

Engineering and Management Institute of India

Diploma in Engineering

CERAMIC ENGINEERING SYLLABUS

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Department of Ceramic Engineering

Vision:-

To strengthen the region through imparting superior quality technical education and research; which enables the fulfillment of industrial challenge and establish itself as a Centre of Excellence in the field of Ceramic Engineering.

Strength of Material (CRE-2.1)**UNIT-I**

Simple Stresses & Strains : -Elasticity and plasticity – Types of stresses & strains–Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio & volumetric strain – Elastic moduli & the relationship between them – Bars of varying section – composite bars – Temperature stresses. Strain energy – Resilience – Gradual, sudden, impact and shock loadings.

UNIT –II

Shear Force and Bending Moment Diagrams: - Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, u.d.l., uniformly varying loads and combination of these loads – Point of contra flexure.

UNIT – III

Flexural Stresses: - Theory of simple bending – Assumptions – Derivation of bending equation: $M/I = f/y = E/R$ Neutral axis – Determination bending stresses – section modulus of rectangular and circular sections (Solid and Hollow), I, T, sections. Shear Stresses: Derivation of formula – Shear stress distribution across various beams sections like rectangular, circular, triangular, I, T sections.

UNIT – IV

Thin Shells:- Definition – Thin and thick cylindrical shell Failure of thin cylindrical shell subjected to internal pressure Derivation of Hoop and longitudinal stress causes in a thin cylindrical shell subjected to internal pressure simple problems change in dimensions of a thin cylindrical shell subjected to internal pressure -problems Derivation of tensile stress induced in a thin spherical shell subjected to internal pressure simple problems change in diameter and volume of a thin spherical shell due to internal pressure.

UNIT –V

Torsion of Circular Shafts: -Theory of pure torsion, Derivation of torsion equations: $T/J=q/r=N\theta/L$ Assumptions made in theory of pure torsion-Torsional moment of resistance – Polar section modulus – Power transmitted by shafts. Thin Cylinders: Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and volumetric strains – changes in dia, and volume of thin cylinders.

Reference Book :-

- 1.Strength of Materials by (R.K. Bansal ,Laxmi Publications 2010).
2. Strength of materials by (Sadhu Singh.Khanna Publications).
3. Strength of Materials by (S.Timshenko)

Fluid Mechanics (CRE-2.2)**UNIT-I**

Fluid statics:- Dimensions and units: physical properties of fluids-specific gravity, viscosity and its significance, surface tension, capillarity, vapor pressure. Atmospheric gauge and vacuum pressure –measurement of pressure. Manometers- Piezometer, U-tube, inverted and differential manometers. Pascal's law, hydrostatic law. Buoyancy and floatation: Meta center, stability of floating body. Submerged bodies. Calculation of metacenter height. Stability analysis and applications.

UNIT –II

Fluid kinematics:- Introduction, flow types. Equation of continuity for one dimensional flow, circulation and vorticity, Stream line, path line and streak lines and stream tube. Stream function and velocity potential function, differences and relation between them. Condition for irrotational flow, flow net, source and sink, doublet and vortex flow.

Fluid dynamics:- surface and body forces –Euler's and Bernoulli's equations for flow along a stream line, momentum equation and its applications, force on pipe bend.

Closed conduit flow:- Reynold's experiment- Darcy Weisbach equation- Minor losses in pipes- pipes in series and pipes in parallel- total energy line-hydraulic gradient line.

UNIT – III

Boundary Layer Theory:- Introduction, momentum integral equation, displacement, momentum and energy thickness, separation of boundary layer, control of flow separation, Stream lined body, Bluff body and its applications, basic concepts of velocity profiles.

Dimensional Analysis:- Similitude and modelling – Dimensionless numbers.

Performance of hydraulic turbines:- Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer. Hydraulic systemshydraulicram, hydraulic lift, hydraulic coupling. Fluidics – amplifiers, sensors and oscillators. Advantages, limitations and applications.

UNIT – IV

Basics of turbo machinery:- hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency, flow over radial vanes.

of turbo machinery:- hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency, flow over radial vanes.

UNIT –V

Centrifugal pumps:- classification, working, work done – manometric head- losses and efficiencies- specific speed- pumps in series and parallel-performance characteristic curves, cavitation & NPSH.

Hydraulic Turbines:- classification of turbines, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies, hydraulic design – draft tube- theory functions and efficiency.

Reference Book :-

1. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, Kotaria & Sons.
2. Hydraulic Machines by Banga & Sharma, Khanna Publishers.

Workshop Technology (CRE-2.3)**UNIT-I****Introduction and Demonstration: -**

Introduction to various shops / sections and workshop layouts. Safety norms to be followed in a workshop should be conveyed to students.

Carpentry Shop:-

Introduction of Tools & operations, Types of woods & their applications, Types of Carpentry hardware and their uses, Carpentry Joints, carpentry operations such as marking ,sawing, planing, chiseling, grooving, boring, joining, types of woods and carpentry hardware.

UNIT –II**Fitting Shop:-**

Introduction of Tools & operations, Types of Marking tools & their uses, Types of fitting cutting tool & their uses, fitting operations such as chipping, filing, scraping, grinding, sawing, marking, drilling, tapping.

Smithy Shop:-

Tin Smithy: - Introduction of Tools like hammers, stakes, scissors etc, & operations like shearing , bending ,joining. Types of Sheet metal joints and applications. Black Smithy: Introduction of forging tools and it's operations.

UNIT – III**Metal Joining Shop: -**

Introduction of Tools, Types of welding Joint, Arc welding, Gas welding. Gas Cutting. Soldering, Brazing.

Machine Shop:-

Introduction of machine tools and operations, Demonstrations of basic machine tools like Lathe, Shaper, drilling, Milling machine and CNC with basic operations and uses.

UNIT – IV**Masonry:-**

Different types of Bricks, Different size and part of Bricks, Different types of Bonds, Types of tools used for various masonry works.

Electrical:-

Measure voltage, current, frequency, phase difference, power, power factor for single and three phase supply, Wire fan, tube light, two-way control, Wire MCB, ELCB for a given load circuit.

UNIT – V**Electronics:-**

Introduction to basic electronics components, Controller and its testing: Resistors, Inductors, Capacitor, Diode, BJT, Introduction to testing and Measurement Instruments: Power Supply, Function Generator, Oscilloscope.

Reference Book :-

1. Internal Combustion Engine by V. Ganesan.
2. Internal Combustion Engine by R.K. Rajpoot.

ENVIRONMENTAL ENGINEERING (CRE-2.4)**UNIT-I****INTRODUCTION:-**

Man and Environment: - Overview (socio-economic structure & occupational exposures) – Scope of Environmental Engineering – pollution problems due to urbanization & industrialization.

UNIT –II**AIR POLLUTION:-**

Causes of air pollution: - types & sources of air pollutants- Climatic & Meteorological effect on air pollution concentration- formation of smog and fumigation.

UNIT – III

Analysis of Air Pollutants: - Collection of Gaseous Air Pollutants- Collection of Particulate Pollutants – Analysis of Air Pollutants like : Sulphur dioxide – Nitrogen oxide – Carbon monoxide – Oxidants &Ozone – Hydrocarbons – Particulate Matter.

UNIT – IV

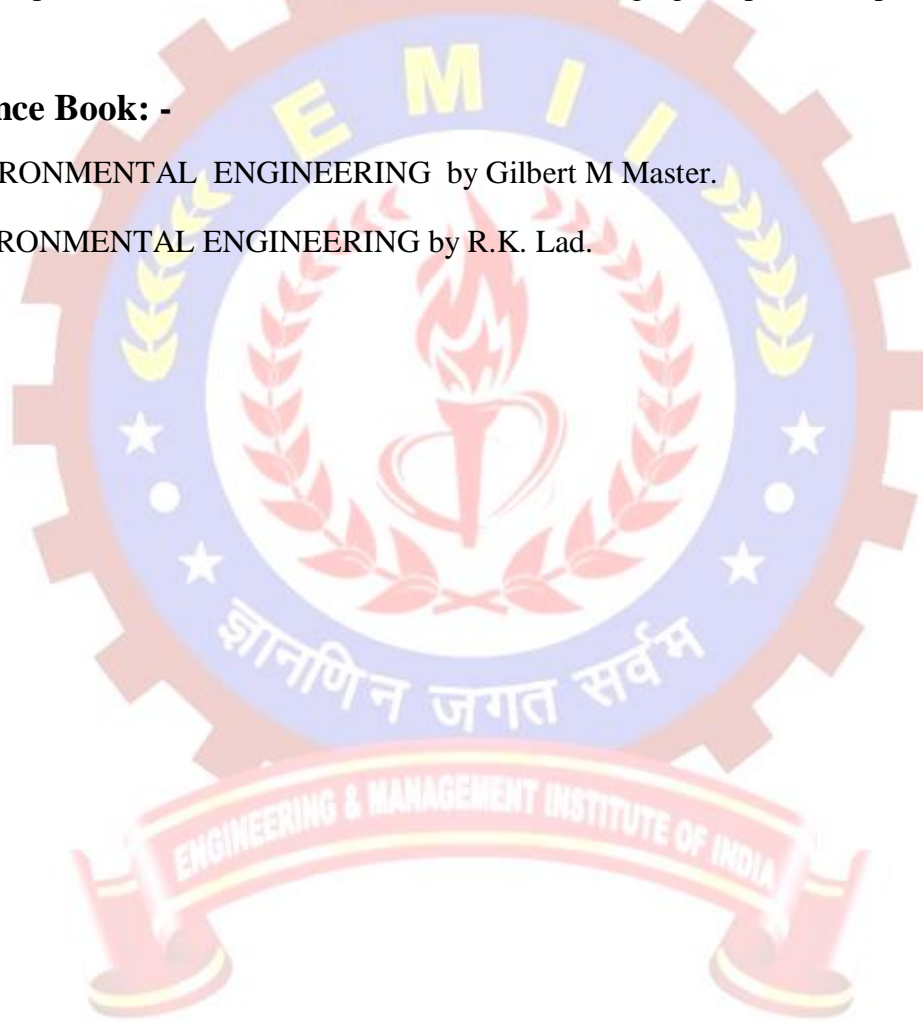
Air Pollution Control Measures & Equipment: - Control of Particulate Emission – Control of Gaseous Emission – Flue Gas Treatment Methods : Stacks Gravitational and Inertial Separation, Settling Chambers, Dynamic Separators, Cyclones, Filtration, Liquid Scrubbing, Spray Chambers, Packed Towers, Orifice and Ventury Scrubbers, Electrostatic Precipitators, Gas/solid Adsorption, Thermal Decomposition.

UNIT –V

Methods & Approach of Air Pollution Control: - Controlling smoke nuisance – Develop air quality criteria and practical emission standards – Creating zones suitable for industry based on micrometeorology of air area – Introducing artificial methods of removal of particulate and matters of waste before discharging to open atmosphere.

Reference Book: -

1. ENVIRONMENTAL ENGINEERING by Gilbert M Master.
2. ENVIRONMENTAL ENGINEERING by R.K. Lad.



MATERIAL SCIENCE & ENGINEERING (CRE-2.5)**UNIT-I**

Introduction and structure of materials: - study properties of materials? Structure of atoms - Quantum states-Atomic bonding in solids-binding energy-inter atomic spacing - variation in bonding characteristics - Single crystals – polycrystalline - Non crystalline solids - Imperfection in solids – Vacancies – Interstitials - Geometry of dislocation - Schmid’s law - Surface imperfection - Importance of defects - Microscopic techniques - grain size distribution.

UNIT-II

Solid solutions and alloys - Phase diagrams - Gibbs phase rule - Single component systems – Eutectic phase diagram – lever rule - Study of properties of phase diagrams - Phase transformation - Nucleation kinetics and growth.

UNIT – III

Band model of semiconductors - carrier concentrations in intrinsic, extrinsic semiconductors – organic semiconductors - Fermi level - variation of conductivity, mobility with temperature – law of mass action - Hall effect - Hall coefficients for intrinsic and extrinsic semiconductors – Hall effect devices. Application of diffusion in sintering, doping of semiconductors and surface hardening of metals.

UNIT – IV

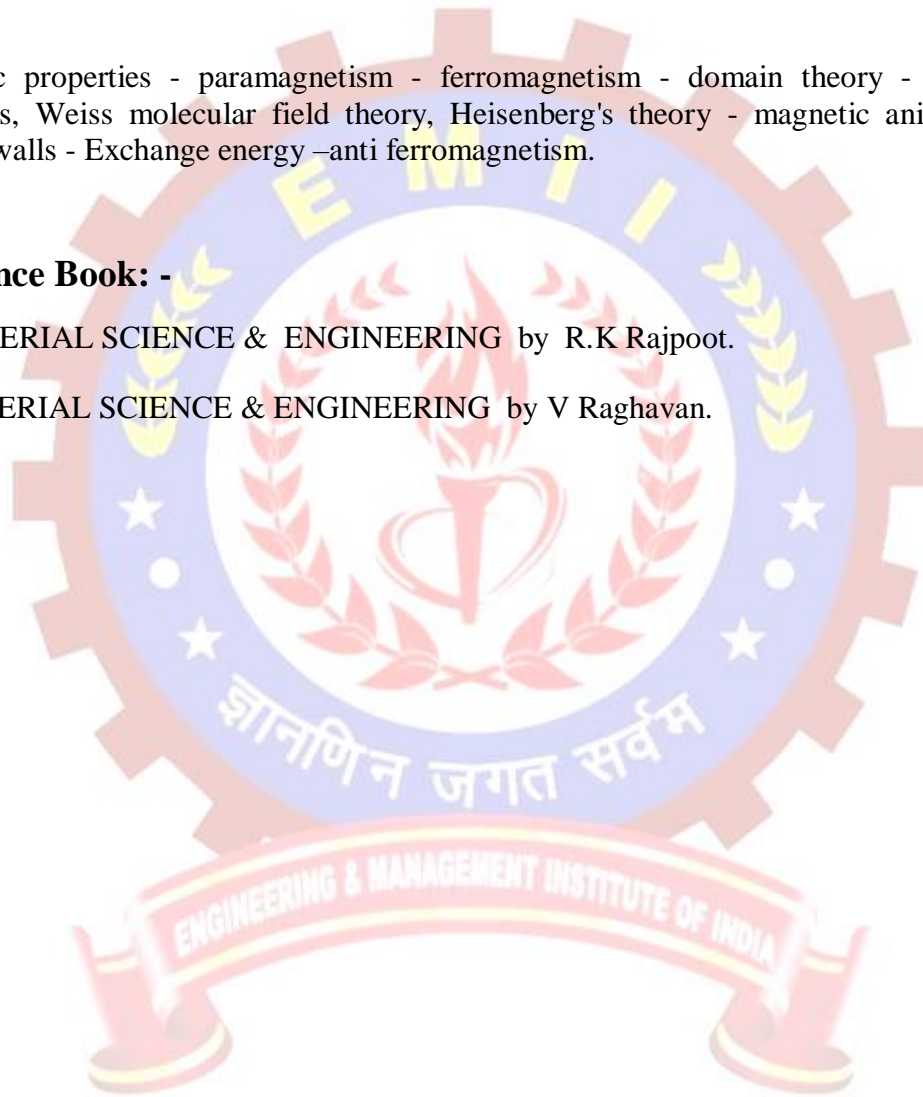
Mechanical properties - Stress, Strain, Elastic properties – Deformation – elasticity – hardness - Optical properties - Light interaction with solids - Atomic, electronic interaction, non – radiative transition - refraction, reflection, Absorption, Transmission, Insulators, luminescence.

UNIT –V

Magnetic properties - paramagnetism - ferromagnetism - domain theory - magnetic hysteresis, Weiss molecular field theory, Heisenberg's theory - magnetic anisotropy - domain walls - Exchange energy –anti ferromagnetism.

Reference Book: -

1. MATERIAL SCIENCE & ENGINEERING by R.K Rajpoot.
2. MATERIAL SCIENCE & ENGINEERING by V Raghavan.



HEAT & MASS TRANSFER (CRE-2.6)**UNIT-I****Introduction to Heat transfer: -**

Introductory concepts, modes of heat transfer – conduction, convection and radiation, Basic equations and applications,

UNIT –II**Conduction: -**

one dimensional heat conduction without heat generation, composite walls, cylinders and spheres, electrical analogy of thermal systems and critical thickness of insulation. Heat transfer through extended flat and circular surfaces (Fins) : General equation, , heat flow, fin efficiency, fin effectiveness.

UNIT – III**Convection: -**

Concept of Natural and forced convection, concept of viscous and thermal boundary layers, Natural convection: Grashoff number, constant heat flux, horizontal flat surfaces, simplified correlation for air, combined free and forced convection. Forced Convection: Dimensional analysis, Nusselt number, force convection for internal laminar flow.

UNIT – IV**Radiation: -**

Definition and laws of thermal radiation, black body, real surfaces, gray surfaces, radiation properties, radiation shield, gas radiation basics only.

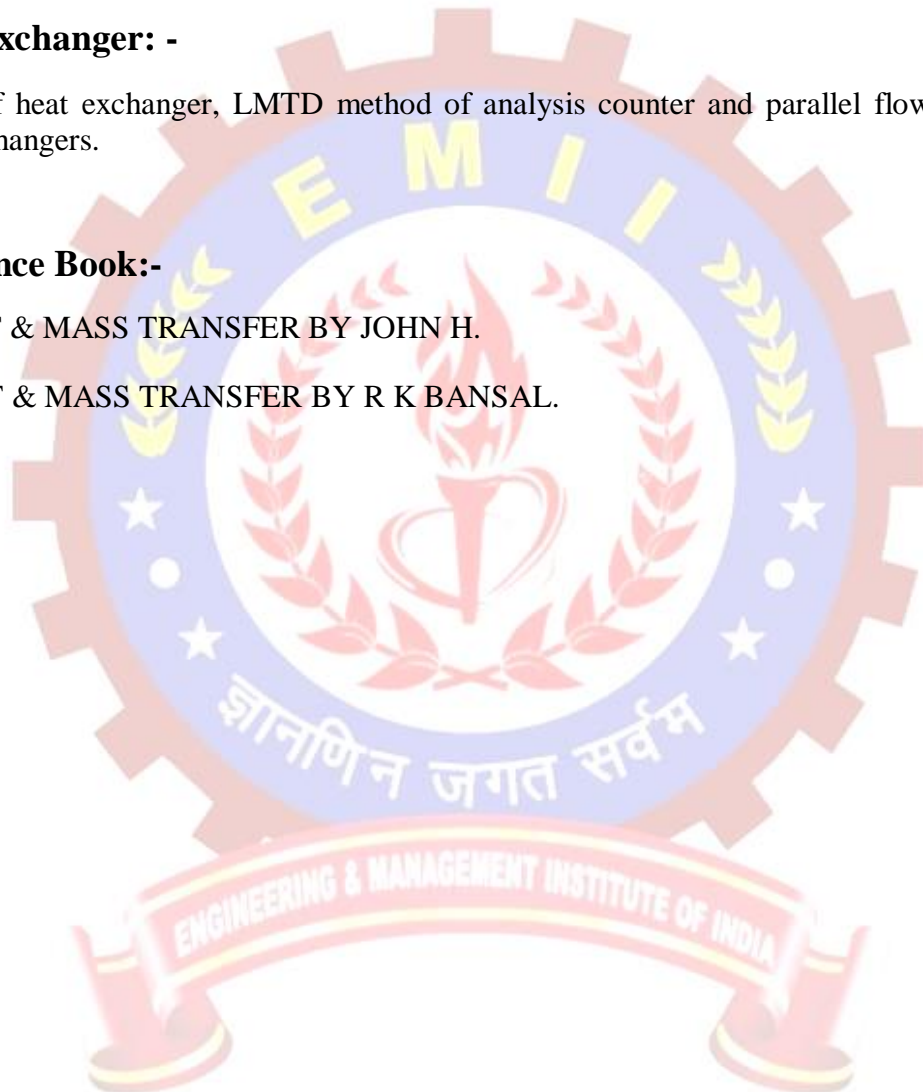
UNIT -V

Heat Exchanger: -

Types of heat exchanger, LMTD method of analysis counter and parallel flow, storage type exchangers.

Reference Book:-

1. HEAT & MASS TRANSFER BY JOHN H.
2. HEAT & MASS TRANSFER BY R K BANSAL.



MANUFACTURING PRACTICE (CRE-2.7)**UNIT-I**

Unconventional Machining Methods: - Limitations of conventional machining. Working Principle, operating parameters and application of unconventional machining . Electro Chemical Machining, Chemical Machining, Electric Discharge Machining, Electron beam Machining, Ultra Sonic Machining, Abrasive Jet Machining, LASER Beam Machining, Plasma Arc Machining.

Coating & Deposition processes: - plating & related processes, physical vapor deposition, chemical vapor deposition, Organic Coating,

Rapid Prototyping: - Need, Fundamentals, Technologies and applications.

UNIT –II

Manufacturing Automation: - Introduction to Numerical control, Computer Numerical control, Direct Numerical Control, CNC Millings M/c, CNC Turning M/c, Turn mill centers, flexible manufacturing system, Preliminary idea of robotics. Introduction to G and M code as used in part programming. Use of Canned cycles. Simulation of parts, drawing generated through CAD, its modeling and transfer.

Flexible Manufacturing systems: - Elements, Limitations, Feature & Characteristics, New development.

Robotics: - Introduction to robotics, concept, and application, A4 level automation.

UNIT – III

Total Quality Management (TQM): - Evolution, definition, preparation stages in TQM implementation, Integrated TQM model, customer satisfaction, Employee involvement. Continuous Process Improvement, 5s, Kaizen, and KANBAN, Supplier Partnership, Performance Measures. Just in Time systems (JIT) – Introduction, application and advantages.

Total Productive Maintenance (TPM): - Introduction, Plan, New Philosophy Improvement needs, Six Major losses Life cycle costing, work groups.

UNIT – IV

Introduction to Quality Standards: - ISO 9000- Introduction History, Indian Equivalence, System requirements for ISO 9001, 9002, 9003, steps for installation, How to apply. QS 9000 Quality Management systems. ISO 14001- Introduction, Environment Management system, Background, vocabulary and Application, OHSAS 18001- Occupational Health and Safety Assessment Series. Introduction, scope, related terms, structure and operating features 36 TS 16949 – Quality system certificate consisting following standard APQP – Advance product quality planning FMEA - Failure mode and effect analysis MSA – Measurement system analysis.

UNIT –V

Lean manufacturing: - System design for Lean manufacturing adopting.

Six Sigma systems: - Basics of Six Sigma, competitive advantage of implementing six sigma systems. Briefs of what, why and how six sigma works to initiate and sustain greater productivity, profitability and customer satisfaction rates.

Reference Book:-

1. MANUFACTURING PRACTICE BY JOHN H.
2. MANUFACTURING PRACTICE BY R K BANSAL.

HUMANITIES (CRE-2.8)**UNIT-I**

Concept and Nature of Communication: - What is communication? Stages of communication. Ideation, encoding, transmission, decoding & response. Channels of communication. Communication in organizational settings. Etiquettes in social and Office settings. Work culture in Jobs. Barriers to effective communication. Guidelines to overcome communication barriers.

UNIT –II

Self Development and Assessment: - Self Assessment, Awareness,. Personal goal Setting.

Effective presentation: - Pre- presentation jitters. Preparation and practice. Delivering the presentation. Qualities of a skilful presenter. Capturing and maintaining attention. Handling questions Power point presentations.

UNIT – III

Nature and Mechanics of Writing (Basic Writing Skills): - Techniques for writing precisely: Defining. Describing, Classifying. Use of Phrases and Clauses in sentences Importance of Proper Punctuation. Organizing Principles of Paragraphs in documents.

UNIT – IV

Technical Writing: - Importance, structure and drafting and revising of Technical Reports. Technical writing style and Language. Business writing: Letters, 6 Approved in Academic Council held on 25.10.2018 Preparing resume, notices, agenda and minutes of meeting.

Vocabulary Development: - Word Formation. Derivatives: Prefixes & Suffixes. Root words. Synonyms, Antonyms, Homophones and Homonyms. One word substitution.

UNIT –V

Grammar and Usage: - Subject-Verb Agreement. Noun-Pronoun Agreement. Prepositions, Articles.

Identifying Common errors in writing: - Redundancies, Clichés, Misplaced modifiers, words often confused and misused.

Reference Book:-

1. HUMANITIES BY DAVID PAGE.
2. HUMANITIES BY JAGBIR SINGH.

CERAMIC RAW MATERIAL (CRE-2.9)**UNIT-I**

Technical Ceramics: -Purification of raw materials, shaping techniques, and firing techniques, Electrical Ceramics, Electronic Ceramics, Ceramic Composites, Magnetic Ceramics, Nuclear Ceramics and other Structural Ceramics. Stabilized Zirconia and products, Alumina products, Ceramic Laboratory.

UNIT –II

Refractories :- Classification, properties and fabrication techniques of Refractories, Insulating Refractories, Kiln furniture and accessories, Refractory Cements and mortars , Alumino silicate Refractories, Silica Refractories, Dolomite Refractories, Magnesite Refractories, Chrome-Magnesite Refractories, Mag-Chrome Refractories, Carbon Refractories, Chromite Refractories. Super Refractories properties and uses, refractory laboratory.

UNIT – III

Glass: -Raw materials, Classification of glass making raw materials, Batch preparation, weighing, mixing, Conveying and Charging, Glass melting process, Types of furnaces, Types of fabrication techniques for Containers, Sheet glass, Float glass, optical glasses, safety glass, Tubes, Annealing, Tempering, Decoration, Testing and Quality Control of glass, Special glasses, Heat resistant glasses, Fiber glass, Glass ceramics, Glass Laboratory.

UNIT – IV

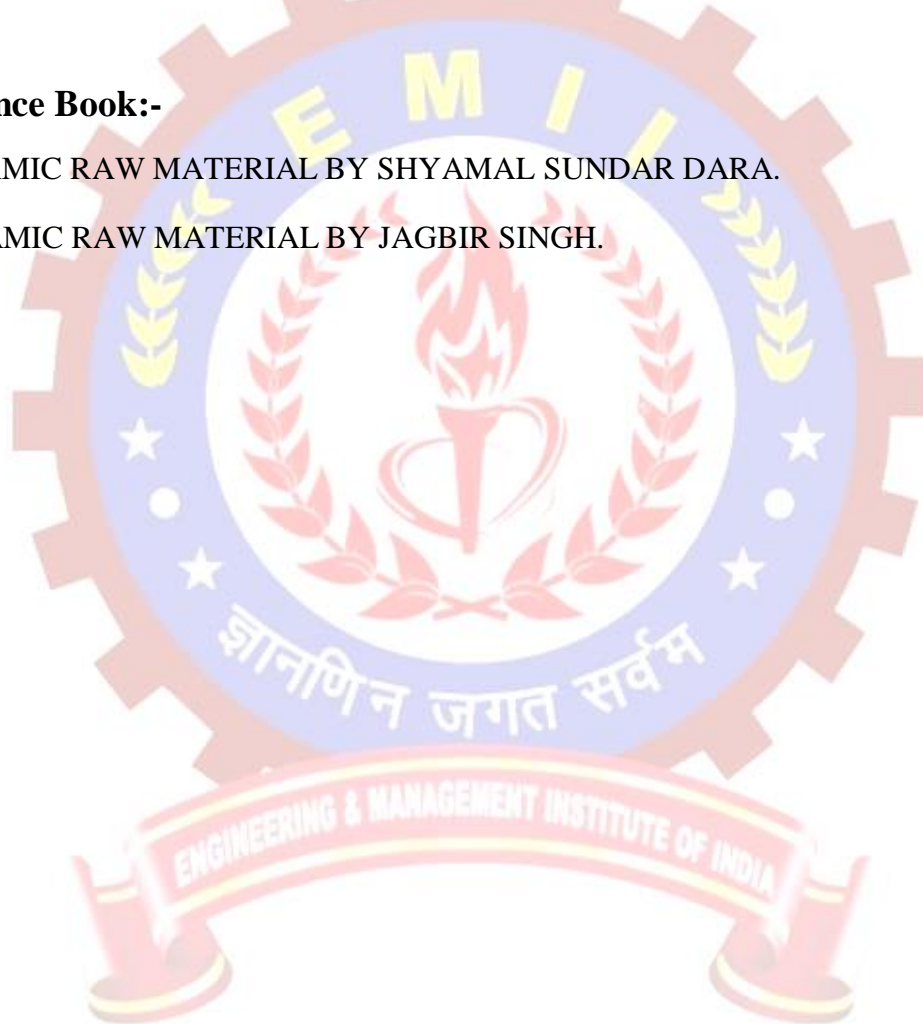
Enamel: -Raw materials, Enamel Compositions, Batch preparation, Metal treatment of enamels, Application of enamel and firing of enamels, Defects and decoration, Batch compositions of glazes, Glaze preparation, Firing, Defects and testing of Lead glazes, Leadless glazes, Feldspathic & Calcareous glazes, Enamel laboratory.

UNIT –V

Cement Tech: -Raw materials lime stone and limes, Batch preparation, Mixing, Types of manufacturing process, Natural Cements, Portland Cements, Special Cements, and Rotary kilns, Cement laboratory (Physical Testing and Chemical Analysis) .

Reference Book:-

1. CERAMIC RAW MATERIAL BY SHYAMAL SUNDAR DARA.
2. CERAMIC RAW MATERIAL BY JAGBIR SINGH.



UNIVERSAL HUMAN VALUES (CRE-2.10)**UNIT-I****Course Introduction - Need, Basic Guidelines, Content and Process for**

Value Education: - Understanding the need, basic guidelines, content and process for Value Education 2. Self-Exploration–what is it? - its content and process; ‘Natural Acceptance’ and Experiential Validation- as the mechanism for self-exploration 3. Continuous Happiness and Prosperity- A look at basic Human Aspirations 4.Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority 5.Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario6. Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

UNIT –II**Understanding Harmony in the Human Being - Harmony in Myself: -**

1. Understanding human being as a co-existence of the sentient ‘I’ and the material the Body’ 2. Understanding the needs of Self (‘I’) and ‘Body’ - Sukh and Suvidha 3. Understanding the Body as an instrument of ‘I’ (I being the doer, seer and enjoyer) 4. Understanding the characteristics and activities of ‘I’ and harmony in ‘I’ 5. Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail 6. Programs to ensure Sanyam and Swasthya - Practice Exercises and Case Studies will be taken up in Practice Sessions.

UNIT – III

Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship: - 1. Understanding Harmony in the family – the basic unit of human interaction 2. Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; a. Trust (Vishwas) and Respect (Samman) as the foundational values of relationship 3. Understanding the meaning of Vishwas; Difference between intention and competence 4. Understanding the meaning of Samman, Difference between respect and differentiation;

the other salient values in relationship 5. Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitvaas comprehensive Human Goals 6. Visualizing a universal harmonious order in society- Undivided Society (AkhandSamaj), Universal Order (SarvabhaumVyawastha)- from family to world family!.

UNIT – IV

Understanding Harmony in the Nature and Existence - Whole existence as Coexistence: - 1. Understanding the harmony in the Nature 2. Interconnectedness and mutual fulfillment among the four orders of nature-recyclability and self-regulation in nature 3. Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space 4. Holistic perception of harmony at all levels of existence.

UNIT –V

Implications of the above Holistic Understanding of Harmony on Professional Ethics: -1. Natural acceptance of human values 2. Definitiveness of Ethical Human Conduct 3. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order.

Reference Book:-

1. UNIVERSAL HUMAN VALUES BY SHYAMAL SUNDAR DARA.
2. UNIVERSAL HUMAN VALUES BY JAGBIR SINGH.

GLASS ENGINEERING (CRE-2.11)**UNIT-I**

Glass:- Definition of glass, model of glass structure, types and composition of glass, Glass constituents and batch ingredients, decolourisers and refining agents, batch calculation, batch preparation.

UNIT –II

Glass melting: - Fundamental of glass formation, factors that influence glass formation, Zachariasen's rules, kinetic & thermodynamic criteria for glass formation, nucleation and crystal growth, TTT diagram, structural models of silicate and non- silicate glasses, bridging and non-bridging oxygen, tank furnaces, feeding of glass batches, melting process, refining of glass, batch redox number, electric heating, cold top furnace, pot melting.

UNIT – III

Quality control of glasses: - control of compositions, measurement of density, thermal expansion, viscosity, liquid immiscibility and phase separation in glasses structural theories of liquid immiscibility, thermodynamics of liquid immiscibility, mechanism of phase separation, chemical durability of glass. Fabrication: pressed and blown wares, flat glass, tubing and bulbs, fiber glass.

UNIT – IV

Defect: - Defect in glass, stones, seeds, cords and blisters, gas inclusion, entrapped gas in batch, decomposition of batch materials, bubbles from refractory, nucleation and growth of bubbles from a supersaturated, detection of gases contained in bubble, detection of vitreous inclusions, removal of vitreous inclusion, crystalline inclusion, batch stones, refractory inclusion.

UNIT –V

Glass–Ceramics: - Definition, production of glass-ceramics, description & application of various glass ceramics, types of glass ceramic; photosensitive lithium aluminum silicate, magnesium aluminum silicate, machinable glass ceramics, bio-active glass ceramics, sintered glass ceramics.

Special Glasses: - Technology of making radiation shielding glasses, heat absorbing glasses, solder glasses. Optical properties of glass, optical glass, photosensitive glasses, coating of glass, colored glass including photochromic and electrochromic glass.

Reference Book:-

1. GLASS ENGINEERING BY U K SINGH.
2. GLASS ENGINEERING BY GAVIN TOWLER.

ADVANCE CERAMICS(CRE-2.12)**UNIT-I**

INTRODUCTION TO ADVANCE CERAMIC: -Introduction of advance ceramic 1.2 Characteristics of Advance ceramic 1.3 Important and application of advance Ceramic 1.4 Raw materials for advance ceramic. 1.5 Difference between conventional ceramic and Advance ceramic. 1.6 General preparation &Fabrication of advance ceramic.

UNIT –II

HIGH TEMPERATURE CERAMICS: -Introduction of High Temperature Ceramics. 2.2 Explain the properties and application of the 2.3 Oxide Ceramics. 2.4 Explain the properties and uses of carbide, boride, and nitride ceramic. 2.5 Advance ceramic materials & Components for high temperature use. 2.6 Ceramic heating elements.

ELECTRICAL CERAMICS: -Define Dielectric ceramics, Properties & application. 3.2 Ferro Electric and pyroelectric ceramics, piezoelectric ceramic products, their properties & application. 3.3 Low loss ceramic & their application. 3.4 High and low tension electrical porcelain their manufacturing and application.

UNIT – III

MAGNETIC CERAMIC: - Introduction to magnetic ceramic 4.2 Spinel ferrite 4.3 Hexagonal ferrite 4.4 Preparation of ferrite 4.5 Difference between hard ferrite and soft ferrite. 4.6 Application of ferrite.

UNIT – IV

MECHANO-CERAMICS: - Abrasive materials and abrasive grain. 5.2 Manufacturing of abrasive grain and its application 5.3 Ceramic grinding and cutting wheel. Manufacturing and application.

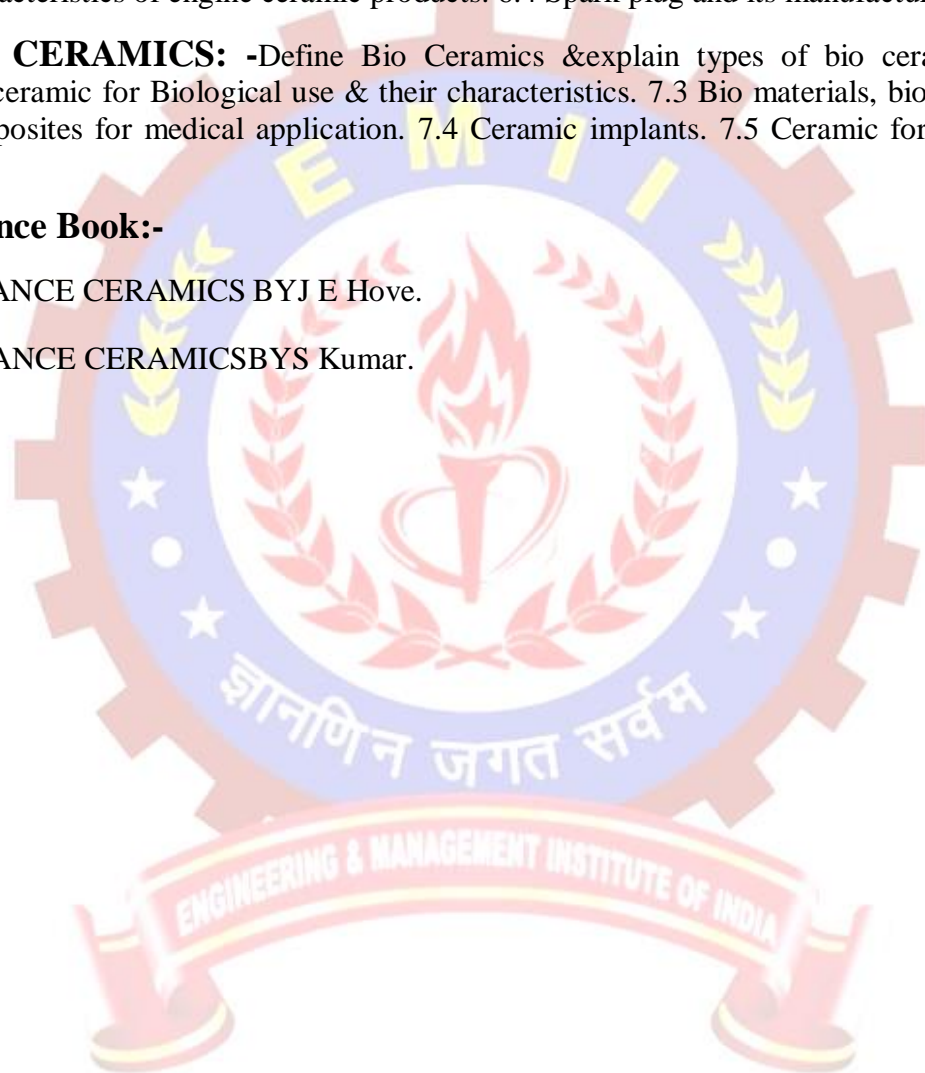
UNIT –V

ENGINE CERAMIC: -Introduction to engine ceramic 6.2 Ceramic for automobile. 6.3 Characteristics of engine ceramic products. 6.4 Spark plug and its manufacturing.

BIO – CERAMICS: -Define Bio Ceramics & explain types of bio ceramic. 7.2 Special ceramic for Biological use & their characteristics. 7.3 Bio materials, bio- glass & bio-composites for medical application. 7.4 Ceramic implants. 7.5 Ceramic for artificial teeth.

Reference Book:-

1. ADVANCE CERAMICS BY J E Hove.
2. ADVANCE CERAMICS BY S Kumar.



CERAMIC FABRICATION PROCESSES (CRE-2.13)**UNIT-I**

SLIP FORMING PROCESS: -Introduction. Slip- selection of materials, particle size measurement, viscosity, surfactant concentration, binders, pH, zeta potential, settling, solid recovery, slip recovery, slip conditioning and storage. Plaster mould – process, preparation. Slip casting – methods, mechanisms.

UNIT-II

PLASTIC FORMING PROCESS: -Plastic mass preparation – pug mill, pugging defects. Shaping methods – extrusion, jiggering, injection molding, roller machine, compression molding.

UNIT – III

DRY FORMING PROCESS: -Theory of packing. Pressing- Uniaxial pressing – stress distribution on green body – defects and remedies, vibration compaction, isostatic pressing, reactive hot pressing – advantages – defects and remedies.

UNIT – IV

DRYING AND FINISHING: -Mechanism of drying – transfer of heat – factors that control drying – types of dryers – intermittent and continuous dryers – process of drying – drying defects – finishing – cutting and trimming – sponging, fettling and towing – scumming.

UNIT –V

FIRING: -Action of heat on ceramic bodies – physical changes, chemical changes. Firing equipments, firing schedules – fast firing, firing range. Problems, defects. Liquid phase sintering, vitrification, microstructure control.

Reference Book:-

- 1.CERAMIC FABRICATION PROCESSES BY Alan G. King.
- 2.CERAMIC FABRICATION PROCESSES BY James S. Reed.



ENVIRONMENTAL STUDIES (CRE-2.14)**UNIT-I**

Introduction:- Basics of ecology, eco system- concept, and sustainable development, Resources renewable and non renewable.

Air Pollution: - Source of air pollution. Effect of air pollution on human health, economy, plant, animals. Air pollution control methods.

UNIT –II

Water Pollution: - Impurities in water, Cause of water pollution, Source of water pollution. Effect of water pollution on human health, Concept of dissolved O₂, BOD, COD. Prevention of water pollution- Water treatment processes, Sewage treatment. Water quality standard.

UNIT – III

Soil Pollution: - Sources of soil pollution. Types of Solid waste- House hold, Hospital, From Agriculture, Biomedical, Animal and human, excreta, sediments and E-waste. Effect of Solid waste. Disposal of Solid Waste- Solid Waste Management.

UNIT – IV

Noise pollution: - Source of noise pollution, Unit of noise, Effect of noise pollution, Acceptable noise level, Different method of minimize noise pollution.

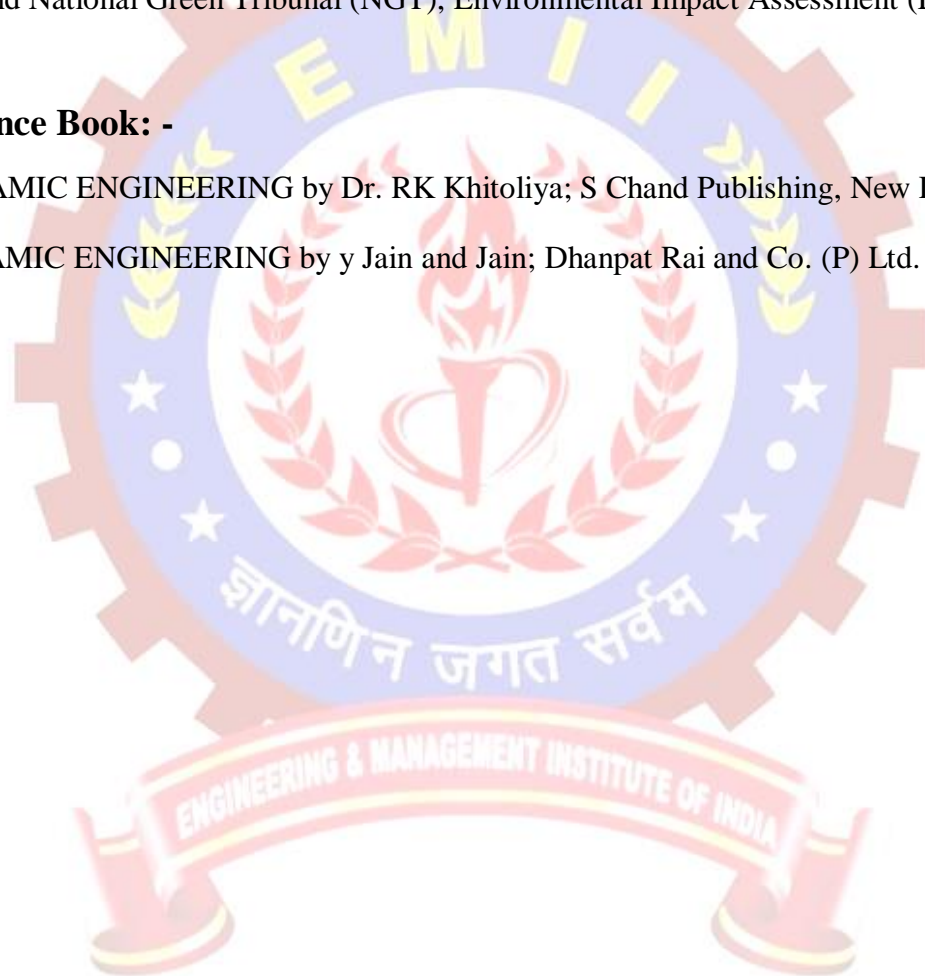
Impact of Energy Usage on Environment: - Global Warming, Green House Effect, Depletion of Ozone Layer, Acid Rain. Ecofriendly Material, Recycling of Material, Concept of Green Buildings.

UNIT -V

Environmental Legislation: - Introduction to Water (Prevention and Control of Pollution) Act 1974, Introduction to Air (Prevention and Control of Pollution) Act 1981 and Environmental Protection Act 1986, Role and Function of State Pollution Control Board and National Green Tribunal (NGT), Environmental Impact Assessment (EIA).

Reference Book: -

1. CERAMIC ENGINEERING by Dr. RK Khitoliya; S Chand Publishing, New Delhi.
2. CERAMIC ENGINEERING by y Jain and Jain; Dhanpat Rai and Co. (P) Ltd. Delhi.



BACIS CERAMIC STUDIES (CRE-2.15)**UNIT-I**

INTRODUCTION TO CERAMIC MANUFACTURING: -Various steps for manufacturing ceramic. 1.2 Various machines used in manufacturing process. 1.3 Kiln used for ceramic firing. 1.4 Important factors relating to ceramic making. 1.5 Important tests for ceramic production quality assessment.

UNIT –II

SIZE REDUCTION: - Various types of machines used in size reduction . 2.2 Discuss various methods of crushing & grinding. 2.3 Various factors influencing grinding efficiency & special emphasis on ball mill 2.4 Particle size analysis and various sieves and equipment used for it. 2.5 Fundamental ideas on furnace model of packing, Theory of settling, application of stoke's law.

UNIT – III

FORMING METHODS AND FORMING MACHINE: -Body preparation and machines used for it. 3.2 Basic ideas on the principle of operation of machines for body preparation such as Blunger, Agitator, Filter press, Spray drier, Pug mill etc. 3.3 Fundamental ideas on refractory batch making and machines used for it, Such as mixing machines. 3.4 Forming methods and machines used for it for white ware making. 3.5 Principle of operation of potter's wheel, jigger& jolly, roller head, pan mill, press etc. 3.6 Basic ideas on various types of pressing machines for refractory shaping. Special emphasize on FSP, Hydraulic press, Isostatic press.

UNIT – IV

DRYING AND DRIERS: -Various stages of Drying of ceramic wares 4.2 Discuss on changes on drying and various external parameters on drying. 4.3 Various drying defects and their elimination. 4.4 Description of various types of industrial dryers and special emphasize on tunnel drier.

UNIT –V

FIRING BEHAVIOR: -1 Discuss various changes on firing. 5.2 Various type of firing operation. 5.3 Various stages of firing of ceramic ware. 5.4 Explain various firing defects and their elimination. 5.5 Basic ideas on calcinations, sintering, vitrifications, fusion and melting. 5.6 Advance firing process in ceramic making. 5.7 Kiln, kiln accessories, conveyer and feeders need for manufacturing process.

Reference Book: -

1. CERAMIC ENGINEERING by Dr. RK RAJPOOT New Delhi.
2. CERAMIC ENGINEERING by y Jain and Jain; Delhi.

Entrepreneurship Development & Management (CRE- 2.16)**UNIT-I**

Introduction:- Meaning and Importance, Evolution of term 'Entrepreneurship, Factors influencing entrepreneurship, Psychological factors, Social factors, Economic factor, Environmental factors, Characteristics of an entrepreneur, Entrepreneur and Entrepreneur, Barriers to entrepreneurship.

Types of entrepreneur:- According to Type of Business, According to Use of Technology, According to Motivation, According to Growth, According to Stages, New generations of entrepreneurship viz. social entrepreneurship, Edupreneurship, Health entrepreneurship, Tourism entrepreneurship, Women entrepreneurship etc.

UNIT –II

Entrepreneurial Motivation:- Motivation, Maslow's theory, Herzberg's theory, McGrigor's Theory, McClelland's Need – Achievement Theory, Culture & Society , Values / Ethics , Risk taking behavior.

Creativity:- Creativity and entrepreneurship, Steps in Creativity, Innovation and inventions, Using left brain skills to harvest right brain ideas, Legal Protection of innovation, Skills of an entrepreneur, Decision making and Problem Solving (steps indecision making).

UNIT – III

Organisation Assistance:- Assistance to an entrepreneur, New Ventures, Industrial Park (Meaning, features, & examples), Special Economic Zone (Meaning, features & examples), Financial assistance by different agencies, MSME Act Small Scale Industries, Carry on Business (COB) licence, Environmental Clearance, National Small Industries Corporation (NSIC), Government Stores Purchase scheme (e-tender process), Excise exemptions and concession, Exemption from income tax, Quality Standards with special reference to ISO, Financial assistance to MSME, Modernisation assistance to small scale

unit, The Small Industries Development Bank of India(SIDBI), The State Small Industries Development Corporation(SSIDC), Export oriented units, Incentives and facilities to exports entrepreneurs, Export-Import Bank of India, Export oriented zone.

UNIT – IV

Rules And Legislation:- Applicability of Legislation, Industries Development (Regulations) Act, 1951., Factories Act, 1948, The Industrial Employment (Standing Orders) Act, 1946, Suspension, Stoppage of work, Termination of employment, West Bengal Shops and Establishment Act, 1963, Environment (Protection) Act, 1986, The sale of Goods Ac, 1950, Industrial Dispute Act 1947.

Project Report:- Introduction, Idea Selection, Selection of the Product / Service, Aspects of a Project, Phases of a Project, Project Report, Contents of a Project Report, Proforma of a Suggested Project Report for a manufacturing Organization, Suggested Readings.

UNIT –V

Agencies for industrial assistance:- West Bengal Electronics Development Corporation, ICICI West Bengal Infrastructure Development Corporation, West Bengal Industrial Infrastructure Development Corporation, Other Corporations with focus as specific segments, State Industrial Development Corporation (SIDC), State Financial Corporation (SFCs), Directorate General of Supplies and Disposals(DGS & D), Registration with DGS & D, Registration Categories, Registration Procedure, Benefits of DGS & D, Information facilities centre in DGS & D, Khadi and Village Industries Commission (KVIC), Industrial Estate, Financing of Industrial Estates, Shilpabandhu-M Incentives for entrepreneurs 9reference to The West Bengal State Support for Industries Scheme 2008 & 2013.

Reference Book :-

1. Entrepreneurial Development, by S S Khanka.
2. The Entrepreneur, by Mark Casson.

Industrial Management (CRE-2.17)**UNIT-I**

Basic of Management:- Management - Definition – Administration- Definition – Henry-Fayol’s principles of management- Business Organisation-Types- Proprietorship-Partnership- Joint stock- Cooperative Society-Advantages and disadvantages -Functions of Management – Planning-Definition-Functions- Organisation-Definition- types of organisation –Line-Functional-Line &staff- advantages and disadvantages- Leadership -Types –Quality of good leader- Motivation - Maslow’s Theory of Motivation -Hierarchy of needs- Communication - Process of Communication – Barriers for effective communication.

UNIT –II

Production Management:- Concept of project work - Project planning -Market survey- Project capacity-selection of site for project- Plant layout-Types of Plant layout- Product design-Stages in product design-drawing-Specifications-Material requirement- operation-Planning-Production-definition-Job, Batch & Mass production with their advantages and disadvantages-Productivity-definition-factors to improve productivity- Production planning and Control (PPC)-definition-Functions of PPC- planning, routing, scheduling, dispatching and Inspection-Introduction to CPM and PERT –Comparison.

UNIT – III

Material Management: - Material management - definition, functions- Purchase - Objectives, different methods of purchasing -Purchase procedure-Comparative statement-purchase order-Tender-Types of tender- Storekeeping- classification of stores - Functions of store keeper. Store management-Bin Card - Material Issue Requisition- Material Returned Note- Store ledgers -Codification of stores-Inventory Management- Definition - functions of Inventory Control- Advantages of Inventory Control. Material management - definition, functions- Purchase - Objectives, different methods of purchasing -Purchase procedure-Comparative statement-purchase order-Tender-Types of tender- Storekeeping- classification of stores - Functions of store keeper. Store management-Bin Card - Material Issue Requisition- Material Returned Note- Store ledgers -Codification of stores-

Inventory Management- Definition - functions of Inventory Control- Advantages of Inventory Control.

UNIT – IV

Total Quality Management:- Quality–Concept–Quality control- Definition - Factors affecting quality- Advantages of quality control –Inspection–Different types of inspection Total Quality Management–Meaning- Principles of total quality management–PDCA cyclesQuality Circles–definition–Function. TQM Tools- Flow charts, Control charts, Histograms, Pareto charts, Cause and effect diagram–5-S- Kaizen, and Six-sigma Quality Certification Systems- ISO 9000 series quality standards, QS14000– ISO 9000, ISO 9001,ISO9002,ISO9003 & ISO 9004- ISO9000 quality certification procedure.

UNIT –V

Plant Maintenance and Industrial Safety:- Plant maintenance–Definition -Types of maintenance–Preventive maintenance- Break down maintenance–Advantages and disadvantages- Total Productive Maintenance–Meaning benefits of TPM -Tools of TPM–planned maintenance and predictive maintenance. Industrial safety –Meaning - Accident–causes for accident- Direct and indirect losses due to an accident–Personal protective devices for preventions of accidents–Safety department- role of safety officer – safety supervisor -safety committee – Fire prevention and Protection- Fire triangle–principles of fire extinguishing- various classes of fire- A, B,C, D types of fire extinguishers.

Reference Book :-

1. Industrial Engineering and Management by S. C. Sharma, T. R. Banga.
2. Industrial Engineering and Management by Ravi, V.

Final year Project

Project (CRE-2.18)

Select any one topic:-

1. Polymer fiber Reinforced Concrete Pavements.
2. Waste & Recycled Material in Concrete technology.
3. Highway Network System.
4. Design Of Under Ground water System.
5. Treatment of Waste Water.
6. Hydraulic Bridge.
7. Determination of Road Profile in an area.
8. Noise Absorbing Composite Materials Using Agro waste Products.