Faculty of Engineering & Technology

Study and Evaluation Scheme

Of

Bachelor of Technology

B.Tech. – CEMENT TECHNOLOGY

II, III & IV Year

(Applicable w.e.f Academic Session 2013-16 till revised)

AKS UNIVERSITY, SATNA

Study and Evaluation Scheme

** The University Authorities reserve all the rights to make any additions/ deletions or changes/ modifications to this syllabus as deemed necessary.

AKS University, Satna

Sherganj, Panna Road, Satna (MP) 485001

Study & Evaluation Scheme
of
Bachelor of Technology (Cement Technology)
SUMMARY

Programme :   **B.Tech (CT)**

Duration :   Four year full time (Eight Semesters)

Medium :   English

Minimum Required Attendance : 75 %

Maximum Credits: 168+54 (First Year)= **222**

Evaluation Assessment :	**Internal**	**External**	**Total**
	50	100	150

Internal Evaluation (Theory/ Practical Papers)

	Sessional-I	**Sessional-II**	**Continuous Assessment & attendance**
	10	10	10+20= 30
Duration of Examination :	**External**	**Internal**	
	3 hrs.	2 hrs	

To qualify the course a student is required to secure a minimum of 36% marks in aggregate including the semester end examination, internal assessment evaluation (Both theory & Practical Papers)

A candidate who secures less than 36% or Grade **'D'** of marks in a Subject/Paper(s) shall be deemed to have failed in that Subject/Paper(s). In case a student has secured less than 36% or Grade **'R'** in Subject/Paper(s), he/she shall be deemed to re-appear (ATKT Examination) in Subject/Paper(s) to achieve the required percentage (Min. 36%) or grade (Min. D) in the Subject/Paper(s).

Question Paper Structure

1. *The question paper shall consist of 26 questions in three Sections. Out of which Section-A shall be of Objective type 10 questions and will be compulsory. (weightage 2 marks each).*
2. *Section-B shall contain 10 Short answer type questions and students shall have to answer any eight (weightage 5marks each).*
3. *Out of the remaining six question s are long answer type questions, student shall be required to attempt any four questions. The weightage of Questions shall be 10 marks each.*

Faculty of Engineering & Technology

Department of Cement Technology

B.Tech. and B.Tech+M.Tech (Integrated)

(Cement Tech.)

Semester- III

TEACHING & EXAMINATION SCHEME

Code No.	Subject	L	T	P	Total Credit
04MS301	Engineering Mathematics III	3	1		4
04CT302	Process Calculation	3	1		4
04ME303	Fundamental & Advance Thermodynamics	3	1		4
04ME304	Strength of Material	3	1		4
04CT305	Introduction to Cement & Cement Raw Material	3	1		4
04GE306	Geology and Mining of Limestone Deposit	3	1		4
04SD307	Soft Skill Development			2	1
04ME351	Strength of Material Lab			2	1
04ME352	Fundamental & Advance Thermodynamics Lab			2	1
04CT353	Testing of Cement Raw Materials Lab			4	2
					29

Faculty of Engineering & Technology

Department of Cement Technology

B.Tech. and B.Tech+M.Tech (Integrated)

(Cement Tech.)

Semester- IV

TEACHING & EXAMINATION SCHEME

Code No.	Subject	L	T	P	Credit
04ME401	Heat & Mass Transfer	3	1		4
04CT402	Raw Mix Design & Cement Chemistry	4	1		5
04CT403	Size Reduction & Pre Homogenization	4	1		5
04ME404	Fluid & Fluid Particle Mechanics	3	1		4
04ME405	Electrical Engineering	3	1		4
04SD406	SSD			2	1
04ME451	Fluid Mechanics lab			2	1
04CT452	Size Reduction & Pre Homogenization Lab			2	1
04ME453	Electrical Engineering lab			4	2
					27

Faculty of Engineering & Technology

Department of Cement Technology

B.Tech. and B.Tech+M.Tech (Integrated)

(Cement Tech.)

Semester- V

TEACHING & EXAMINATION SCHEME

Code No	Subject	L	T	P	Total Credit
04CT501	Refractory Engineering	3	1		4
04CT502	Pyro processing & Clinker manufacture	4	1		5
04CT503	Energy Management	4	1		5
04CT504	Fuels & Firing system	4	1		5
04EV505	Environmental Engineering	3	1		4
04SD506	Soft Skill Development			2	1
04CT551	Refractory Engineering Lab			2	1
04CT552	Environmental Engineering Lab			4	2
04CT553	Fuels & Firing system Lab			2	1
					28

Faculty of Engineering & Technology

Department of Cement Technology

B.Tech. (Cement Tech.)

Semester- VI

TEACHING & EXAMINATION SCHEME

Code No	Subject	L	T	P	Total Credit
04CT601	Instrumentation & process control	3	1		4
04CT602	Maintenance Practices in Cement Plant	4	1		5
04CT603	Waste Utilization in Cement Production	4	1		5
04MT604	Total Quality Management	4	1		5
04CT605	Special Cements & Performance of Cement	4	1		5
04CT651	Testing of Concrete Lab			2	1
04CT652	Testing of Cement by BIS Method Lab			4	2
04CT653	Instrumentation Lab			2	1
					28

Faculty of Engineering & Technology

Department of Cement Technology

B.Tech. (Cement Tech.)

Semester- VII

TEACHING & EXAMINATION SCHEME

Code No	Subject	L	T	P	Total Credit
04MT701	Project Management	4	1		5
04CT702	Plant Design & Process Economics	4	1		5
04CT703	Elective	4	1		5
04CT704	Modeling , Simulation & Application Software in Cement Manufacture	3	1		4
04CT705	Optimization Technique	4	1		5
04CT751	Application of Cement Lab			4	2
04CT752	Application Software Lab			2	1
04CT753	Advance Method of Cement & Clinker Testing Lab			2	1
					28

Electives

1.Nano Technology in cement manufacture	4. Use of low grade limestone in cement manufacture
2. EIA and EMP of cement plant	5. Quality control & Quality assurance in cement manufacture
3. Process optimisation in cement manufacture	6. Performance of cement and concrete

Faculty of Engineering & Technology

Department of Cement Technology

B.Tech. (Cement Tech.)

Semester- VIII

TEACHING & EXAMINATION SCHEME

Code No	Subject	L	T	P	Total Credit
04MT801	Plant Management	3	1		4
04MM802	Marketing of cement	3	1		4
04CT851	Project work , seminar and viva				20
					28

B.TECH.
III SEMESTER
ENGINEERING MATHEMATICS-III

Unit – I: Function of Complex variable
- Definition, derivatives of complex function, Analytic function.
- Cauchy-Riemann equations, in Cartesian form and polar form.
- Conjugate function, Harmonic function, Methods for finding the analytic function.
- Cauchy's integral theorem, Cauchy's integral formula for analytic function.
- Poles and singularities of analytic function, Residue theorem (without proof) and its application.

Unit – II: Numerical Techniques – I

- Finite differences: Difference table [Forwarded Difference operator, Backward Difference operators and central Difference operator]
- Interpolation**:** Newton-Gregory forward and backward interpolation formula for equal intervals, Gauss's forward and backward interpolation formula for equal intervals, Gauss's central difference formula for equal intervals.
- Stirling's formula, Bessel's formula, Everett's formula for equal intervals.

Unit – III: Numerical Techniques – II
- Numerical Differentiation : Newton's forward difference formula and Newton's backward difference formula for derivative, Gauss's forward difference formula for derivative, Newton's divide difference formula for derivative.
- Lagrange's interpolation formula for unequal intervals and Newton's divided difference interpolation for unequal intervals.
- Numerical integration: Trapezoidal rule, Simpson's one third rule, Simpson's three-eight rules, and Weddle's rule.

.**Unit – IV Numerical Techniques –III**
   Numerical solution of algebraic and Transdantal equations: Bisection method, Secant method, Regular-falsi method, Newton-Raphson method and Graeffe's root squaring method.
- Numerical solution of ordinary differential equations: Taylor's series method, Euler's method, Euler's modified method, Picard's method, Runge- Kutta method.
- Solution of simultaneous algebraic equation: Gauss- Seidal method, Gauss elimination method, Guass-jordan method.

Unit – V Probability Distribution
- Binomial Distribution: Hypothesis, characteristics, mean, variance and standard deviation and moments.
- Poisson distribution: Hypothesis, characteristics, condition for Poisson distribution, mean, variance and standard deviation.

- Normal Distribution: Standard normal distribution, properties of normal curve.
- Curve fitting: Method of least squares, Fitting of straight lines, and parabola of second degree.

Text Books:
1. D.C. Agrawal, Engineering Mathematics-III, Sai prakasan
2. H.K.Das, Basic Engineering Mathematics-III, S.Chand & company Ltd.
3. D. K. Jain., Engineering Mathematics-III
4. Sonendra Gupta, Engineering Mathematics-III, Dhanpat Rai Publishing Company(P) Ltd.

Reference Books:-
1. B.S.Grewal, Engineering Mathematics, Khanna Publishers, 2004.
2. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers, 2005.
3. Chandrika Prasad, Advanced Mathematic for Engineers, Prasad Mudranalaya,1996.
4. B.V.Ramana,Higher Engineering mathematics,Tata Mcgraw-Hills Publishing Company Limited.

B.Tech.(Cement Tech.)

III Semester

Process Calculation

Objective: This course is designed such that a student can understand the problem of Process Calculations in cement manufacture

Unit-I

Basic and derived units, use of model units in calculations, Methods of expression, compositions of mixture and solutions, Ideal and real gas laws - Gas constant - calculations of pressure, volume and temperature using ideal gas law, Use of partial pressure and pure component volume in gas calculations, applications of real gas relationship in gas calculation.

Unit-II

Stoichiometric principles, application of material balance to unit operations like distillation, evaporation, crystallization, drying etc., Material balance with chemical reaction, Limiting and excess reactants, recycle, bypass and purging.

Unit-III

Unsteady state material balances, calculation of absolute humidity, molal humidity, relative humidity and percentage humidity, use of humidity in condensation and drying, Humidity chart, dew point.

Unit-IV

Determination of Composition by Orsat analysis of products of combustion of solid, liquid and gas fuels, calculation of excess air from orsat technique and problems, heat capacity of solids, liquids, gases and solutions, use of mean heat capacity in heat calculations, problems involving sensible heat and latent heats, evaluation of enthalpy.

Unit-V

Standard heat of reaction, heats of formation, combustion, solution, mixing etc., calculation of standard heat of reaction, effect of pressure and temperature on heat of reaction, Energy balance for systems with and without chemical reaction, unsteady state energy balances. Introduction to Computer aided calculations-steady state material and energy balances.

Text Books:
1. Bhatt, B.L., VORA, S.M., "Stoichiomentry ", Tata McGraw-Hill, 1976.
2. Hougen, O.A., Watson, K.M and Ragatz, R.A., " Chemical Process Principles Part-I ",John Wiley and Asia Publishing, 1970.
3. Himmelblau, D.M., "Basic Principles and Calculations in Chemical Engineering ",Fourth Edition, Prentice Hall Inc., 1982.

Reference Books:
1. Whitwell, J.C., Tone, R.K. "Conservation of Mass and Energy ", McGraw-Hill, 1973.
2. Process Calculation for Chemical Engineering, Second Revised Edition, Chemical Engineering Education Development Centre, I.I.T., Madras, 1981

B.Tech.(Cement Tech.)

III Semester

Fundamental and Advance Thermodynamics

Objective: This course is designed such that a student can understand the Fundamental and Advance Thermodynamics for clinker manufacture

Unit-I

Fundamental concepts in thermodynamics: heat and work, the first law of thermodynamics, joule's experiment, Internal energy, state functions, enthalpy, steady-state steady-flow processes, equilibrium and the phase rule, reversible processes, processes at constant volume and constant pressure, heat capacities, thermodynamics analysis of control volume, unsteady flow processes, charging and discharging of vessel.

Unit-II

Volumetric properties of pure fluids, P-V-T diagrams, Ideal gas, virial equation and its applications, cubic equations of state, generalized correlations for gases and liquids.

THERMAL EFFECTS: Sensible heat and latent heat. Standard heat of formation, heat of reaction and heat of combustion, effect of the temperature on the heat of reaction, the second law of thermodynamics, statement of the second law, heat engines, carnot cycle, thermodynamic scale of temperatures, entropy, the third law of thermodynamics.

Unit-III

Thermodynamic properties of pure fluids, maxwell's equations, helmholtz and gibbs functions. residual properties. two-phase systems, tables and diagrams of thermodynamic properties of gases and liquids.

Cycles for conversion of heat into power, refrigeration and liquefaction, thermodynamic analysis of processes.

Unit-IV

An Introduction to vapour-Liquid Equilibria, qualitative behaviour of the vapour-liquid equilibria (VLE), Simple models for vapour liquid, equilibria: Raoult's and henry´s laws, dewpoint and bubble point calculations, VLE by modified raoult´s law and K-value correlations. Flash calculations.

Unit-V

Solution Thermodynamics, Applications Liquid phase properties from VLE data. Fugacity. Activity coefficient. Excess Gibbs energy. Data reduction. Thermodynamic consistency. Models for the excess Gibbs energy. Local composition models. Property changes of mixing. Heat effects of mixing processes.

Text Book: :

1. Thermodynamics an engineering approach- 5th edition, Yunus A Cengel

2. Introduction to Chemical Engineering Thermodynamics, 7/e,J.M Smith , H.c Van ness

Reference Book:

1. Chemical Engineering Thermodynamics-I; K A Gavhane: Nirali Prakashan

Thermodynamics Lab.

List of Experiments :

1. Experimental Measurement of P-V-T data

2. Experiment 2: Measurement of activity coefficient at infinite dilution by using gas chromatograph

3. Measurement of Vapor-Liquid Equilibrium Data

4. Refrigeration cycle experiment

B.Tech.(Cement Tech.)

III Semester

Strength of Materials

Objective: This course is designed such that a student can understand strength of the materials

Unit-I

Simple Stress and Strains: Introduction types of loads and deformation, types of stresses and strain. Hooke's law, stress strain diagram for ferrous and non ferrous materials modulus of elasticity. Rigidity and bulk modules of materials Stress in bars of varying cross sections, composite sections and compound sections Thermal stresses and strains ,thermal stresses in composite section. Poisson's ratio, volumetric strain, relation between different modulus, strain energy, resilience, proofresilience, modules of resilience suddenly applied loads and impact loads.

Unit-II

S.F. and B.M. Diagrams: Definition, types of loading types of beams, shear force and bending moment sign conventions S.F. and B.M. diagrams forcantilever simply supported and overhanging beams with point or concentrated loads uniformly distributed loads and combination of point and U.D.L. Point of contra flexure, numerical problems.

Principal Planes and Principal Stresses: Stresses on inclined plane subjected to direct shear or combination of stresses in two mutually perpendicular planes. Principal planes and principal stresses, analytical and graphical methods.

Unit-III

Bending Stresses in Beams: Theory of simple bending as assumptions made in simple bending theory position of neutral axis, surface moment or resistance. Modules of section of symmetrical sections such as rectangular, circular and I sections, bending stresses in symmetrical sections. Simple problems. Reinforced concrete beams, beam of uniform strength.

Shear Stresses in Beams.: Introduction shear stress equation, assumptions made, distribution of shear stresses over various sections, such as rectangular, circular and I,L &T sections, Simple numerical problems.

Deflection of Beams: Introduction Strength and stiffness of beam curvature of bent beam, Derivation of equation for slope and deflection of beam in case of cantilever and simply supported beam loaded with point loads U.D.L. and combination. Simple numerical problems. Importance of deflection and practical applications.

Unit-IV

Torsion of Shaft: Definition of torsion relation between stress, strain and angle of twist assumptions made strength of solid and hollow circular shaft, polar moment of inertia. Calculation of shaft diameter on the basis of strength and stiffness for the given horse power transmitted torsional rigidity. Maximum torque comparison of solid and hollow shaft size of as haft for a given torque.

Unit-V

Spring: Definition types and useof springs, leaf spring, helical and spiral springs, Stiffness of a spring and maximum shear stress, defection of spring. Spring Classification based on size shape and load.

Columns and struts: Definitions crippling load different end conditions, slenderness ratio, equivalent length, Euler's theory Rankine's formulae, radius of gyration, Rankine constant for different materials Limitations of Rankine formula simple problem B.I.S. code for columns.

Stresses in Frames: Definition of frame, perfect ,deficient and redundant frame.

Text Books:
1. Strength of Materials : R.S. Khurmi
2. Strength of Materials: K.D. Sexena
3. Laboratory Experiments In Strength of Materials : B.D. Sharma
4. Strength of Materials :Ryder.

Reference Books:
5. Strength of Materials. B.C. Punmia.
6. Strength of Materials: Sadhu Singh.
7. Strength of Materials: S. Ramamuruthan.

Strength of Materials Practical

List of Experiment:

1. Study and demonstration of Universal Testing Machine &its attachments
2. Tension Test on mild steel, Aluminium & compression test on Bricks and Concrete block on Universal Testing Machine.
3. Direct Shear Test of mild steel on Universal Testing Machine.
4. Brinell Hardness Test on Mild Steel.
5. Rockwellhardness Test on Hardened Steel.
6. Izod & Charpy- Impact tests of a standard specimen
7. Torsion Test on Mild steel bar.

B.Tech.(Cement Tech.)

III Semester

Introduction to Cement and Cement Raw Materials

Objective: History of Cement and Binding Materials, chemical and Physical characteristic of Cement Raw materials.

Unit-I

Introduction to Cement and Binding materials : History of binding materials and Cement, Classification of Cement Binders, Lime as Binder, cement and its importance in construction, Cement and its Raw Mill Composition, History of Cement manufacturing process, material composition of cement, various unit operation of cement manufacture, the present status and future of cement industry in India.

Unit-II

Types of Cement-I: Description and use of various type of Cement such as, Ordinary Port Land Cement (OPC -33 grade , 43 grade and 53 Grade) , Portland Pozzolana Cement (PPC), Portland Slag Cement (PSC),

Unit-III

Type of Cement-II:

Ordinary & Rapid Hardening Portland cement, Extra Rapid Hardening Portland cement, Sulphate Resisting Portland cement, Low – Heat Portland cement, Oil well cement, White Portland cement, Coloured Portland cement, Water Repellent and Hydrophobic Portland cement , Masonry cement, Expansive cement, K – type Expansive , M – type Expansive , S – type Expansive, Portland Pozzolanic cement, Super Sulphated cements, High Early Strength cement, Alinite cement, Belite cement, Early strength cement.

Unit-IV

Calcareous Raw Materials: Source of Lime, Limestone, Chalk, Marl, Industrial wastes as cement Raw materials

Unit-V

Argillaceous Raw Materials: Source of Silica, Alumina, Iron Oxide, Shale and effect of coal ash and additives use as corrective materials, Fly ash , Slag, sludge as cement raw materials.
Additives and Gypsum : Origin and occurrences and distribution of various additive in India such as Bauxite, Iron Ore , Laterite, and gypsum.

Text Books:

1. Chemistry of Cement and Concrete: F M Lea, Arnold, London
2. Cement Data Book: W. H Duda , Verlag G m Bh,Berlin.

Reference Books:

1. Norms for limestone exploration for cement manufacture : NCCBM
2. Text Book of Geology : P K Mukherjee
3. Geology of India and Burma : MS Krishnan, CBS Publisher and Distributer, Delhi

Testing   Cement Raw Materials

List of Experiment

Chemical Analysis :

    Limestone

1. Chemical analysis

   a. Determination of CC & MC
   b. Chemical analysis for Major Constituents (LOI, CaO, SiO_2, Al_2O_3, Fe_2O_3, MgO)
   c. Chemical analysis for minor constituentas (TiO_2, P_2O_5, Mn_2O_3, Choride)

2. Physico Mechanical Analysis
   a. Colour and Texture of Limestone
   b. Bulk Density Porosity
   c. Moisture Content
   d. Hardness
   e. Compressive Strength of Limestone

3. Gypsum: Determination of SO_3 & Moisture

B.Tech.(Cement Tech.)

III Semester

Geology and Mining of Limestone

Objective: The Course has been design to give the knowledge about the geological origin, distribution in India, chemical and physical characteristic of cement grade limestone and the mining practices to supply homogeneous material from the limestone quarry/mines.

Unit-I

Introduction to Stratigraphy & Geology of Limestone : Introduction to Indian stratigraphy and distribution of limestone, origin & formation of calcareous rocks, Brief idea about Structural Geology: fold, fault, joint, unconformities:, Igneous , Sedimentary and Metamorphic rocks.

Unit-II

Distribution and characteristic of Cement Grade Limestone : Physical and Chemical characteristic of limestone, Classification cement grade limestone deposits. Distribution of cement grade limestone deposits in India and its physical and chemical characteristics, Petrographic study of Limestone.

Unit-III

Limestone Requirement for Cement Plant :National Inventory of Cement grade limestone deposits of India, Requirement of limestone for various capacity of Cement plant and its physical and chemical requirements, UNFC Classification of Limestone Deposits.

Unit-IV

Exploration and Deposit Evaluation : Phases of Geological Exploration with reference to limestone deposits , Brief idea about Geological Mapping, Surveying , Sampling practices, Recoding of Exploration Data, Preparation of Geological Maps and section,   Methods of Reserve estimation, Statistical and Geo Statistical evaluation of Bore Hole data , Computer Aided Deposit evaluation and Development of 3-D Deposit Model.

Unit-V

Mining of Limestone: Introduction to surface mining, method of mining of limestone deposits, estimation of block size and bench height, estimation of block wise bench wise grade and tonnage, selection of mining equipment (Excavator, Dozer, Dumper etc.) , Blasting techniques, type of explosive use,   Mine production scheduling and planning , Advance method of limestone mining, Pit Head Quality Control practices. Brief idea about PL and ML application, EIA and EMP of Limestone Mines

Text Books:

1. Text Book of Geology : P K Mukherjee
2. A Hand book on Surface Mining Technology : Samir Kumar Dash, Sagar prakashan, Khargpur
3. Cement & Concrete Science & Technology , Vol-I , Part- II : S N Ghosh

4. Norms for limestone exploration for cement manufacture : NCCBM
5. National Inventory of cement grade limestone deposits in India : NCCBM

Reference Books:

1. Geology of India and Burma : MS Krishnan, CBS Publisher and Distributer, Delhi
2. SME, Mining Engineering Hand Book; Arthur B. Cummins, Ivan A. Given: Society of Mining Engineers of the American Institute of Mining, Metallurgical and Petroleum Engineers, Inc, New York.

B.Tech.(Cement Tech.)

IV Semester

HEAT AND MASS TRANSFER

OBJECTIVE: To impart knowledge on aspects of heat and mass transfer operations in cement and manufacturing industries**.**

Course Content: After completion of this course, the student will be able to handle problems related to mass transfer and design and performance of heat exchangers for industries.

UNIT-I

Introduction to heat transfer and general concepts of heat transfer by conduction, convection and radiation, Conduction: Basic concepts of conduction in solids, liquids, gases, steady state temperature fields and one dimensional conduction without heat generation e.g. through plain walls, cylindrical and spherical surfaces, composite layers, etc. Insulation materials, critical and optimum insulation thickness. Extended surfaces, fins and their applications. Introduction to unsteady state heat transfer.

UNIT-II

Convection: Fundamentals of convection, Basic concepts and definitions, natural and forced convection, hydrodynamic and thermal boundary layers, laminar and turbulent heat transfer inside and outside tubes. Dimensional analysis, determination of individual and overall heat transfer coefficients, heat transfer in molten metals.

UNIT-III

Radiation: Basic laws of heat transfer by radiation, black body and gray body concepts, view factors, Kirchhoff's law, solar radiations, combined heat transfer coefficients by convection and radiation.

UNIT-IV

Definition, Ficks Law, Flux equation, Molecular diffusion in gases, Steady state diffusion of A through non diffusing B, Steady state equimolar counter diffusion. Problems. Analogy between mass transfer and heat transfer, film theory, surface renewal theory, penetration theory, equilibrium.

UNIT-V

Concepts & general principles, equilibrium Rate of drying curve, time of drying, Problems based on above topic. Drying equipments- Tray drier, Rotary drier, Drum drier, Spray drier, fluidized bed drier, Pneumatic drier, applications

REFERENCE BOOKS :

TEXT BOOKS / REFERENCE BOOKS

1. McCabe, W. L., Smith, J. C. and Harriot, P., Unit Operations of Chemical Engineering, Tata McGraw Hill, New Delhi.
2. **Brown, G. G., Unit Operations, CBS Publishers, New Delhi.**
3. Kern, D. Q., Process Heat Transfer, McGraw Hill, New Delhi,
4. Treybol, R. E., Mass Transfer Operations, McGraw Hill, New Delhi

RAW MIX DESIGN & CEMENT CHEMISTRY

Objective: The objective of the course to understand chemical aspect of cement, its composition, cess manufacture and its influence on performance.

UNIT I

Sampling and pre blending of cement raw materials, estimation of Silica Modulus, Alumina Modulus, Hydraulic Modulus, Lime saturation Factor, Liquid Content, method proportioning, 2,3 and 4 component mixes, impact of moduli values on cement manufacturing process and quality of clinker.

UNIT II

Cement manufacturing process, chemical composition of various types cement, cement component and their phase relation, Binary and ternary compounds of cement and formation of eutectic.

UNIT III

Bauge's calculation, clinker minerals , absorption of constituents in clinker phases, phase diagram, chemical reaction during clinkerisation, Role of miner constituents in clinkerization , Thermo chemistry of clinker formation

UNIT IV

Mineralizer, Role of additive in clinker formation, various mineralizer and fluxes, their role in manufacture of clinker,

UNIT V

Hydration of clinker minerals, role of gypsum in cement hydration process, hydration of Portland cement and strength of Portland cement

Text Books / Reference Books :

1. F. M. Lea, Chemistry of Cement and Concrete, Arnold, London.
2. Cement Data Book: W. H Duda , Verlag G m Bh,Berlin
    3. R. H. Bouge, Chemistry of Portland Cement, Reinhold, New York

B.Tech.(Cement Tech.)
IV Semester

SIZE REDUCTION AND PREHOMOGENISATION

Objective: The purpose of this course is to familiarize with unit operations and practices related to size reduction, homogenization, blending and controls in a cement plant.

Course Content: After completion of this course, a student will be familiar with these unit operations in a cement plant.

UNIT-I Particle Size Analysis:
Sieve analysis, cumulative and fractional plot, size distribution, size averaging and equivalence, size estimation in sub-micron range. Optimum sizes at various stages from extraction from mines. Influence of size fraction on reactivity of lime stone.
Screening equipments such as grizzlies, stationary, vibrating, curved and DSM screens & screen capacity.

UNIT-II
Size Reduction: Laws of size reduction (Bond's, Rittinger's & Kick's); energy requirement in size reduction; work index. Theory of crushing & grinding; crushing efficiency; size reduction machinery crushers such as Jaw crusher, gyratory crushers, impact crushers, roll crushers and cone crushers; Grinders such as hammer mills, roller mills and ball mills & tube mills.

UNIT-III
Coal: Grinding & drying of coals; blending of coals; storage and handling of coals.

UNIT-IV
Material Handling: Various systems of material handling; haulage and transportation from mines, trucks, dumpers etc.
Conveying of Solids: Conveyor selection, classification of conveyors, conveyors such as belt, screw, chain, vibratory, apron. Pneumatic and hydraulic transportation of solids; pneumatic conveying systems.

UNIT-V
Storage of Solids: Bins, silos, hoppers & feeders; storage of raw materials in piles
Blending & Homogenization: Preparation of cement raw meal as per raw mix design, combined & segregated pre-homogenization, Blending bed theory; batch & continuous homogenization; Fuller's one-eight blending method. Stacking of blending beds namely in longitudinal & circular stockpiles system & their comparison. Equipments used for reclaiming material from stockpiles such as scraper, bucket wheel, bucket wheel with slewing boom and drum re-claimers.
Size Classification and Air Separators: Methods of size classification, principles of air separators, and different types of air separators used in cement manufacturing. Wet classification; hydro-cyclones; cyclone material balances in open circuit and closed circuit operations & separating efficiency.

Text Books / Reference Books :
1. Cement Data Book: W. H Duda , Verlag G m Bh,Berlin
2. Handbook of Material Handling
3. Maintenance Engineers Hand book,
4. Cement Engineers Hand Book: Labhaanand Kolhaans
5. Operational Norms for cement plant: NCCBM publication

SIZE REDUCTION LAB
List of experiments

1. To study the performance of Ball Mill and find out it's crushing efficiency.
2. To study the performance of Jaw Crusher and find out it's crushing efficiency.
3. To study the performance of Crushing Rolls and find out it's crushing efficiency.
4. To study the settling characteristics.(Free & Hindered settling) of a given suspension of particles.
5. To study the filtration characteristics of rotary vacuum filter.
6. To study the filtration characteristics of Plate and frame filter press.
7. To study the filtration characteristics of Leaf and sparkle filter.
8. To carry out differential and cumulative screen analysis of given sample of solid particles.
9. To study the pressure drop characteristics through packed beds.
10. To study the pressure drop and porosity in Air fluidized bed.
11. To study the pressure drop and porosity in Liquid fluidized bed

B.Tech.(Cement Tech.)
IV Semester
FLUID & FLUID PARTICLE MECHANICS

Objective: This course is designed such that a student can understand the problem of fluid flow, size reduction and related areas

UNIT I

Properties of fluids, fluid statics, Forces on fluids, pressure depth relationship for compressible and incompressible fluids, Forces on submerged bodies, Rigid body motion, pressure measurements, Euler's equation, Bernoulli's theorem.

UNIT II

Kinematics of flow, Description of velocity field, Stream functions, Angular velocity, Fluids in circulation, Irrotational flow, Dimensional analysis, Buckingham Pi Theorem, Dimensionless numbers and their physical significance, Similitude Criteria.

UNIT III

Fluid flow: Laminar and turbulent flows, Pressure drop in pipes, pipe fittings and pipe network, friction factor, Conservation of mass, momentum and energy, Mechanical engineering Bernoulli's equation

UNIT IV

Flow measuring devices for chemical plants, venturimeter, orifice meter, nozzle, Rota meter, pitot's tube and v-notch.

UNIT V

Pumping and compressing of chemicals and gases, reciprocating pumps, rotary pumps, centrifugal pumps and blowers, NPSH and calibrations, mixing and agitation, types of mixers and their selection, power requirement, compressible fluid flow, introductory concepts of two-phase flow.

Text Books / Reference Books :

1. Fluid Mechanics and its application: Guta ,V and Gupta, S.K.
2. Element of Fluid Mechanics: Seshdri, E .V and Patankar, S . V.
3. Unit Operation Of Chemical Engineering: McCabe, W. L., Smith, J. C and Harriot, P: Tata Mcgraw Hill, New Delhi
4. Unit Operations : Brow, G. G. : CBS Publisher , New Delhi
5. Fluid Mechanics and its Applications, Gupta, V. and Gupta, S. K.,
6. Elements of Fluid Mechanics, Seshadri, E. V. and Patankar, S. V., Prentice Hall of India,

FLUID MECHANICS LAB

List of Experiment :

1. Measurement of water pressure in a pipe through Piezometer, different type of monometer
2. Determination of discharge through a given venturimeter and Orifice meter
3. Determination of discharge through Pitot Tube.
4. Determination of Cc, Cv, and Cd for different type of orifices and mouth pieces
5. Detemination of loss of head due to sudden enlargement & friction in pipe
6. Determination of Discharge through different type of notches
7. Study of reciprocating pump
8. Study Centrifugal pump

B.Tech.(Cement Tech.)

IV Semester

BASIC ELECTRICAL ENGINEERING

Objective: This course is designed such that a student can understand the basic concept of electrical & electronics engineering

UNIT-I

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

UNIT-II

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

UNIT-III

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

UNIT-IV

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

UNIT-V

Introduction to basic electronics devices – junction diode, BJT, amplifier, op-amps & instrumentation amplifier with mathematical operation.Number System: Introduction to binary, octal, decimal & hexadecimal systems, representation of negative numbers, 1's, 2's, 9's, 10's complement and their arithmetic.

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

ELECTRICAL ENGINEERING LAB

List of Experiment

1. To draw open circuit characteristics (E to I_f) and load characteristics for a self excited DC generator
2. To draw open circuit characteristics (E to I_f) and load characteristics for a separately excited DC generator
3. To find the self and mutual inductance of a transformer
4.   To perform short circuit and open circuit test for a single phase transformer and hence find the core losses and copper losses and other transformer parameters associated with it.
5. To study and plot V-I characteristic of thyristor
6. To find maximum dv/dt and di/dt limit of thyristor
7. To study the forced commutation circuit of thyristor and to fi Find out its commutation period
8. To study different chopper circuit using thyristor.
9. Verification of thevinin theorem
10. Verification of maximum power transfer theorem

**B.Tech (Engg.)/B.Tech (Ag.)/B.Tech (BT)/B.Sc.(Hons) Ag./B.Sc
(BT)/B.Pharm/BBA/B.Com/B.com(Hons)/BCA(Hons)/Diploma (Engg.)**

Introduction to CPP Program: 'Soft skills' are a framework of desirable qualities which gives a candidate an edge over his peers during the selection process of a company. We, at AKS University, have designed the Campus Placement Program (CPP) to help out our students who are sitting for their placement process in various Companies.

Teaching methods: The teaching methods in CPP training includes lectures, projects, role plays, quizzes, and various other participatory sessions. The emphasis will be on learning by doing. Since the method of training is experiential and highly interactive, the students imbibe the skills and attributes in a gradual and subtle way over the duration of the program. The students will not only learn the skills and attributes but also internalize them over a period of time.

Objective of the Program:
- ❖ Develop effective communication and Presentation skills.
- ❖ Develop all-round personality with a mature outlook to function effectively in different circumstances.
- ❖ Understand the skills tested and participate effectively in Group Discussion.
- ❖ Take part effectively in various selection procedures adopted by the recruiters.
- ❖ Develop broad career plans, evaluate the employment market, identify the organizations to get good placement, match the job requirements and skill sets.

UNIT-1
Soft skills – a general overview, Talking about Present, Past and Future, Describing Processes and operations, Expressing Opinion: Agreement & Disagreement, Special Expressions in English, Pronunciation and neutral accent,

UNIT-2
Introduction and definition of a GD, Purpose of a GD, Types and strategies in a GD, Do's and Don'ts in GD, Presentation skills: A presentation about the company will be made by the students throughout the Unit. Each and every student is required to go through at least 10 Companies Profile related to their domain expertise., Telephone etiquettes- Preparing for business calls/Making business calls/Telephonic phrases, Dining etiquettes, Email etiquettes

UNIT-3
Industry Expectations, SWOT & STAR, Self Discovery, Leap to success- 7 Orientations, Time Management, Team building & leadership, Goal Setting, Developing Positive Attitude, Organizing meetings, Anchoring in a formal setting.

UNIT-4
Resume writing: Concept and Practice, Body Language, Corporate Grooming Dressing.
Mastering Personal Interviews: Paper Interview, Personal Interview, FAQs, Interview Practice, Domain Specific Interview Preparation, Peer review- Pair interview, Interview model (Vocabulary for an effective Interview).

Reference Books:

1.Peter, Francis. Soft Skills and Professional Communication. New Delhi: Tata McGraw Hill.
2. Singh, Prakash and Raman, Meenakshi. Business Communication. New Delhi: Oxford UP.
3. Bailey, Edward P. Writing and Speaking at Work: A Practical Guide for Business Communication.
4. Pease, Allan and Peas, Barbara. The Definitive Book of Body Language.
5. Sherfield, R. M. ; Montgomery, R.J. and Moody, P, G. (2010). Developing Soft Skills. 4th ed. New Delhi: Pearson.
6. Johnson, D.W. (1997). Reaching out – Interpersonal Effectiveness and Self Actualization. 6th ed. Boston: Allyn and Bacon.
7. Jain, Alok, Pravin S.R. Bhatia & A.M.,Sheikh Professional Communication Skills. S.Chand.
8. Krishnaswami,N and Sriraman, T., Creative Englishfor Communication,Macmillan.
9. Mohan Krishna & Meera Banerji. Developing Communication Skills. Macmillan.
           10. Robbins, S. P. and Hunsaker, Phillip, L" Training in Interpersonal skills"

B.Tech.(Cement Tech.)

V Semester

Refractory Engineering

Objective: This course is designed such that a student can understand the refractories and its use in cement Plant

Unit-I

Fundamentals of refractory, their classification, importance of refractories for cement production, types of refractories, its application, factors effecting wear of refractories in cement industry. Castables, its types and composition, mortars

Unit-II

Drying and firing phase diagram, manufacture and properties of silica, alumina silicate refractories, periclase, magnesite, magnesite- chrome, dolomite, high and low temperature insulating refractories, acid proof bricks and carbon based refractories

Unit-III

Properties and measurement of porosity, bulk density, fusion point, permeability, cold crushing strength, refractoriness under load, hot modulus of rapture , creep behaviour, abrasive resistance, thermal conductivity , thermal expansion& spelling, reaction of refractories, Slag, glasses, Carbon monoxide, acids, alkalise, flue gases, corrosion of regenerated refractories by flue gases.

Unit-IV

Subdivision of burning process & selection of refractory in kiln drying zone, preheating zone, calcining zone, transition zone, sintering zone, cooling zone, lining of preheater, kiln hood, coolers, features of refractory installation (brick joints, lining methods, rotating methods, screw jack method etc)

Unit-V

Selection of refractories and castables for different location of Cement plant, Procedure for laying start up and stoppage of kiln for cement plant, measures to improve refractory life in rotary kiln in cement plant, cost effectiveness, case studies for payback calculation.

Test Books:

7. Refractory Engineering and Kiln Maintenance in Cement Plant: J P Saxena, CRC Press, Technology & Engineering
8. Refractory Lining of Cement Kiln System : Process Technology: Cement Seminar, Holderbank

Reference Books:

9. Hand Book of Industrial Refractories Technology: Stephen C, Carniglia Godon L Barma, Noyes Publication
10. Refractory Linings: Thermo mechanical Design and Applications: Charles Schacht, CRC Press, Technology & Engineering

Refractory Engineering Practical

List of Experiment:

1. Determination of
   a. Sp. Gravity
   b. Bulk Density
   c. Porosity
   d. Permeability
   e. Thermal Spalling
   f. P CE (Refractoriness)
   g. Refractory Under Load
   h. Thermal Conductivity
   i. Coefficient of thermal expansion

B.Tech.(Cement Tech.)

V Semester

Pyroprocessing and Clinker Manufacture

Objective: This course is designed such that a student can understand the Pyroproceesing of Rotary Kiln and manufacturing of Clinker .

Unit-I

Types of kiln, Rotary Kiln, different type of clinkerisation process, , Advantages and Dis advantages of each process; **Dry process** : 4 stage cyclone preheater kiln, 2 stage cyclone preheater kiln, shaft preheater kiln, long dry kiln, **Semidry process**; grate preheater Kiln (LEPOL, ACL) , **Wet Process**; Long wet process Kiln

Unit-II

Thermal heat calculation, sizing of kiln, Heat balance of kiln, air balance of kilns, inlet seal ,methods used to feed raw meal in the kilns, evolution and types of **preheater**s, comparison , selection of different stages(4/5/6) preheaters,

Unit-III

Precalciners : Theoretical aspect of Precalciners, Basic arrangement, Features of precalciners , Present status of precalciner development, advantages and dis advantages of different type of precalciners , primary air, secondary air, tertiary air, Optimization of kiln output, factors affecting the kiln output, determination, parameters of kiln evaluation ; thermal loading, volumetric loading, % filling etc, norms for pyro processing, kiln operation, kiln bypass system

Unit-IV

Process fans, purpose of fan, types of fans, their application, concept of pressure, velocity pressure, total pressure in an air stream, characterstic curves of fans, fan laws, comparison and selection of principal type of fans

Unit-V

Cooling of Clinker : purpose of clinker cooling, types of coolers

Grate Cooler Reciprocating grate cooler, History, Design features of modern coolers, Cooler control, Cooler de dusting, Non-ventilating cooler, Travelling grate cooler.

Rotary Cooler : General, Design, Cooling performance, Advantages / Disadvantages
Planetary Cooler : General, Design features, Internal heat transfer equipment, Heat transfer and efficiency, Enhanced. cooling, Advantages / Disadvantages
Other Systems : g-cooler, Shaft cooler
Comparison of Coolers : Range of application, Operating data and heat balance, Capital and operating costs Method of clinker storage, Silos and Gantry

Test Books:
   1. Cement Data Book: W. H Duda , Verlag G m Bh,Berlin.
   2. Kiln System : Process Technology: Cement Seminar, Holderbank
   Reference Books:
      1. Precalcining System : Process Technology: Cement Seminar, Holderbank
      2. Clinker Cooler : Process Technology: Cement Seminar, Holderbank

B.Tech.(Cement Tech.)

V Semester

Energy Management

Objective: This course is designed such that a student can understand the Energy Management in Cement Plant

Unit-I

Energy management: Introduction, definition, Need for Energy management, general principles of Energy management, planning for energy management, Energy Basics for Energy manager, starting of Energy management program, world Energy Utilisation.

Unit-II

Energy Audit: Introduction, Energy Audit basics, preparing for an energy Audit, Tools for Energy Audit, Phase-II The facility inspection, preliminary Identification, Energy Management opportunities, EA report, energy action plan, Implementation of recommendations, Energy Bills Electrical rate structures. Energy Consevation acts,

Unit-III

Lighting: Introduction, Components of Lighting system, Lamp types, Ballasts, determing lighting needs, maintenance of lighting system, Survey, identifying potential Energy management opportunities
HVAC: Introduction, Working of HVAC system, Heating cooling ventilation loads.

Unit-IV

Ecomomic Analysis: Introduction, costs, cash flow diagrams, simple payback period, Time value of money, energy discounted cash flows, single sum analysis, cost analysis methodology, cost effectiveness, taxes and depreciation, inflation

Unit-V

Energy utilisation in cement manufacturing process: Energy consumption scenario in rusher, raw material grinding, pyro processing, cement grinding, coal grinding, packing. Energy conservation opportunites in cement industry, Perform Achive and trade (PAT) Energy Conservation Acts. Energy Audit Case Studies.

Text Books:
1. Energy management principle- Applications, benefits, savings by craig B.Smith Pergamon press.
2. Guide to energy management, Barney.L capehart, Wayne C Tarner, William J Kennedy

Reference Books:
1. Energy Efficiency in Electrical Utilities : Guide Book National Certification Examination for Energy Manager and Energy Auditors , Bureau of Energy Efficiency, New Delhi
2. Plant Engineers and managers by Albert Thuman 2nd edition.
3. Handbook of energy audits by Albert Thuman.

B.Tech.(Cement Tech.)

V Semester

Fuels and Firing System

Objective: This course is designed such that a student can understand the fuel requirement and firing systems in manufacturing of clinker

Unit-I
Introduction: Type of fuels, Coal, Lignite, Oil and Natural Gas, Geological Origin and distribution of coal Lignite and Oil and Natural gas. Distribution of coal and lignite deposits in India. Introduction to alternative fuels for cement manufacture.

Unit-II
Characteristics of Fuel: Physical and Chemical characteristics of different types of fuel, Ultimate and Proximate analysis of coal, calculation of theoretical air requirement, Characteristics of coal& lignite and their influence in burning of clinker, preparation and handling of fuel, safety hazards

Unit-III

Firing System-I: Introduction to various types of firing system in cement plant, their advantages and disadvantages.

Coal Firing System: introduction to coal firing system, classification of firing system, selection criteria for coal firing, Pulverised coal ash flame, Pulverised coal ash burner.

Unit-IV

Firing System-II

Oil Firing System: Introduction to Fuel oil, Fuel Oil transport and storage, Fuel oil Automization, Fuel oil Burners, Control loops in fuel oil plant

Gas firing System: Natural gas, Natural gas preparation, Natural gas burners, Flame adjustment, safety precautions.

Unit-V

Flame & Burners: Introduction, types of flame, flame characteristics, flame adjustment, flame momentum, Secondary firing and pre-calcinator, Combustion Indications. Burners, types of burners , application

Test Books :

1. Fuels and combustion : Samir Sarkar, New Delhi
Reference Books:

1. Firing System: Process Technology: Cement Seminar, Holderbank
2. Flame & Burners : Process Technology: Cement Seminar, Holderbank

Fuels and Firing System Practical

List of Experiment:

1. **Analysis of Coal , Lignite and Pet Coke**

   a. **Proximate analysis**
      i. Moisture content
      ii. Volatile Matter
      iii. Fixed Carbon
      iv. Ash Content
   b. **Ultimate Analysis**
      i. Wt % of Carbon
      ii. Hydrogen
      iii. Oxygen
      iv. Sulphur
      v. Nitrogen
   c. **Determination of Gross Calorific value**

B.Tech.(Cement Tech.)

V Semester

Environmental Engineering

Objective: To get a broad perspective on environment issues related with cement industry

Unit-I

Introduction : The Environment, Interaction of Humans and Environment, Role of an engineer in Environmental improvement, Types of pollution, Air Quality-sources and classification of pollutants, Influence of meteorological phenomena on air quality, plume behaviour, Water Quality - physical, chemical & biological parameters, Noise and ground vibration, Standards & limits for air, water, waste water, noise, solid and hazardous waste

Unit-II

Sources of Pollution in Cement Industry :
Air - Ambient Air Quality, Fugitive dust, Point Source – Green House Gas, particulate matter (PM), SO_2, NOx, CO, HCl, HF, Heavy Metals, Dioxins & Furans, TOC, TVOC etc. **Water** – Consumption, sources of water, waste water generation, storm water
Noise – Sources, **Solid and Hazardous Waste** – utilization

Unit-III

Control of Pollution-I: **Air** - Control measures for improving ambient air quality (AAQ) and fugitive dust, AAQ – Monitoring methods, Air Pollution Control Equipments for controlling Point Source Emissions – Bag Filter / Bag House, ESP, Hybrid Filter, Multi Cyclones, Wet Scrubber, Gravity Setting chamber, Control of gaseous emissions by primary and secondary (SCR/ SNCR) techniques. Stack monitoring for particulate matter and gases. GHG control – Blended cement, use of alternate fuels, carbon sequestration.

Unit-IV

Control of Pollution-II

Noise - abatement techniques, **Waste water** – treatment methods and reuse. .
Solid and Hazardous Waste – Management,   Measures for pollution control in Mines

Unit-V

Environment Management : Introduction to various Environmental Act & Regulations, Environment Protection Act 1986, Water (Prevention and Control of Pollution) act, Water (Prevention and Control of Pollution) Cess act, Air (Prevention and Control of Pollution) act, Forest (Conservation) Act, Hazardous Waste (Management, Handling and trans boundary movement) Rules, Solid Waste Management Rules, Mines Act, Factory Act, Corporate Responsibility for ENV Protection (CREP).

Environment Management Tools
     i.   EMS – ISO 14001
     ii.   Environmental Audit / Statement
     iii.   Environment Impact Assessment (EIA) / EMP
     iv.   Life Cycle Assessment (LCA) ISO 14040 / 44
Clean Development Mechanism (CDM)

Text Books:

     1. Environmental Pollution Control Engineering : C S Rao

     2. Air Pollution : M N Rao, H.V.N. Rao

     3. Environmental Engineering : Peavy and Rowe

Reference Books:

     4. Air Pollution Control by S P Mahajan, T.V. Ramachandra

     5. Pollution Control in Process Industries : S P Mahajan

Environmental Engineering Practical

List of Experiment

I.   Air

    A. Ambient Air Quality Monitoring

       i.   Sampling and collection Methodology

      ii.   Monitoring of Ambient Air pollutants

           1.   Particulate Matter
- Fugitive Dust using High Volume Sampler (HVS) / Respirable dust sampler (RDS)
- PM_{10} using Respirable dust sampler
- $PM_{2.5}$ using Fine Particulate Sampler
- Dust fall

           2.   Gaseous Pollutants
- SO_2
- NO_2
- CO

II.   Water

    A. Physical and chemical tests of water

    pH, Colour, Turbidity, Electrical Conductivity, Suspended /Dissolved /Total Solids, Coagulation and Flocculation, Hardness, Acidity, Alkalinity, Salinity, Chloride, Fluoride, Residual Chlorine

    B. Test to determine the quality/strength of Waste water

    BOD, COD, SVI, Sulphates, Chlorides, Nitrates

III.   Noise and Ground Vibration

    A. Noise Monitoring (Leq, Ld, Ln, Ldn)

Ground Vibration Monitoring using Blast Mate

B.Tech.(Cement Tech.)

VI Semester

Instrumentation And Process Control

Objective: To get a broad perspective of Instrumentation and process control in cement plant

Unit-I

General Principles: Introduction to Process control systems, Regulator & Servo control, Feed Forward & Feed backward control, Negative & Positive Feed back Control, variables & Physical Elements of a Control system,Physical, Block & Signal Flow Diagram. Use of Laplace & Inverse Laplace Transformation in study of Process Dynamics.
Dynamic Modeling of a Process, Dynamic behavior of First order systems and First order systems in series. Dynamic behavior of second & higher order system for various kind of inputs, Transportation & Transfer Lag.

Unit-II
Modes of control action, Controllers & Final control Elements, Reduction of Block & Signal Flow Diagrams, Closed loop transfer function and response of closed loop control system for various type of control actions. On Off controllers , P controllers , PI controllers , PID controllers

Unit-III
Measurement of Temperature: Thermocouples, Resistance Thermometer, Expansion Thermometers ,Pyrometers Measurement of Pressure & Vacuum, Hydrostatic type, Elastic Element type, Electrical Type and other type of instruments like Neleod Gauge, Thermocouple gauge, Knudson Gauge, Ionization Gauge.
Instruments for Measurement of Flow rate, level & Viscosity, Variable Area & variable head flow meters,

Unit-IV
Stability analysis, Rouths criterion, Root locus Analysis, Frequency Response Analysis & Design of Controllers for optimum Performance

Unit-V
Measuring instruments in cement plant , Use of expert system Fuzzy logic control CCR operation Process control advances for cement industry (DDC/DCS/PLC/SCADA)

Text Books/Reference books :

1**.**Chemical Process control : Stephanopolous,G.PHI 1990

2. Process system analysis and control : Coughanower, McGraw Hill 1991

3.Principles of measurement systems: Bently JP Longomans.

4.Principles of Industrial Instrumentation: Patranabis, D, TMH

Instrumentation Lab

 List of Experiments:

1. To study the response, time constant of thermocouple/ Bimetallic thermometer.
2. To study the response of a liquid level tank system
3. To study the response of a two tank non-interacting system
4. To study the response of a two tank interacting system.
5. To study the response of a stirred tank heater system
6. To study the characteristics of an on-off controller.
7. To study the characteristics of a PI/PID pneumatic / electronic controller.
8. To study the performance of a closed loop control system containing controller, final control element, measuring element.
9. Calibration of temperature and pressure measuring instruments
  10. Analysis of solution by UV/VIS spectrophotometer

.

.

B.Tech.(Cement Tech.)

VI Semester

Maintenance Practices in Cement Plant

Objective: The course is designed to familiarise with cement plant utilities , maintenance and operational problem

Unit-I

Basic Concepts of Reliability: Probability distributions used in maintenance engineering- Binomial, Poisson, Exponential, Normal, Log-normal, Gamma and Weibull distribution; failure rate, hazard rate, failure modes, MTTR, MTBF, MTTF

Unit-II

System Reliability Models: System reliability-n-component series systems, m-component parallel systems and combined system; standby systems; K-out-of-m systems; redundancy techniques in system design; event space, decomposition (Key Stone), cut and tie sets, Markov analysis, reliability and quality, unreliability, maintainability, availability

Unit-III

Maintenance Concepts and Strategies: Introduction, maintenance functions and objectives, maintenance planning and scheduling, maintenance organization.

General Introduction to Maintenance Types: Breakdown, emergency, corrective, predictive, and preventive; maintenance prevention; design-out maintenance, productive maintenance, shutdown maintenance and scheduled maintenance.

Unit-IV

Condition Based Maintenance: Principles of CBM, pillars of condition monitoring, CBM implementation and benefits; condition monitoring techniques- visual monitoring, vibration monitoring, wear debris monitoring, corrosion monitoring, performance monitoring

Unit-V

Reliability Centered Maintenance (RCM):- Concept, methodology, benefits;Total Productive Maintenance: Evolution of TPM, TPM objectives, concept, pillars of TPM.Failure Modes and Effects Analysis (FMEA)/ Failure Modes, Effects and Criticality Analysis (FMECA): Overview, elements of FMECA, applications and benefits, risk evaluation, risk priority numbers, criticality analysis, process FMEA, qualitative and quantitative approach to FMECA; design FMEA and steps for carrying out design FMEA

Text Books :

1. Ebeling CE; An Introduction To Reliability & Maintainability Engg; TMH
2. Srinath L.S; Reliability Engineering; East West Press.

3. Naikan; Reliability engg and life testing; PHI
4. Kapur KC and Lamberson LR; Reliability in Engineering Design; Wiley India
5. Telang AD and Telang A; Comprehensive Maintanance Management; PHI
6. Mishra R.C; Reliability and Maintenance Engineering; New age International publisher.
7. Balaguruswamy; Reliability Engg; TMH
8. Dhillon; Engg Maitainability- How to design for Reliability and easy maintenance; PHI

B.Tech.(Cement Tech.)

VI Semester

Waste Utilization in cement Production

Objective: To get a broad perspective about the waste utilization and effluent in cement industry

Unit-I

Waste volume reduction- introduction, various techniques and benefits.
Classification of wastes :Conservation of wastewater: Changing production to decrease wastes: Re using both industrial and municipal effluents for raw water supplies: Elimination of Batch or slug discharge of process wastes, Waste strength reduction-introduction, Process Changes: Equipment Modification: Segregation of Wastes: Equalization of Wastes: By-Product Recovery: Proportioning Wastes: Monitoring Waste Streams:, Neutralization-Introduction Acceptable Methods of Neutralization:, Proportioning, Equalization. Reuse and recycling concepts-Stages, Life cycle thinking

Unit-II

Effluent and solid waste utilization in cement industry by various methods- RFID (Radio Frequency Identification) tags, GPS and integrated software packages

Unit-III

Value added products from other industries to cement industry- Agro-waste (organic), Industrial waste (inorganic) , Mining/mineral waste ,Non hazardous waste, Hazardous waste. Fly ash, bottom ash, rice husk,ash, palm oil fuel ash, organicfibers, Phosphogypsum, waste glass, granulated blast-furnace slag, waste steel slag, rubber tire , Quarry dust , Construction and demolition debris (concrete rubble, tiles, waste bricks, etc.)

Unit-IV

Recovery of energy from in cement industry- Possible Heat Sources such as Kiln Shell,clinker cooler,kiln system exit gas. waste heat recovery/thermal energy storage applications :Sensible Heat Storage ,1. Magnesia Brick 2. Granite 3. Limestone 4. Draw Salt 5.Oil – Dowtherm Caloria 6. Sodium Hydroxide 7. Rock 8. Eutectic Carbonates 9. Sodium Hydroxide Chemical Energy Storage 10. Sulfurdioxide - trioxide 11. Anmoniated Salts

Unit-V

Case studies: fly ash obtained from coal-burning power stations ,
- slag obtained from steel industry blast furnaces,Marbal slurry and dust from various sources, coffee bean husks for energy, biomass, Cane Sugar waste, effluent & baggasse form paper pulp, Other processes

Text Books/ Reference books :
1)Archana Ghose "Urban Environment Management" Local government and community action, Concept publishing company, New Delhi, 2003.
2)Rajeev Narayan, "Human Resources Development in Urban Administration" , Serials publication, New Delhi, 2006.
3)K.Aswathappa, "HumanResource Management", Mc Grow Hill companies, Third edition,
4) Assessment of utilization of Industrial solid wastes in cement manufacturing , CPCB
5)Cement Data Book: W. H Duda , Verlag G m Bh,Berlin.

B.Tech.(Cement Tech.)

VI Semester

Total Quality Management

Objective: To get a detailed review of quality policies and quality objective in cement plant

Unit-I

Introduction: Definition and Need of quality, Aspects of quality, Quality characteristic, Quality specification, Quality function, Economics of quality. Inspection, Its objectives and types, Inspection versus Quality Control, Statistical Quality Control, its Tools, Advantages, limitations and Applications.
Probability & Statistics: Definition, Measures of Central tendency & Dispersion, Concept of Variation, Variable and attribute data, Frequency distribution.

Unit-II

Control Charts: Concept of variability, Assignable & chance causes, Concept of specifications and tolerances, Definition and objectives of control charts, Control charts for variables and attributes & related problems, Variable charts vs attribute charts, Patterns on control charts,Type–I & Type-II Errors, Process capability and its methods of determination.

Unit-III

Acceptance Sampling: Definition, Advantages over 100% inspection, Methods of taking samples, Operating characteristics curve & its characteristics. Single, Double and Multiple, Sequential Sampling Plan & Related problems.

Unit-IV

Quality Assurance: Need, Principles, Essentials and Advantages of Quality Assurance System, Quality Manual, Field complaints, Quality Audit & its types, Quality Assurance Methods, Quality Control vs Quality Assurance.

Unit-V

Quality systems: Brief on, ISO:9001–2000 Quality management systems. Description of TQM Concept of quality circles ,Practices of quality Control system in a cement plant. Life cycle assessment

Text Book: :

1. EL Grant & RS Leavenworth, "Statistical Quality Control",McGraw Hill & Co.
2. M. Mahajan, "Statistical Quality Control", Dhanpat Rai & Co.
3. O.P. Khanna, "Statistical Quality Control", Dhanpat Rai & Co.
4. R.C. Gupta, "Statistical Quality Control", Khanna Pulishers
5. Guide Norms for cement plant operations, NCB Publication.

Reference Book:

1. Amitav Mitra, "Fundamentals of Quality Control", Pearson Education
2. Feigenbaum, "Total Quality Control", McGraw Hill & Co.
3. Taylor J.R., "Quality Control systems", McGraw Hill Int. Education

Testing of Cement by BIS Method Lab

Practical:

1. Chemical testing of cement.
   - Determination of loss on ignition
   - Determination of SiO_2
   - Determination of Al_2O_3
   - Determination of Fe_2O_3
   - Determination of CaO
   - Determination of MgO
   - Determination of SO_3
   - Determination of insoluble residue
2. Mechanical testing of cement

   - Determination of density

   - Determination of specific surface

   - Determination of normal consistency

   - Determination of setting time

   - Determination of soundness test by

        ➢ Le Chatelier

        ➢ Autoclave

   - Determination of compressive strength

   - Determination of drying shrinkage

B.Tech.(Cement Tech.)

VI Semester

Special Cements & Performance of Cement

Objective: . To study Special Cements & their Performance

Unit-I

Introduction to Geopolymeric cement, characteristic of fly ash, Granulated blast furnace slag, other Pozzolanic materials for cement production.

Unit-II

Special Cement: Chemical, Mineralogical and physical Characteristic of some of special cement such as Portland Pozzolana Cement (PPC)

Portland Slag Cement (PSC); Supersulphate Cement; Oil Well Cement; Low heat Cement.

Unit-III

Application of Cement and Performance Requirement: Concrete and mortars, introduction to various infrastructure and use of cement,. Requirement of setting, strength and durability of different concrete constructions, effect of chemical composition and physical characteristic of cement on performance, fineness and particle size distribution , tailoring performance of cements.

Unit-IV

Durability consideration of concrete, sulphate attacks, corrosion of reinforcing steel in concrete, attack by acid and other aggressive agencies.

Performance of Blended Cement, advantages of Portland Pozzolana Cements(PPC) and Portland Slag Cement (PSC)

Unit-V

Chemical Admixtures and mineral additives : Function of admixtures, Classification of admixtures, physical requirement of admixtures, Indian standard specifications, Mineral or supplementary additivesProperties of fresh and hardened concrete: workability and its measurement, factors affecting workability, requirements of workability, Estimation of errors, Strength of concrete , stress and strain characteristics of concrete, Dimensional stability- shrinkage and creep, creep of concrete , permeability of concrete, durability of concrete, concrete in marine environment, acid attack, Efflorescence , fire resistance, Thermal properties of concrete

Text Books/.Reference Books:

1. Chemistry of Cement and Concrete: F M Lea, Arnold, London
2. Properties of Concrete : Neville, A.M. Longmans.
3. Cement Industry Data Book, CAM , New Delhi
4. World Cement Directory: CEMBUREAU

Testing of Concrete

List of Experiment

1) Soundness test

2) Setting time test

3) Standard consistency

4) Heat of hydration

5) Compressive strength

6) Aggregate impact value

7) Slump test

Text book/Reference book:

1) Concrete technology : MS Shetty

B.Tech.(Cement Tech.)

VII Semester

Project Management

Objective: To handle green field and brown field cement projects

Unit-I

Role of project engineering in project organisation ;Plant location and plant layout; Startup and shut downs of project; Preliminary data for construction projects; Process engineering; Flow diagram, Plot plans, Scheduling the project; Engineering design and drafting.

Unit-II

Business and legal procedures **Procurement operations**: Organisation and operation of aprocurement department, Contract versus Commodity buying; Procurement requiring engineering participation, Procurement of off-the-shelf materials, Expediting and inspection, Procurement procedure, Project engineering and procurement .Office procedure: Conferences, Technical writing, Filing systems, Contracts and contractors: Engineering and constructors firms, Selecting the contractor, The basis of contract, Type of reimbursement, The contract form, Exhibits, Overtime payments, Lump-sump contract form, Contracts and engineers, Ethics and the contract.

Unit-III

Details of engineering design and equipment selection, Process instruments, Plant utilities, Foundations, Structures and buildings, Safety and plant design.

Unit-IV

Construction planning: Construction personnel: Jurisdictional disputes and labour relations, Construction labours distribution, Labour rates.Construction operations: Site preparation, Driving of pile, Temporary buildings, Temporary water supply, Roadways and rail road spurs, Excavation operation, Installation of underground facilities, Electrical conduit, Foundation construction, Erection of guyed derrick, Erection of elevated reinforced concrete structures and structural steel, Erection of major equipment,Installation of piping, pipe identification, insulation, Buildings, final stage of construction.

Unit-V

Critical path method (cpm): Events and activities; Network diagramming; Earliest starttime and earliest finish time ;latest start time and latest finish time; Float, Advantage of CPM ;Cost to finish he projects earlier than normal cost; Precedence diagramming. Programme evaluation and review technique . Single versus multiple time estimates; Frequency distribution

Text Books/ Reference Books:
1.Peter S. Max & Timmerhaus, Plant design and economics for chemical engineers. Mc Graw Hill (2002).
2. Srinath L. S., "PERT AND CPM." affiliated east press pvt. Ltd., new york (1973)
3. Perry J. H.,"Chemical engineering handbook" 7TH ed. Mc Graw Hill (1997).
4. JELLEN F. C., "Cost and optimization in engineering". Mc Graw Hill

B.Tech.(Cement Tech.)

VII Semester

Plant Design & Process Economics

Objective: To have an economic design of cement plant plant equipment and economic analysis

Unit-I

Process Development: Process selection, study of alternative processes, pilot plant, Scale up methods, Flow sheet preparation, sketching techniques, Equipment numbering, Stream designation, Material and energy balances
Plant Design: Design basis ,Process selection -Selection of equipment, specification and design of equipment's, material of construction, Plant location, Plant layout and installation ,Safety, Start up, Shutdown and Operating guidelines

Unit-II
Time value of money and equivalence, Interest, cost comparisons by present worth, Annual equivalent cost and capitalised cost methods, Uniform gradient and series. Depreciation, Taxes and Insurances Nature of depreciation, Methods of determining depreciation, depreciation rates in current Indian situation, Types of taxes and insurance's, Procedure for cost comparison

Unit-III
Cost Estimation: Types of cost estimation, capital investment cost, fixed capital cost, working capital cost, start-up costs, process equipment cost estimation, cost index, Equipment costs due to inflation, Battery limit investments, estimation of plant cost, Estimation of total product cost, Manufacturing cost, General expenses.
Profitability: Criteria of profitability, Payout period, Return on investment, Present value, Cash flow analysis, Alternative investment analysis, Sensitive analysis in project profitability

Unit-IV
Economic Optimization and Optimum Design: Nature of optimization , Uni-variable and multivariable systems, Analytical, graphical and incremental methods of solution, LaGrange multiplier method, Linear programming and dynamic programming establishing optimum conditions, Break even chart for production schedule, Optimum production rates in plant operation, Optimum conditions in batch, cyclic and semicyclic operation, Sensitivity and response analysis

Unit-V
Preparation of techno-economic feasibility report & D.P.R

Text Books/Reference Books:
1 Peters M., Timmerhaus K. & Ronald W., Plant Design & Economics for Chemical Engineers, McGraw Hill
2 James R Couper, Process Engg. Economics (Chemical Industries) CRC Press
3. Aries & Newton, Chemical Engg. Cost Estimation, McGraw Hill
 .

B.Tech.(Cement Tech.)

VII Semester

Modelling, Simulation & Application Software in Cement Manufacture

Objective: Development of different models and simulation of process parameters to optimize process and plant productions

Unit-I

Introduction to mathematical modeling; Advantages and limitations of models and applications of process models of stand-alone unit operations and unit processes; Classification of models – Simple vs. rigorous, Lumped parameter vs. distributed parameter; Steady state vs. dynamic, Transport phenomena based vs. Statistical; Concept of degree of freedom analysis.

Unit-II

Simple examples of process models; Models giving rise to nonlinear algebraic equation (NAE) systems, - steady state models of flash vessels, equilibrium staged processes distillation columns, absorbers, strippers, CSTR, heat exchangers, etc.; Review of solution procedures and available numerical software libraries.

Unit-III

Steady state models giving rise to differential algebraic equation (DAE) systems; Rate based approaches for staged processes; Modeling of differential contactors – distributed parameter models of packed beds; Packed bed reactors; Modeling of reactive separation processes; Review of solution strategies for Differential Algebraic Equations (DAEs), Partial Differential Equations (PDEs), and available numerical software libraries

Unit-IV

Unsteady state (time dependent) models and their applications; Simple dynamic models of Batch reactors, Adsorption columns, Multistage separation systems; Model reduction through orthogonal collocation; Review of solution techniques and available numerical software libraries.

Unit-V

Introduction to flow sheet simulation; Sequential modular approach; Equation oriented approach; partitioning and tearing; Recycle convergence methods; Review of thermodynamic procedures and physical property data banks.

Text Books/Reference Books:
1. Luyben W.L., "Process Modeling, Simulation, and Control for Chemical Engineering", Wiley.
2. M.M. Denn, "Process Modelling", Wiley, New York, (1990).
3. Hussain Asghar, "Chemical Process Simulation", Wiley Eastern Ltd., New Delhi, (1986)
4. C.D. Holland and A.I. Liapis, "Computer Methods for Solving Dynamic Separation Problems", McGraw Hill, (1983).
5. C.D. Holland, "Fundamentals of Modelling Separation Processes", Prentice Hall, (1975)
6. S.M. Walas, "Modelling with Differential Equations in Chemical Engineering", Butterworth, (1991)
7. M.E. Davis, "Numerical Methods and Modelling for Chemical Engineers", Wiley, New York

B.Tech.(Cement Tech.)

VII Semester

Optimization Technique

Objective: Application of operation research techniques to optimise various cement plant process parameters

Unit-I

Introduction to process optimization; formulation of various process optimization problems and their classification. Basic concepts of optimization-convex and concave functions, necessary and sufficient conditions for stationary points.

Unit-II

Optimization of one dimensional functions, unconstrained multivariable optimization- direct search methods. Bracketing methods: Exhaustive search method, Bounding phase method Region elimination methods: Interval halving method, Fibonacci search method, Golden section search method. Point-Estimation method: Successive quadratic estimation method. Indirect first order and second order method. Gradient-based methods: Newton-Raphson method, Bisection method, Secant method, Cubic search method. Root-finding using optimization techniques.

Unit-III

Multivariable Optimization Algorithms: Optimality criteria, Unidirectional search, direct search methods: Evolutionary optimization method, simplex search method, Powell's conjugate direction method. Gradient-based methods: Cauchy's (steepest descent) method, Newton's method.

Unit-IV

Constrained Optimization Algorithms: Kuhn-Tucker conditions, Transformation methods: Penalty function method, method of multipliers, Sensitivity analysis, Direct search for constraint minimization: Variable elimination method, complex search method.

Unit-V

Successive linear and quadratic programming, optimization of staged and discrete processes.Specialized & Non-traditional Algorithms: Integer Programming: Penalty function method, Nontraditional Optimization Algorithms.

Text Books/ Reference Books:
1. T.F. Edgar and D.M. Himmelblau Optimization of Chemical Processes – McGraw Hill (1989)
2. K. Urbanier and C. McDermott - Optimal Design of Process Equipment – John Wiley (1986)
   Kalyanmoy Deb ,Optimization for engineering design, , Prentice Hall of India
3. G.S. Beveridge and R.S. Schechter, Optimization theory and practice, Mc Graw Hill,
   Newyork, 1970.
4. Rekllitis, G.V., Ravindran, A., and Ragdell, K.M., Engineering Optimization- Methods
   and Applications, John Wiley, New York, 1983.
5. SS Rao, Optimization Theory and Applications
   .

B.Tech.(Cement Tech.)

VII Semester

Application of Cement Lab

1. Preparation of laboratory scale clinker

2. Preparation of PPC flyash based in the laboratory

3. Preparation of PSC in the laboratory

4. Performance study of PPC and PSC prepared in the lab

B.Tech.(Cement Tech.)

VII Semester

Application Modelling simulation lab

1. Auto Cad

2. Determination of 3 dimensional deposit model

3. Matlab

4. SAP

5. Aspen plus

B.Tech.(Cement Tech.)

VII Semester

Advance Method of Cement & Clinker Testing Lab

1. XRD method for analysis of chemical

2. XRF for analysis of cement and raw materials

3. Optical microscopic studies of clinker , limestone and concrete

B.Tech.(Cement Tech.)

VIII Semester

Plant Management

Objective: To handle green field and brown field cement projects

Unit-I
Introduction: Concept of management, concept of a system, production system, production functions. Organisation fundamentals. Guidelines for good practice, organisation structures, organisation charts, span of control, number of levels, number of executives, management functions. Scheduling. Scheduling process scheduling for a multistage production system, sequencing production operations

Unit-II
Facilities management: Plant location—factors influencing plant location, cost factors, plant location decision process, selection of a location for new facilities, evaluation of alternative regions and sub-regions. Plant layout-objectives, decision process, types of layouts, comparison of layouts. Line balancing and sequence analysis concepts. Materials handling-devices for materials handling, basic considerations in the selection of materials handling system

Unit-III
Human factor engineering: Methods analysis and works measurement, methods study, process analysis, operation process chart, operator process chart, motion study, principles of motion economy, motion analysis. Time study-types of studies, procedure for job time study, physical environment. Aggregate planning. Planning time horizons, inputs to aggregate planning systems, single and multistage aggregate planning systems, decision processes for aggregate planning—graphical method, linear decision rule, and linear programming method-Demand management. Time span for forecasts, forecasting system, forecasting methods-time series, casual and predictive forecasting methods, selection of a forecasting method.

Unit-IV
Quality management: Three aspects of quality, functional responsibility for quality in a manufacturing system, economics of quality assurance, quality control, QC decision variables, process control, control charts, acceptance sampling, single, double and sequential sampling plans, concept of total quality control (TQC).
Maintenance management: Maintenance functions, concept of reliability engineering, reliability improvement, preventive maintenance, preventive maintenance policy, repair policy, replacement decisions, queuing theory and its applications in maintenance. Introduction to PERT/CPM.

Unit-V
Plant economics: Kinds of costs, evaluation of capital investments. Capital budgeting, break-even analysis, make or buy decisions, evaluation of alternatives, discounted cash flow, equivalent comparison methods, depreciation

Text Books/ Reference Books:
1.Peter S. Max & Timmerhaus, Plant design and economics for chemical engineers. Mc Graw Hill
2. Srinath L. S., "PERT AND CPM." affiliated east press pvt. Ltd., new york (1973)
3. Perry J. H.,"Chemical engineering handbook" 7TH ed. Mc Graw Hill (1997).
4. JELLEN F. C., "Cost and optimization in engineering". Mc Graw Hill

B.Tech.(Cement Tech.)

VIII Semester

Marketing of Cement

Objective: To have an idea of professional marketing strategy and consumer protection in cement utilisation

Unit-I

Marketing :Definition Importance Scope
Marketing Management :Tasks and Trends, Company orientations towards marketplace : Production Concept, Product Concept, Selling Concept, Marketing Concept, Holistic Marketing Concept, Building customer value, satisfaction and loyalty, Customer Relationship Management(CRM), Analyzing marketing environment : Demographic, Economic , Political and Legal environment, An overview of Indian marketing environment, Marketing mix: concept and components

Unit-II

Market Segmentation, Targeting and Positioning strategies; Marketing Mix; The product; New Product Development; Product Life Cycle and strategies;; Product Mix decisions; Branding; Packaging and Labeling.

Unit-III

Pricing Decisions; Factors influencing Price five "C"s; Pricing Strategies; New product pricing; Price adjustment strategies

Unit-IV

Distribution Decisions; Channel alternatives; Choice of Channel; Channel Management, Channel Dynamics, Managing promotion Mix; Advertising, Personal selling, Sales Promotion and publicity, Integrated Marketing Communication., Market survey of cement, Quality control of cement , Statistical analysis of quality of cement based on the data of field data.

Unit-V
Marketing Control techniques; Marketing Audit; Social Marketing; Green Marketing; Web Marketing; green washing

Text Books:

 Reference Books
1. V.S.Ramaswamy and S.Namakumari Marketing Management
2. Byod Walker et..al , marketing Management, MGH, New Delhi

B.Tech.(Cement Tech.)

VIII Semester

Project work , seminar and viva

1. Quality control of cement manufacture

2. Pyroprocessing in cement

3. Milling system

4. EIA and EMP of cement plant

5. Process optimisation in cement manufacture

6. Use of low grade limestone in cement manufacture

7. Performance evaluation of cement and concrete

8. Role of nanofillers as a performance improver of cement