument, Valid/Invalid versus Sound/Unsound argumentation, Deduction versus Induction, Three classical Aristotelian Laws of Logic, Principle of sufficient reason; Deductive reasoning- Syllogism, Linear ordering, Tree diagrams; and Inductive Reasoning -Valid and invalid arguments. Fallacies. Thinking process while working towards goals, making decisions and analyzing issues. Thinking tools and their applications. Simple tools (e.g. facts and opinions, verification of sources and credibility of authorities etc.); Theoretical Frames (e.g. Scientific Methods/Approach etc.) and Formal Tool (e.g. PMI, STAR method, Shewhart Cycle, Socratic Method, RW & D, Quality Thinking- Paul & Elder Framework etc.) Thinking Critically Critical Thinking standards: clarity, precision, accuracy, relevance, consistency, logical correctness, completeness, and fairness. Barriers to Critical Thinking: Egocentrism, sociocentrism, unwarranted assumptions and stereotypes, relativist thinking, and wishful thinking. Critical Thinking Approach: Thinking actively, using questions for probing situations, evaluating our evidences and their types, Impartial versus adversarial critical thinking. Critical Thinking in Everyday Life Problem Solving: Defining a problem, attitudes towards problems-general and desired, Problem solving process, case studies on problem analysis Perceiving: Defining perception and its prominence in succeeding through life, Critical thinking and perception, Evaluating the differences in perception (through tests, optical illusions etc.), Perception processes, Factors governing perception, Difficulties / errors in perception process (perceptual errors). Believing and Knowing: Believing versus knowing, values and their types, identifying one's values in life; defining and classifying beliefs, Accuracy scale for evaluating thoughts, thinking patterns and organizing concepts, Ways to Organize Thoughts, Types of causal relationships – causal chains, contributory and interactive causes.

CURRICULUM

COURSE CODE & TITLE

MG-257 ORGANIZATIONAL BEHAVIOR (Social Science Elective)

Credit Hours: 2+0

COURSE CONTENTS

Introduction to Organizational Behavior: What is Organizational Behavior? The Individual: Diversity in Organizations, Attitudes and Job Satisfaction, Emotions and Moods, Personality and Values, Perception and Individual Decision Making, Motivation Concepts, Motivation: From Concepts to Applications. The Group: Foundations of Group Behavior, Understanding Work Teams, Communication, Leadership, Power and Politics, Conflict and Negotiation, Foundations of Organization Structure. The Organization System: Organizational Culture, Human Resource Policies and Practices, Organizational Change and Stress Management.

COURSE CODE & TITLE

ME-433 LAW FOR ENGINEERS (Social Science Elective)

Credit Hours: 2+0

COURSE CONTENTS

Introduction to legal studies, concepts and sources of law, Industrialization and role of Law, Development and role of contract legislative intervention. Intellectual property, Designs, Trademark, Patents, Copyright in Engineering, Enforcing rights to intellectual property. Engineering Contracts, Rights & Obligations, Legal documentation, Tendering and sub-contracting, Claims Concept of negligence Dispute Resolution in Domestic and International dealings. Liability for defective products, Role of Insurance. International Aspects of Laws, Law of Agency, Law of property. Taxation, Service Tax, Income Tax, VAT, Excise Duty. Aspects of employment law, Labour laws Environmental Law for Engineers, Need for a Environmental Protection Policy, Environmental Policy Act, Air and Water Pollution Acts, ISO 14000. Public Procurement Rules, Procurement planning, pre-qualification, bidding documents, evaluation criteria, Re-bidding.

CURRICULUM

COURSE CODE & TITLE

MM-309 CONSTRUCTION MATERIALS (Technical Elective-IV)

Credit Hours: 2+0

COURSE CONTENTS

Introduction to materials in construction environment, Fundamentals of soil. Cement: Introduction, Types of Cement, Manufacturing Process, Admixtures, Hydration Process, Pozzolans, High Alumina & Slag Cement, Testing of Cement, Fine & Coarse Aggregate, Properties of Aggregate. Concrete: Introduction, Types of Concrete, Properties of fresh and harden concrete, Concrete Mix Design, Micro cracking, Stress-strain relation, Deformation of concrete, Strength and failure of concrete, Cohesion & Segregation, Effect of Temperature on Concrete, Durability of concrete. Masonry: Introduction, materials for masonry, Structural behaviour. Construction Steel: Introduction, Steel Reinforcing Bars, steel for other structural sections, weathering steel. Wood: Introduction, Sustainability of wood, Lumber, wood products. Advanced Construction materials: Fiber Reinforced Concrete, High Performing Concrete, Self-Healing Concrete. Laboratory activities.

COURSE CODE & TITLE

PF-206: ENGINEERING ECONOMICS AND MANAGEMENT (Management Sciences Elective)

Credit Hours: 2+0

Introduction: Basic Concepts and principles of Economics, Micro- and Macro-economic theory, the problem of scarcity. Basic concepts of Engineering Economy, Financial effectiveness and non-monetary factors. Economic Environment: Consumers and producer goods, Goods and services, Demand & Supply concept. Market Equilibrium, Elasticity of demand, Elasticity of Supply, Measures of Economics worth, Price, supply-demand-relationship, Revenue, Cost and profit function. Elementary Financial Analysis: Basic accounting equation. Development and interpretation of financial statements-Income Statement, Balance Sheet and Cash Flow, Working capital management, Financial Ratio Analysis. Time Value of Money and Financial Returns: Concepts of simple, compound and effective interest rates, Less often than compounding period and more once a year; Present Value, Future Value and Annuities concepts, Uniform gradient and geometric sequence of cash flow. Depreciation and Taxes: Depreciation concept, Economic life, Methods of depreciation, Gain (loss) on the disposal of an asset, Depreciation as a tax shield. Basic cost concepts and Break Even Analysis: Types of costs and cost curves; Determination of Cost/Revenues. Numerical and graphical presentations. Practical applications, BEA as a management tools for achieving financial/operational efficiency. Management: Project Management; Integration of Organization Strategy with Projects, Defining the project, developing a network plan, managing risk, reducing project time, project selection and comparing alternatives techniques scheduling resources. Introduction to System, Application and Products (SAP) in Data processing