Where talent meets opportunity

SRI SATYA SAI UNIVERSITY
OF TECHNOLOGY AND MEDICAL SCIENCES

SYLLABUS REVISION

Name of School-School of Engineering

Department-Chemical Engineering

2017-18 TO 2021-22

www.sssutms.co.in

Opp.Oilfed Plant, Bhopal-Indore Road,Sehore (M.P), Pin - 466001

(+91) 07562-292740 | 7562292720

Sri Satya Sai
University of Technology and Medical Sciences
(Established under Govt. of M.P. Registered under UGC 2(F) 1956)

Bhopal-Indore Road, Opp. Pachama oilfed plant, Pachama, Dist.-Sehore M.P.PIN-466001
Ph. 07562-223647, Fax : 07562-223644, Web: www.sssutms.co.in, info@sssutms.co.in

Name of Faculty : School of Engineering

Name of Department: **Chemical Engineering**

Minutes of Board of Studies Committee Meeting Dated on **10.06.2017**

The Board of Studies Committee Meeting was held in the room of Department of Chemical Engineering at 2:30 PM. on **10.06.2017**, Following members were present.

1. Dr. Anuradha Devi, Asstt. Prof. (Chemical Engineering), - Chairman
2. Dr. S. Suresh Assoc. Prof. (Chemical Engineering, MANIT Bhopal),-External Member
3. Dr. Neelu Jain, Prof. (Chemistry), Member
4. Mr. Manoj Kumar Gandwane, Asstt. Prof. (Chemical Engineering), Member
5. Mrs. Priyanka Jhavar, Asstt. Prof. (Mechanical Engineering), Member

The Chairman of Board of Studies Committee welcomes and appreciated the efforts put up by the faculty for progress of the departmental activities. The following Agenda points were discussed and resolved.

Agenda Preparation of syllabus and Scheme for III and IV Sem CBCS.

Discussion Scheme

Scheme and syllabus was put up before the member as per recent AICTE guidelines, It was discussed in detail by the members and some modification were suggested.

Resolution of the Discussion:

It was resolved that scheme and syllabus as proposed with some modification and may be accepted

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

SSSUTMS

EMPLOYABILITY

SKILL DEVELOPMENT

ENTREPRENEURSHIP

The Chairman thanks the members for peaceful conduction of meeting.

Signature of All members (Including Chairman)

S.No.	BOS Members	Signature
1	Dr. Anuradha Devi, Asstt. Prof. (Chemical Engineering), - Chairman	
2	Dr. S. Suresh Assoc. Prof. (Chemical Engineering, MANIT Bhopal),- External Member	
3	Dr. Neelu Jain, Prof. (Chemistry), Member	
4	Mr. Manoj Kumar Gandwane, Asstt. Prof. (Chemical Engineering), Member	
5	Mrs. Priyanka Jhavar, Asstt. Prof. (Mechanical Engineering), Member	

Chairman

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

SSSUTMS Faculty of Engineering SEHORE (M.P.)

Sri Satya Sai University of Technology & Medical Sciences, Sehore (M.P)

Scheme of Examination - CBCS Pattern

Academic Year 2017– 2018

Branch : Chemical Engineering **Semester - III**

S.No.	Subject Code	Subject Name	Maximum Marks Theory Slot			Maximum Marks (Practical Slot)		Periods/ hour/ week			Credits	Total Marks
			End Sem. Exam.	Mid Tests	Assign-ments/Quiz	End Sem. Practical & Viva	Practical Record /Assignment/ Quiz / Presentation	L	T	P		
1	**MTH - 301**	Computational Techniques	60	30	10	-	-	2	1	-	3	100
2	CMC - 302	Advanced Engineering Chemistry	60	30	10	30	20	2	1	2	4	150
3	CMC - 303	Chemical Engineeiring Thermodynamics-I	60	30	10	30	20	2	1	2	4	150
4	CMC - 304	Chemical Process Calculations	60	30	10	30	20	2	1	2	4	150
5	CMC - 305	Chemical Instrumentation	60	30	10	30	20	2	1	2	4	150
6	CMC - 306	Inorganic Chemical Process Industry	60	30	10	30	20	2	1	2	4	150
TOTAL			**360**	**180**	**60**	**150**	**100**	**12**	**6**	**10**	**23**	**850**

w.e.f july 2017

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P)

SSSUTMS School of Engineering SEHORE (M.P.)

Sri Satya Sai University of Technology & Medical Sciences, Sehore (M.P)

Scheme of Examination - CBCS Pattern

Academic Year 2017– 2018

Branch : Chemical Engineering **Semester - IV**

S.No.	Subject Code	Subject Name	Maximum Marks Theory Slot			Maximum Marks (Practical Slot)		Periods/ hour/ week			Credits	Total Marks
			End Sem. Exam.	Mid Tests	Assign-ments/Quiz	End Sem. Practical & Viva	Practical Record /Assignment/ Quiz / Presentation	L	T	P		
1	CMC - 401	Chemical Process Control	60	30	10	30	20	2	1	2	4	150
2	CMC - 402	Mechanical Operations	60	30	10	30	20	2	1	2	4	150
3	CMC - 403	Fluid Mechanics	60	30	10	30	20	2	1	2	4	150
4	CMC - 404	Computational Methods in Chemical Engineering	60	30	10	30	20	2	1	2	4	150
5	CMC - 405	Material Science and Technology	60	30	10	-	-	2	1	-	3	100
6	CMC - 406	Organic Chemical Process Industry	60	30	10	30	20	2	1	2	4	150
TOTAL			**360**	**180**	**60**	**150**	**100**	**12**	**6**	**10**	**23**	**850**

Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P)

SSSUTMS School of Engineering SEHORE (M.P.)

MTH-301
COMPUTATIONAL TECHNIQUES

UNIT I

MATRICES:- Eigenvalues and Eigenvectors of a real matrix , Characteristic equation , Properties of Eigenvalues and eigenvectors, Cayley-Hamilton Theorem , Diagonalization of matrices , Reduction of a quadratic form to canonical form by orthogonal transformation

UNIT II

INFINITE SERIES:- Sequences , Convergence of series , General properties , Series of positive terms , Tests of convergence (Comparison test, Integral test, Comparison of ratios and D'Alembert's ratio test) , Alternating series , Series of positive and negative terms , Absolute and conditional convergence , Power Series , Convergence of exponential, logarithmic and Binomial Series.

UNIT III

FUNCTIONS OF SEVERAL VARIABLES:- Limits and Continuity , Partial derivatives , Homogeneous functions and Euler's theorem ,Total derivative ,Differentiation of implicit functions , Change of variables , Partial differentiation of implicit functions , Taylor's series for functions of two variables . Errors and approximations, Maxima and minima of functions of two variables

UNIT IV

IMPROPER INTEGRALS:-Improper integrals of the first and second kind and their convergence, Evaluation of integrals involving a parameter by Leibnitz rule – Beta and Gamma functions, Properties, Evaluation of integrals using Beta and Gamma functions , Error functions.

UNIT V

MULTIPLE INTEGRALS:- Double integrals , Change of order of integration ,Area enclosed by plane curves, Triple integrals, Volume of Solids, Change of variables in double and triple integrals, Area of a curved surface.

TEXT BOOKS :

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 40th Edition, 2007.
2. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill Co. Ltd.,

CMC – 302

ADVANCED ENGINEERING CHEMISTRY

UNIT I

Electronic Effect: Chemical properties of molecules, hyper conjugation and steric effects, studies on formation and stability of carbonation and Carbonium ions (with Inductive effects, conjugation & resonance and their effects)

UNIT II

Chemical Kinetics: Rate constant, order and molecularity of a reaction, zero, orders of reactions, methods of determination of order of reactions, Kinetics of opposing reactions Reaction rate theories, Arrhenius, parameters, Catalysis (including enzyme catalysis), effect of catalyst on reaction rate

UNIT III

Electrochemistry: Galvanic cell, EMF and its determination, free energy concept, Nernst equation of electrode potential, standard electrode potential; PH value, its measurement and pH metric titration, Conductance, its measurement in polar and non polar solvents; Debye & Huckel theory and its modifications in case of strong electrotypes, conductometric titration. Phase Rule: Phases, Degrees of freedom, component definition and derivation of phase rule, phase diagram study of Pb-Ag & Zn-Mg systems.

UNIT IV

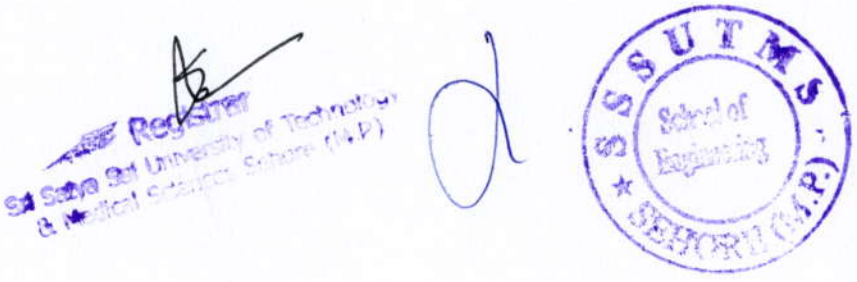
Properties of simple monomers: Production, properties & industrial applications of following monomers – Ethylene Styrene, Vinyl Chloride, Vinyl alcohol, Acrylic acid, Methyl Acrylate, Ethyl Acrylate & Methyl Methacrylate.

UNIT V

Oils and Fats: Vegetable oils by solvent extraction, processing of animal fats, hydrogenation and esterification of oils; Soaps and Detergents Bathing & laundry soaps, cationic and anionic detergents; Specially cleaning, polishing and sanitation proportions, surface active agents, sulphonate oils.

REFERENCES:

1. B.S.Bahl & G. D. Tuli- Essentials of physical Chemistry. S. Chand & Publishers.
2. Glasstone – Textbook on Physical Chemistry – Prentice Hall, India, New Delhi.
3. Dryden CE- Outlines of Chemical Technology- Prentice Hall, India, New Delhi
4. Levine; Physical Cheistry; TMH.
5. Sivasamkar; Engg Chemistry; TMH
6. Jain & Jain- Engineering Chemisry – Dhanpat Rai Publishing Company, Delhi.
7. Austin G.T, Shreeves; Chemical Process Industry – McGraw Hill – Kogmina



LIST OF EXPERIMENTS:

1. To determine the viscosity of a viscous liquid by falling sphere method
2. Determination of saponification value of oil sample
3. Application of pH meter to find acidity and alkalinity of a solution.
4. To study the hydrolysis of cane sugar solution in the presence of an acid by Fehling's solution method and to find out the reaction constant.
5. Determination of the strength of unknown hydrochloric acid (app. 0.1N) by titrating it against caustic soda by
6. conductometric method.
7. To determine the % composition of a given binary liquid solution by polarimeter.
8. To determine the solubility of a sparingly soluble salt in water by conductance measurement.
9. Determination of pH of mixture of CH3COOH and CH3COONa and the dissociation constant of the acid.
10. Preparation of laundry soap and to determine its yield.

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

SSSUTMS
School of Engineering
SEHORE (M.P.)

CMC – 303

CHEMICAL ENGINEERING THERMODYNAMICS - I

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.

UNIT III

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 IV

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.

UNIT V

Compression & expansion of fluids; single stage, multiple stage requirements & efficiency along with effect & engineering along with effects clearance, compression of real gas.

REFERENCES:

1. Smith J.M and Van Ness- Introuction to Chemical Engg Thermodynamics – 6th edition
2. Daubert; chemical engg thermodynamic; TMH
3. K V Narayan- Chemical engineering thermodynamics
4. Rathakrishnan E; Fundamentals of Engg Thermodynamics; PHI
5. Dodge B.F. Chemcail Engineering –Thermodynamics –McGraw Hill
6. Balzhiser Samules and Eliassen-Chemical Engg- Thermodynaics Prentic Hall
7. Sandler S.I Chemical Engg-Thermodynamics-John Wiley and son
8. Rastogi and Mishra-Chemical Engg Thermodynaics

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P)

SSSUTMS School of Engineering

CMC- 304

CHEMICAL PROCESS CALCULATIONS

UNIT I

Mathematical and Engineering Calculation. Units, different unit systems, conversion of unit from one system to other dimensions. Dimensional analysis, dimensional group. Fundamental of conservation of mass conservation of energy. Basic of calculation.

UNIT II

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

UNIT III

Material balance-Introduction of component balance solving material balance, with and without simultaneous equation at steady state material balance, with and without simultaneous at unsteady state, recycle bypass and purge calculations.

UNIT IV

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.

UNIT V

Stochiometry & unit operations-Introduction of unit operation, Distillation Crystallization Drying, Evaporation, Stochiometry and its application. Introduction to Computer aided calculations-steady state material and energy balances.

REFERENCES:

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.
4. Whitwell, J.C., Tone, R.K. "Conservation of Mass and Energy ", McGraw -Hill, 1973.
5. Process Calculation for Chemical Engineering, Second Revised Edition, Chemical Engineering Education Development Centre, I.I.T., Madras, 1981.
6. O.A. Hougen, K.M. Watson, R.A. Ragatz; Chemical Process Principles Part I –CBS pub.

Registrar
Shri Sathya Sai University of Technology & Medical Sciences Sehore (M.P.)

SSSUTMS School of Engineering SEHORE (M.P.)

LIST OF EXPERIMENTS:

1. Determination of boiling point relation wrt concentration of caustic soda and verify Dehring' rule.
2. Application of dry and wet bulb thermometer to find out atmospheric humidity
3. Use of humidity chart to find enthalpy dew point humid heat and saturation.
4. Solubility at room temperature and boiling point of urea in water and verify the material balance.
5. Crystallization of copper sulfate in saturated solution by cooling and finding out the crystal yield.
6. To find out the heating value of coal using a calorimeter
7. Combustion of coal & performing the material balance
8. Proximate analysis of coal sample
9. Measurement of flame temp & compare actual & theoretical temp.
10. To find the heat of reaction using calcium oxide and water.

Shri Satya Sai University of Tech... & Medical Sciences Sehore (M.P.)

SSSUTMS School of Engineering

CMC – 305

CHEMICAL INSTRUMENTATION

UNIT I

Introduction to chemical process instrumentation, Process Variables, Static and Dynamic characteristics of instruments & their general classification.

UNIT II

Elements of measuring systems & their functions, principles, construction & operation of instruments for measurement, Process Flow Diagram (PFD), Actuator, Solenoid, Sensors

UNIT III

Control / Indication / Recording of process variables like pressure, flow, level, humidity and composition. Temperature Measuring Devices: Thermocouple, Resistance Temperature Detector (RTD). Pressure Measuring Devices: Differential Pressure Cell, Bellows Resistance Transducer. Flow Measuring Devices: Hot-wire anemometer, Nutating Disc displacement meter. Level Measuring Devices: Ball float, Magnetic Bond Level Indicator

UNIT IV

Principles of Transducers, Electro-Pneumatic transducers, Pneumatic transducers, Electrical & Multi-pressure devices. Actuator, Primary elements, Regulators and safety valves, Math function.

UNIT V

Piping and Instrumentation Diagram (P&ID), Instrumentation symbols Process instrumentation diagram and symbols, process instrumentation for process equipment's such as distillation column, heat exchanger, fluid storage vessel

REFERENCES:

1. Albert D. Cooper- Modern Electronic Instrumentation, PHI
2. Eckman-Industrial Instrumentation
3. H.S. Kalsi- Electronic Instrumentation
4. Curties Johnson- Process Control Instrumentation Technique, IV Edn, PHI
5. Harriot; Process control; TMH
6. Patranabis; Principles of process control; TMH
7. Jaggi, Mathur; Engineering Mathematics; Khanna Publisher.
8. B.G. Liptak- Instrument Engineering 'Handbook, Volume 1 : Process Measurement
9. Austin E. Fribance- Industrial Instrumentation Fundamentals, new York: Mcgraw-Hill 1962
10. Ernest Doebelin- Measurement Systems: Application and Design, McGraw-Hill

LIST OF EXPERIMENTS:

1. Time constant of pH-meter
2. Study of pressure gauge
3. Bellow tube pressure gauge
4. Calibration of different instruments used in chemical processes

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

SSSUTMS School of Engineering SEHORE (M.P.)

5. Study of electro-pneumatic transducers for pressure, flow, level
6. Measurement of water level using differential pressure meter
7. Measurement of flow using electromagnetic flow meter
8. Measurement of flow using differential pressure cell across orifice/ venturimeter

CMC -306

INORGANIC CHEMICAL PROCESS INDUSTRY

UNIT I

Chlor-Alkali Industries: Solvay process of manufacturing soda ash, caustic soda and chlorine manufacture by electrolytic process: mercury, diaphragm and membrane cells, Bleaching powder, Sodium chloride.

UNIT II

Sulfur: Elemental Sulfur mining, Sulfur from ores, Oxides of Sulfur (SO_2, SO_3). Acids: Sulfuric acid, Nitric acid, Hydrochloric acid, Phosphoric acid and phosphates.

UNIT III

Fertilizers: Ammonia, Urea, Ammonium chloride, Ammonium nitrate, Ammonium phosphate, Ammonium sulfate, DAP, Biofertilizers, N-P-K Fertilizers and micronutrients

UNIT IV

Cement: Various kinds of cements and their major constituents, cement manufacture by cement rock (limestone) beneficiation and Portland process. Glass: Nature, types, composition and uses of glass, its manufacture: melting, shaping, annealing and finishing operations.

UNIT V

Coal gasification technologies: various types of fuel gases: producer, water, coke oven, synthesis, LPG & natural gases, various industrial gases: carbon dioxide, hydrogen, oxygen, nitrogen, helium, acetylene, carbon monoxide, sulphur dioxide, their sources and applications.

REFERENCES:

1. Austine G.T.and Shreeves; Chemicals Process Industries; Mc GrawHill
2. Dryden C.E., M. Gopala Rao; Outlines Of Chemical Technology. Affiliated East-West Press
3. Pandey G.N.; Chemical Technology Volume- I; Lion Press, Kanpur.
4. Bose, P.K., Chemical Engineering Technology, Vol. 1,2, Books and Allied (Pvt Ltd, 2011.
5. Desikan and Sivakumar , Unit Processes in Organic Chemical Industries (Eds., CEDC, IITM, 1982.
6. G.T. Austin, Shreve" s Chemical Process Industries, Mc Graw Hill.
7. Shreve" s, Chemical Process Industries, McGraw Hill, 4th Edition.

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

SSSUTMS
School of Engineering
SEHORE (M.P.)

CMC-401[CHEMICAL PROCESS CONTROL]

Unit I

Construction and characteristics of final control elements such as Proportional, Integral, PD, PID controllers, pneumatic control valve, principles and construction of pneumatic and electronic controllers.

Unit II

Process instrumentation diagrams and symbols, process instrumentation for process equipments such as Distillation column Absorption column, Heat Exchanger, Reactors, Evaporators, fluid storage vessels.

Unit III

Laplace Transform, Linear open loop system, first order system and their transient response. Dynamic response of a pure capacitive process, Transportation lag, Dynamic response of a first order lag system.

Unit IV

Second order system and their transient response. Interacting and non-interacting system. Linear closed loop system, block diagram of closed loop transfer function, controllers, transient response of closed loop system.

Unit V

Stability concept, Routh stability criterion, relative stability, Hurwitz stability criterion, Nyquist's stability criterion. Root locus technique, introduction to frequency response, Bode diagram, Bode stability criterion, gain and phase margins, Ziegler Nichols controller setting.

References:

1. Coughnower & Koppel – Process System Analysis And Control- McGraw Hill, New York.
2. D. P. Eckman – Automatics Process Control – McGraw Hill, New York.
3. Peter Harriot – Process Control – McGraw Hill, New York.
4. J. J. Nagrath & M. Gopal; Control System Engineering.

List of Experiment (Pl. expand it):

1. To study the characteristics of control valves (linear, quick opening, etc)
2. To study the dynamics of liquid level systems of non-interacting and interacting types.
3. To study the response of mercury in glass thermometer with and without a thermowell.
4. To study the characteristics of an electronic PID controller.
5. To study the characteristics of a current to pneumatic converter.
6. To study the effectiveness of computer control of a distillation column.
7. To study the effectiveness of a computer control of a heat exchanger.
8. To study to effectiveness of a computer control of a chemical reactor
9. To study to dynamics of a pressure tanks.
10. To calibrate an air purged liquid level indicator.

Registrar
Sri Satya Sai University of Technology & Medical Sciences, Sehore (M.P.)

SSSUTMS
School of Engineering
SEHORE (M.P.)

CMC-402 [MECHANICAL OPERATIONS]

UNIT I

Particle Technology: Particle shape, particle size, different ways of expression of particle size, shape factor, sphericity, mixed particles size analysis, screens – ideal and actual screens, differential and cumulative size analysis, effectiveness of screen, specific surface of mixture of particles, number of particles in a mixture, standard screens and screen analysis of solids.

UNIT II

Size Reduction: Introduction – types of forces used for communition, criteria for communition, characteristics of communited products, laws of size reduction, crushing, grinding, pulverizing and ultrafining size reduction equipment, power requirement in communication.

UNIT III

Flow of Fluid Past Immersed Bodies: Drag, drag coefficient, pressure drop, fluidization, conditions for fluidization, minimum fluidization velocity, types of fluidization, application of fluidization, slurry transport, pneumatic conveying

.

UNIT IV

Sedimentation: Principles of Sedimentation process for system involving solids, liquids & gases, classification, Separation and Filtration batch and continuous process.

UNIT V

Agitation and Mixing: Application of agitation, Agitation equipment, Mixing of solids, Types of mixers- change can mixers, Muller mixers, Mixing index, Ribbon blender, Internal screw mixer, Tumbling mixer.Sampling, Storage and Conveying of Solids: Sampling of solids, storage of solids, Open and closed storage, Bulk and bin storage, Conveyors – Belt conveyors, Chain conveyor, Apron conveyor, Bucket conveyor, Bucket elevators, Screw conveyor.

REFERENCES:

1. Unit Operations of Chemical Engineering: McCabe and Smith,.TMC
2. Chemical Engineering Vol. I: Coulson & Richardson, Pergamon, 1979
3. Perry RH & Don WG; PERRY'S CHEMICAL Engineering HAND BOOK; McGrawHill.
4. Nevers De; Fluid Mechanics for Chemical Engineers; TMH
5. BancheroBadker; Introduction to chemical engg; TMH
6. Narayan CM, Bhattacharya BC; Mechanical operations for chemical eng.; PHI

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

SSSUTMS School of Engineering SEHORE (M.P.)

List of Experiments :

1. To analyses the given sample by differential, cumulative methods using standard screen.
2. Determination of size & surface area of irregular particles using a Measuring gauge.
3. To study Crushing behavior & to determine the Rittinger's& Bond's Constant of the given solid in aJaw crusher.
4. To determine the efficiency of a ball mill for grinding a material of known.
5. To determine the power consumption of the Hammer Mill.
6. To determine the specific cake resistance for the given slurry by Leaf Filter.
7. To determine the efficiency of a given cyclone separator.
8. To determine the efficiency of fluidized characteristic bed.
9. To study the Dorr type of thickener.
10. To study the Plate & Frame filter press.

Registrar
Sri Satya Sai University of Technology
& Medical Sciences Sehore (M.P)

SSUTMS
School of Engineering
SEHORE (M.P.)

CMC-403 [FLUID MECHANICS]

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 tubeand 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.

References: -

1. McCabe Smith;Unit Operation for Chemical Engg. TMH
2. Modi& Seth; Fluid Mechanics; Standard Book House, Delhi
3. Som and Biswas; Fluid Mechnics and machinery; TMH
4. Rajpoot R. K. ;Fluid Mechanics and Hydrolic Machine.
5. Bansal R.K.; Fluid Mechanics and Hydrolic Machine.

List of Experiment:

1. To determine the local point pressure with the help of pitot tube.
2. To find out the terminal velocity of a spherical body in water.
3. Calibration of Venturimeter
4. Determination of Cc, Cv, Cd of Orifices
5. Calibration of Orifice Meter
6. Calibration of Nozzle meter and Mouth Piece
7. Reynolds experiment for demonstration of stream lines & turbulent flow
8. Determination of metacentric height
9. Determination of Friction Factor of a pipe
10. To study the characteristics of a centrifugal pump.

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

SSUTMS School of Engineering SEHORE (M.P.)

CMC-404 [COMPUTATIONAL METHODS IN CHEMICAL ENGINEERING]

Unit I

Treatment of engineering data – Graphical representation. Empirical equations, Interpolation, Newton's formula, Lagrange's Interpolation formula, extrapolation, Integration, graphical Integration, Graphical Construction of Integral curves, Numerical Integration.

Unit II

Interpretation of Engineering Data- Significant figure, Classification of Measurements, Propagation of Errors, Variation and Distribution of Random Errors, Properties of Variance, Confidence limits for small samples.

Unit III

Ordinary Differential Equations – Formulation, Application of Law of Conservation of Mass– Mixing in flow process. Classification of ordinary Differential Equations and its applications to common Chemical Engineering problem

Unit IV

Numerical Solutions of Ordinary Differential Equations– Linear Second– order Equations with variable coefficients, Numerical solution by Runge Kutta Method. Its application to higher– order equations

Unit V

Formulation of Partial Differential Equations. Finite difference, linear finite difference equations, non-linear difference equations, Optimization, types of methods, its application relating to chemical processes.

References:

1. Mickley HS, Sherwood and Reed; Applied Mathematics In Chemical Engineering;TMH pub.
2. Jenson & Jeffrey's; Mathematical Methods In Chemical Engineering; Mc Graw Hill.
3. Luyben WL; Process modeling, simulation and control for chemical engr; Mc Graw Hill

Registrar
Shri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

SSSUTMS School of Engineering SEHORE (M.P.)

List of Experiment

1. Data representation and treatment by Graphical methods, Pressure- Volume-Temperature and concentration relationships for gases and their mixtures.
2. Integrated methods of data processing. Integral functions and their graphical representation.
3. Estimation of properties from empirical correlations (Nokay)
4. Estimation of critical properties from group contribution method.
5. Redlich-Kwong equation of state and other Virial equations to estimate thermodynamic properties like compressibility factor, molar volume and P-V-T relationships.
6. To study the effect of liquid viscosity and dissolved gases on pump efficiency, reciprocating pump performance.
7. Measurement errors their propagation and minimization of random errors. Selection of confidence limits.
8. Mass balance problems using continuity equation applied to a dynamic system. Formation of differential equations (component balance) and their solution & examples – CSTR and flow through pipes.
9. Numerical Solutions of batch reactor problems. Euler Algorithm
10. Runge-Kutta algorithm and its application in chemical Engineering. Implicit and explicit calculations. Problems related to effect design, optimum liquid concentration.
11. Transient flow of fluid unsteady temperature and varying concentration problems and use of partial differential equation to solve them.

Note: Each student should perform at least eight experiments from the above list

Sri Satya Sai Uni... & Medical Sciences Sehore (M.P.)

SSSUTMS School of Engineering SEHORE (M.P.)

CMC-405 [MATERIAL SCIENCE & TECHNOLOGY]

UNIT I

Introduction: Introduction to material science, Properties and behavior of materials useful in structure, machines and equipment, Structure- Property relationship in materials. Crystal Geometry and Structure Determination: Geometry of crystals- the Bravais lattices, Structure determination X – ray diffraction, Braggs Law, the power method.

UNIT II

Atomic Structure, Chemical Bonding & Structure of Solids: Atomic arrangements in material and imperfections. Crystal Imperfections: Point Imperfections, Line imperfections- edge and screw dislocations, Surface imperfections.

UNIT III

Phase Diagram And Phase Transformations: Phase rule, Single component systems, Binary Phase Diagrams, Lever rule, Typical Phase diagrams for Magnesia-Alumina, Copper-Zinc, Iron-carbon system, Nucleation and growth, Solidification, Allotropic transformation, Cooling curves for pure iron, Iron-carbon equilibrium diagram, Isothermal transformations (TTT curves). Deformation of Materials-Fracture: Elastic deformation, Plastic deformation, Creep, Visco-elastic deformation, Different types of fracture.

UNIT IV

Heat Treatment: Annealing, Normalizing, Hardening, Martempering, Austempering, Hardenability, Quenching, Tempering, Carburising, Cyaniding, Nitriding, Flame hardening, Cathodic protection, protective coatings. Corrosion charts.

UNIT V

Typical Engineering Materials: Nonferrous metals – Copper, Aluminum, Lead, Chromium, Tin, Brass, and Zinc and its alloy, Non-metals – Glass, Enamels, Chemical stone wares, Graphite, Wood, Plastics, Rubber, Polymers and Ceramics.

REFERENCES:

1. Van Vlack; MATERIAL SCIENCE
2. WOOLEF; <Title>; VOL. 1,2,3,4.
3. Perry RH & Don WG; PERRYS CHEMICAL Engineering HAND BOOK; McGraw Hill.
4. Murthy; Structures and properties of Engg Materials; TMH
5. Narula; Material science; TMH
6. Vijaya; Material Science; TMH
7. O.P. Khanna; MATERIAL SCIENCE & METALLURGY; DhanpatRai Publication.
8. S.K. Hajra Choudhry; MATERIALS SCIENCE & PROCESSES; Indian Book DistribCo.

Sri Satya Sai University
& Medical Sciences Sehore (M.P.)

SSSUTMS School of Engineering SEHORE (M.P.)

CMC-406 [ORGANIC CHEMICAL PROCESS INDUSTRY]

Unit I

Soaps and detergents: Difference between soaps and detergents, Classification of cleansing compounds, process of soap manufacture, Glycerol recovery, Manufacture of detergents: sulphated fatty alcohols and alkyl – aryl sulphonates.

Unit II

Important features of Indian sugar industry, Major unit operation of sugar industry, Alcohol fermentation, Production of 95% alcohol and anhydrous or absolute alcohol from fermentation broth, Pollution problems. Raw materials for pulp making, Kraft and Sulphite pulping methods, Semi-chemical pulping, Pulp and paper, pulping process, chemical recovery, stock preparation and paper making,

Unit III

Important petrochemicals, Feed stock, Common unit processes: cracking, alkylation-dealkylation and hydroalkylation, halogenation, oxidation, hydrogenation-dehydrogenation; hydration-dehydration, nitration, amination, esterification, hydrolysis, hydroformylation process.

Unit IV

Basic principles of polymerization reactions: bulk, solution, suspension and emulsion polymerisation, Synthesis of phenol formaldehyde, polyethylene, polystyrene and PVC, Rubbers, their classification and processing, Dyes and Dye intermediates, insecticides and pesticides, nitration and nitrating agents.

Unit V

Natural and synthetic fibres, Fibre properties important in textile production, Fibre spinning processes: melt, dry and wet spinning, Manufacture of nylon 6,6 and nylon 6 fibres, viscose rayon and polyester fibres, polyamides, acrylics, cellulose and acetate,

References:

1. Dryden C.E; Outlines Of Chemical Technology; Affilicted. East West press, New Delhi, 1997
2. G.T. Austin, Shreve's Chemical Process Industries, Mc Graw Hill.
3. Gupta VB & Kathari VK; Manufacturing Fibre Technology; Chapman Hall, Newyork I Edition
4. Kathari V.K.; Progress In Textile, Sciences Technology, Vol I & II; IAFL Publications, S-351 Greater Kailash part I New Delhi – 48 I Ed.
5. Austin, G.T; Shreeves Chemical Progress Industries; . Mc. Graw Hill New York

LIST OF EXPERIMENTS:

1. To prepare soap from the given oil and alkali.
2. To prepare soap in the laboratory and carry out its cost analysis.
3. To determine saponification value of oil sample.
4. To prepare detergent in the laboratory and to carry out its cost analysis.
5. To determine the acid value of the given sample of oil.
6. To separate Fe(II) ion from the given sample by hydrolysis method.

Sri Satya Sai University of Technical & Medical Sciences Sehore (M.P.)

SSSUTMS ★ SEHORE (M.P.)

Sri Satya Sai
University of Technology and Medical Sciences
(Established under Govt. of M.P. Registered under UGC 2(F) 1956)

Bhopal-Indore Road, Opp. Pachama oilfed plant, Pachama, Dist.-Sehore M.P.PIN-466001
Ph. 07562-223647, Fax : 07562-223644, Web: www.sssutms.co.in, info@sssutms.co.in

Name of Faculty : School of Engineering

Name of Department: **Chemical Engineering**

Minutes of Board of Studies Committee Meeting Dated on **15.05.2018**

The Board of Studies Committee Meeting was held in the room of Department of Chemical Engineering at 2:30 PM. on **18.05.2018**, Following members were present.

1. Dr. Anuradha Devi, Asstt. Prof. (Chemical Engineering), - Chairman
2. Dr. S. Suresh Assoc. Prof. (Chemical Engineering, MANIT Bhopal),-External Member
3. Dr. Neelu Jain, Prof. (Chemistry), Member
4. Mr. Manoj Kumar Gandwane, Asstt. Prof. (Chemical Engineering), Member
5. Mrs. Priyanka Jhavar, Asstt. Prof. (Mechanical Engineering), Member

The Chairman of Board of Studies Committee welcomes and appreciated the efforts put up by the faculty for progress of the departmental activities. The following Agenda points were discussed and resolved.

Agenda Preparation of syllabus and Scheme for V and VI Sem CBCS.

Discussion Scheme

Scheme and syllabus was put up before the member as per recent AICTE guidelines, It was discussed in detail by the members and some modification were suggested.

Resolution of the Discussion:

It was resolved that scheme and syllabus as proposed with some modification and may be accepted

Registrar
Sri Satya Sai University of Technology
Medical Sciences Sehore (M.P.)

SSSUTMS
School of Engineering
SEHORE (M.P.)

The Chairman thanks the members for peaceful conduction of meeting.

Signature of All members (Including Chairman)

S.No.	BOS Members	Signature
1	Dr. Anuradha Devi, Asstt. Prof. (Chemical Engineering), - Chairman	
2	Dr. S. Suresh Assoc. Prof. (Chemical Engineering, MANIT Bhopal),- External Member	
3	Dr. Neelu Jain, Prof. (Chemistry), Member	
4	Mr. Manoj Kumar Gandwane, Asstt. Prof. (Chemical Engineering), Member	
5	Mrs. Priyanka Jhavar, Asstt. Prof. (Mechanical Engineering), Member	

Chairman

Registrar
Sri Satya Sai University of Tech...
& Medical Sciences Sehore (M.P.)

SSUTMS School of Engineering SEHORE (M.P.)

Sri Satya Sai University of Technology & Medical Sciences, Sehore (M.P)

Scheme of Examination - CBCS Pattern

Academic Year 2018– 2019

Branch : Chemical Engineering **Semester - V**

S.No.	Subject Code	Subject Name	Maximum Marks Theory Slot			Maximum Marks (Practical Slot)		Periods/ hour/ week			Credits	Total Marks
			End Sem. Exam.	Mid Tests	Assign-ments/Quiz	End Sem. Practical & Viva	Practical Record /Assignment/ Quiz / Presentation	L	T	P		
1	CMC - 501	Mass Transfer - I	60	30	10	30	20	2	1	2	4	150
2	CMC - 502	Heat Transfer	60	30	10	30	20	2	1	2	4	150
3	CMC - 503	Environmental Engineering	60	30	10	30	20	2	1	2	4	150
4	CMC - 504	Department Elective-I	60	30	10			2	1		3	100
5	CMC - 505	Department Elective-II	60	30	10			2	1		3	100
6	CMC - 506	Open Elective	60	30	10			2	1		3	100
7	CMC - 507	Industrial Training - I					100			4	2	100
TOTAL			**360**	**180**	**60**	**90**	**160**	**12**	**6**	**10**	**23**	**850**

Department Elective-I	CMC -504(A) Oil & Paint Technology	CMC-504(B) Ceramic Technology	CMC-504(C) Enviornmental Pollution & Pollution Control
Department Elective-II	CMC-505(A) Novel Separation Technology	CMC-505(B)Petroleum Processing Technology	CMC-505(C) Conventional & Non-Conventional Energy Sources
Open Elective	CMC-506(A) Polymer Technology	CMC-506(B) Industrial Psychology and Human Resource Management	CMC-506(C) Risk analysis & Hazard

w. e. f. july 2018

SSSUTMS School of Engineering SEHORE (M.P.)

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

Sri Satya Sai University of Technology & Medical Sciences, Sehore (M.P)

Scheme of Examination - CBCS Pattern

Academic Year 2018– 2019

Branch : Chemical Engineering **Semester - VI**

S.No.	Subject Code	Subject Name	Maximum Marks Theory Slot			Maximum Marks (Practical Slot)		Periods/ hour/ week			Credits	Total Marks
			End Sem. Exam.	Mid Tests	Assign-ments/Quiz	End Sem. Practical & Viva	Practical Record /Assignment/ Quiz / Presentation	L	T	P		
1	CMC - 601	Mass Transfer - II	60	30	10	30	20	2	1	2	4	150
2	CMC - 602	Chemical Reaction Engineering - I	60	30	10	30	20	2	1	2	4	150
3	CMC - 603	Chemical Engineering Thermodynamics-II	60	30	10	30	20	2	1	2	4	150
4	CMC - 604	Department Elective-I	60	30	10			2	1		3	100
5	CMC - 605	Department Elective-II	60	30	10			2	1		3	100
6	CMC - 606	Open Elective	60	30	10			2	1		3	100
7	CMC - 607	Industrial Training Project - I				100				4	2	100
TOTAL			**360**	**180**	**60**	**190**	**60**	**12**	**6**	**10**	**23**	**850**

Department Elective-I	CMC-604(A) Bio Chemical Engineering	CMC-604(B) Fertilizer Technology	CMC - 604(C) Petroleum Refinery Engineering
Department Elective-II	CMC-605(A) Pharmaceutical Technology	CMC-605 (B) Corrosion Engineering	CMC-605(C) Numerical Methods in Chemical Engineering
Open Elective	CMC-606(A) Petrochemical Technology	CMC-606(B) Food Technology	CMC - 606(C) Environmental Impact Assessment and Environmental Audit

w. e. f. july 2018

SSSUTMS School of Engineering SEHORE (M.P.)

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P)

CMC-501 Mass Transfer-I

Unit I

Fundamentals of Mass Transfer: Individual and film coefficients, overall mass transfer coefficient and their inter relationships; Analogies in transfer processes, determination of mass transfer co-efficient; two phase flow in packed beds, co-current and counter current processes flooding loading, column internals: types of trays/ plates and packing, point and plate efficiency.

Unit II

Diffusion phenomenon: Introduction, Types of diffusion in fluids. Types of diffusion in solid. Measurement and calculations of diffusivities. **Eddy diffusion:** Mass transfer coefficients and their correlations. Theories of mass Transfer. Interphase mass transfer, Mass transfer theories: film theory Penetration theory and surface renewal theory.

Unit III

Humidification and Dehumidification: Principles, vapour-liquid equilibria, enthalpy of pure substances, basic definition of all humidification terms, wet bulb temperature relation, psychrometric chart, Lewis relation, methods of humidification and dehumidification, equipment like cooling towers, tray towers, spray chambers, spray ponds, cooling tower design – HTU, NTU concept, calculation of height of cooling tower.

Unit IV

Drying: Drying Equilibria. Drying rate curves. Mechanism of drying. Calculation of batch and continuous drying. Drum dryers, spray and tunnel dryers. **Crystallization:** Factors governing nucleation and crystal growth rates. Controlled growth of crystals. Yield calculations and energy balance. Different types of crystallizer equipments. Fractional crystallization.

Unit V

Adsorption: Theories of adsorption, types of adsorbent; activated carbon, silica and molecular sieves, Isotherms, Industrial adsorbents. adsorption; Break through curves, Stagewise operations, Adsorptions calculations and equipments.

Reference Books:

1. Treybal, R.E., Mass Transfer Operations, 3rd Edition, McGraw Hill, 1981.
2. Ananthraman, K.M. Begum, M.S., Mass Transfer Theory and Practice, PHI New Delhi, 2011.
3. Coulson JM, Richardson JF and Sinnott RK, Chemical Engineering Vol I, II, IV and V, 4th Edition, Pergmen Press, 1998.
4. Badger & Banchero, Introduction to Chemical Engineering, TMH, 6th Reprint, 1998.
5. Geankoplis, C. J., Transport Processes and Unit Operation, Prentice Hall(I, 2000.
6. Mc-Cabe W.L, Smith J.M.; Unit Operation In Chemical Engineering; Tat Mc-GrawHill.
7. Sherwood, T.K. Pigford R.L. and Wilke, C.R.; Mass Transfer; Mc. Graw Hill.

List of Experiment:

1. Determination of relative volatility of a given system of acetic acid water.
2. To prepare the drying rate curve for fluidized bed dryer.
3. To study the characteristics of spray dryer.
6. To study the characteristics of drum and Tunnel dryer.
4. To study the drying characteristics of a wet granular material using natural and forced circulation in tray dryer.
5. Tray Dryer – To calculate rate of Drying
6. Rotary Dryer – To study the Characteristics of Rotary Dryer
7. Liquid Diffusion – To calculate the Diffusion Coefficient for a liquid –liquid system
8. To study Solid in air Diffusion
9. To study the characteristics of cooling tower
10. Humidifier and Dehumidifier – To study the Characteristics
11. Interphase Mass Transfer Coefficient – To calculate the individual and overall Mass Transfer Coefficient.

CMC-502 Heat Transfer

Unit I

Introduction: Fundamentals of heat transfer, basic modes of heat transfer. Concept of driving force and heat transfer coefficients, rate expressions for three modes i. e. conduction, convection, radiation. Calculation of overall heat transfer coefficients.

Unit II

Heat transfer by conduction: Fourier's Law, thermal conductivity, conduction through a at slab, composite slab, conduction through a cylinder, composite cylinder, conduction through sphere, composite sphere, Critical radius of insulation. Concept of thermal resistance, Theory of insulation, fouling factors.

Unit III

Heat transfer by convection:
Fundamental considerations in convective heat transfer, significant parameters in convective heat transfer such as momentum diffusivity, thermal diffusivity, Prandtl number, Nusselt number, dimensional analysis of convective heat transfer-Natural and Forced convection equivalent diameter for heat transfer, estimation of wall temperature, correlations for heat transfer by natural convection from hot surfaces of different geometries and inclination.

Unit IV

Heat transfer by radiation: Emissivity, absorptivity, black body, grey body, opaque body, concept of shape factor, stefan boltzmann, kirchhoff law. Equations for rate of heat transfer by radiation for various cases. Basic unsteady, state radiation heat transfer.

Unit V

Heat Exchangers: Classification and types of heat exchangers, Double pipe heat exchanger, calculation of LMTD, effectiveness NTU method. Introduction to Shell and Tube Heat Exchanger. heat transfer in agitated vessel, heat flux temperature diagram for boiling and condensation under vertical and horizontal surfaces, nucleate & pool boiling, effect of surface condition on condensation, correlation for heat transfer under condensation.
Evaporation- Type of evaporators and their applications single and multiple effect evaporators,
Reboiler: Design Kettle type reboiler, horizontal thermosyphon reboiler, vertical thermosyphon reboiler. Engineering problems and trouble shooting.

References:

1. Donald Q. Kern; Process Heat Transfer; Tata McGraw Hill.
2. Alan J. Chapman; Heat Transfer; Collier McMillan.
3. Rao Y.V.C; Heat Transfer; PHI

Registrar
Shri Satya Sai University of Technology & Medical Sciences

SSSUTMS School of Engineering SEHORE (M.P.)

List of Experiment:

1. To determine the thermal conductivity of metal rod.
2. To determine the equivalent thermal conductivity of composite wall.
3. To determine heat transfer coefficient in force convection.
4. To determine heat transfer coefficient in Natural convection.
5. To determine heat transfer coefficient with the help of Stefan Boltzmann Apparatus.
6. To calculate emissivity of the test plate by emissivity measurement apparatus.
7. To determine heat transfer coefficient in double pipe heat exchanger.
8. To study the heat transfer characteristics of a shell and tube heat exchanger (heating/cooling) of water.
9. To determine heat transfer coefficient in parallel and counter flow heat exchanger.
10. To measure the rate of evaporation using an open pan evaporator.
11. To measure the rate of condensation of pure water vapour and to determine the heat Transfer coefficient.
12. Demonstrate the film-wise drop-wise condensation and determination of he heat transfer coefficient.
13. To study the single effect evaporator and find out the heat transfer coefficient

CMC- 503 Environmental Engineering

Unit-I

Environmental Management: Nature of environment, major component of life support system industrial development and environmental degradation, environmental impact assessment, national environmental policies, environmental guidelines for process industries, environmental pollution control through planned industrial development; environmental pollution and its effect on human beings, animal and vegetation system.

Unit-II

Air Pollution: Sources and effect of air pollution, classification of air pollutants, emission standard of air pollution. Meteorological condition influencing air pollution, Chemical inversion, principle, working and design of control equipment for particulate emission and gaseous pollutants like cyclone separator, gravity settling chamber, multi-tray settling chamber, bag filter, scrubber, E.S.P.

Unit-III

Water Pollution: Sources and effect of water pollution, water born diseases, classification of water pollutants, physical, chemical and bacteriological analysis of water; pollution laws and limits, effluent standards;, design of waste water and industrial effluent treatment plants (physiochemical and biological), advanced treatment methods, modern trends in sedimentation and filtration.

Unit-IV

Pollution due to Solid Waste and Noise: Nature of domestic, municipal, agricultural, industrial, Hospital, Nuclear Wastes; collection, treatment and disposal of solids waste; waste recovery system, solid waste management; noise pollution, sources, noise measurement and control; noise mitigation measures.

Unit-V

Case study with respect to air, water and solid waste: Fertilizer industry, refinery and petrochemical industries, pulp and paper industries, training industry, sugar and alcohol industries, alkali industries, cement and steel industries.

References:

1. Rao C S; Environmental Pollution Control Engineering; New Age India Ltd.
2. Mahajan S P; Pollution Control in Process Industries
3. Canter Lary; Environmental Impact Assessment; TMG
4. Keily; Environmental Engineering; TMG
5. Miller GT Jr; Environmental sciences-working with earth; Cegage Pub

List of Experiments:

1. To determine the BOD of a given water Sample.
2. To determine the D O of a given water Sample.
3. To determine the COD of a given water Sample.
4. To determine the pH value of a given water Sample.
5. To determine the Chlorides in a given water Sample.
6. To determine the Acidity in a given water Sample.
7. To determine the Alkalinity in a given water Sample.
8. To determine the Total Hardness in a given water Sample.
9. To determine the Turbidity of a given water Sample.
10. To determine the Aerobic Microbial colony count.
11. To determine the Total dissolve solid of a given sample.

CMC-504 (A) Oil & Paint Technology

Unit-I

Chemistry of Oils, Fats and Fatty Acids: i. Glycerides, ii. Fatty Acids, iii. Non Glyceride Components of Oils & Fats iv. Chemical Reactions of Fats and Fatty Acids.

Unit-II

Technology and Production of Oils & Fats, Coconut, cotton seed, peanut, palm, sunflower, sesame, softlower, rice fran, rapeseed and mustard seed, linseed, soyabean, tung, casteroil lard and tallow. Minor Oils: Neem Oil and Salfat. a) Mechanical expression of oils, b) Solvent extraction of oilseed and oil bearing material. c) Fat splitting. Refining and Bleaching.

Unit-III

Degumming, alkali refining (batch refining), Miscella refining, refining loses – Bleaching by absorption – continuous bleaching.

Unit-IV

Hydrogenation : Mechanism – selectivity as applied to the reaction and catalysis, Hydrogenation in practice (Batch & continuous) preparation of Raney Nickel catalyst, Soap manufacture : Raw materials required, selection of raw materials – full boiled process.

Unit-V

Nutritional functions of fats, Testing and important analysis of oils and fats in determining the quality and quantity of oils / fats and oilseed; such as moisture, oil content, F.F.A., protein content, color of the raw / refined oil.

References:

1. Feireidoon Shahidi, Bailey's Industrial Oil and Fat Products
2. E. Bernardini, Oils & fats Technology
3. W.M.Morgan, Outlines of Paint Technology
4. V.C.Malshe & Meenal Sikchi, Basics of Paint Technology, Part I & II,.

CMC-504 (B) Ceramic Technology

Unit-I

Introduction – Definition, classification and scope of ceramics, Ceramics Vs. metals and organics, Historical perspective on the development of ceramics and ceramic industries.

Unit-II

Elementary ideas about the raw materials used in pottery, Heavy clayweres, Refractoriers, Glass, Cement, Industries, Raw materials – clays and their classification, Quartz, Polymorphism of quartz, Feldspar and its classification, Talc, Steatite and Mica.

Unit-III

Conventional ceramics – Classification, Elementary ideas about whitewares, Cement, Glass, Refractories, Glaze and Enamels their manufacture and applications. Newer ceramics – classification and scope of Cermets, Abrasives, Electro ceramics.

Unit-IV

Bio-ceramics, Space ceramics, Automotive ceramics, Superconducting ceramics, Elementary ideas of their preparation and their applications. Fabrication methods: Classification and scope of various fabrication methods. Brief study of dry semi dry pressing extrusion, Jiggering and jollying. Slip casting HP & HIP, Drying of ceramics, Biscuit firing and glost firing, fast firing technology, action of heat on triaxial body.

Unit-V

Elementary ideas of various furnaces used is ceramic industries. Applications of ceramic products in everyday life, in different fields such as Metallurgy, Civil Engineering, Electrical, Electronics, Automobiles, Aerospace and Energy Engineering.

References:

1. F. Singer and Singer S.S, Industrial Ceramics.
2. F.H. Norton, Elements of Ceramics
3. W.D. Kingery, Introduction to Ceramics
4. Alan G. King, William Andrew, Ceramic Technology and Processing.

CMC-504 (C) Environmental Pollution & Pollution Control

Unit-I

Interaction of man and environment, overall picture of environmental pollution, environmental air and water quality criteria, standards and acts, effects of pollution.

Unit-II

Air Pollution: dispersion of pollutant in the atmosphere, meteorological factors of air, stability and inversion of atmosphere, control of air pollution, air pollution control equipments. Methods of measuring and sampling of gaseous and particulate pollutants in ambient air and industrial waste gases.

Unit-III

Water Pollution: Sources, types of pollutants in liquid wastes of chemical industries, methods for the treatment of liquid wastes to control pollution, selection of pollution control equipment, Methods of sampling of waste water. Odour and its control.

Unit-IV

Solid Waste Disposal: Characterization of solid wastes, problems of collection and handling, various processing techniques used in solid waste management, solid waste as resource material,

Unit-V

Noise pollution: noise control criteria, noise exposure index, Control.

References:

1. C. S .Rao, Environment Pollution Control and Environmental Engg.
2. Peavy and Row, Environmental Engineering.
3. A.C. Stern, Air Pollution – Engg. Control of Air Pollution Vol IV.
4. J. O .M. Bockris, Environmental Chemistry

CMC-505 (A) Novel Separation Technology

Unit–I

Limitations of common separation techniques – sedimentation, screening, filtration, evaporation, distillation, absorption, liquid-liquid and solid-liquid extraction. Principles of membrane separation process classification, characterization and preparation of membrane.

Unit-II

Analysis and modeling of membrane separation, Membrane modules and application. Reverse Osmosis and ultra-filtration, membrane characteristics and applications, Ion- selective membranes and their application in electrolysis.

Unit-III

Vaporization and gas separation using membranes, Liquid membrane, Industrial applications, Liquid membrane separation, critical extraction, pressure swing adsorption and freeze drying, pervaporation and permeation, nano-separation. Foam and bubble separation, principle, classification, foam and surfactants, Separation techniques, Column Separations.

Unit-IV

Multi-component separation, Zone melting and Zone refining, electrophoresis, desalting by freezing, centrifugation.

Unit-V

Parametric pumping, thermal parametric pumping, batch, continuous pumping, pH-parametric pumping, heatless parametric pumping.

References:

1. Seader J. D. and Henley E. J., Separation Process Principles.
2. Suresh S, Keshav, A Textbook of Separation Processes.
3. King C. J, Separation Processes.
4. Arden T. V., Water Purification By Ion-exchange.

CMC-505 (B) Petroleum Processing Technology

Unit I

Origin and occurrence of petroleum crude, status of petroleum refining in India; composition of petroleum, classification and physical properties of petroleum.; evolution of crude oil and petroleum products, future refining trends.

Unit II

Crude oil distillation process, pretreatment of crude, atmospheric and vacuum distillation process; secondary conversion processes; catalytic reforming, catalytic cracking and deep catalytic cracking.

Unit III

Heavy residue up-gradation technologies; hydro-cracking, hydro-treating, vis-breaking and delayed coking alkylation, isomerisation, dehydrogenation processes, polymerization.

Unit IV

Lubricating oil, grease and bitumen: de-waxing and de-oiling, de-asphalting, lube hydro-finishing, bitumen air blowing, sweetening and desulphurization; hydro-desulphurisation of petroleum products.

Unit V

Refinery products, refinery gas utilization, LPG, propylene and hydrogen recovery, reformulated gasoline; present and future requirements.

References:

1. Nelson WL; Petroleum refinery engineering ; Mc. Graw hill
2. Hobson GD; Modern petroleum technology Part I & II; John Wiely & sons.

CMC-505 (C) Conventional & Non-Conventional Energy Sources

Unit-I

Global and National energy scenario, Conventional & renewable energy sources, need & development of renewable energy sources, types of renewable energy systems.

Unit-II

Energy and development role of energy in industrial activity. Contemporary energy crisis, conventional and non-conventional energy sources, energy demand and availability. Energy audit need for energy conservation.

Unit-III

Solar energy system, introduction to wind energy conversion, Wind turbines, Wind farms, Bio energy system, design and constructional features.

Unit-IV

Thermal renewable energy systems, appropriate energy technology for rural development, energy conservation, environmental aspects of renewable energy systems.

Unit-V

Fluidized bed combustion. Energy conservation in use of heat. Economical design of furnace, water treatment, drying, conditioning and industrial space heating, boiler accessories etc. Heat recovery in waste heat boilers: Conservation, integrated energy systems for industries.

References:

1. Rakosh das begmudre, Energy conservation systems
2. GD Das, Non conventional energy sources
3. S.P. Sukhatme, Solar Energy by Padmashree
4. Harvey A., Dunn J.J, Solid waste Conversionto Energy
5. S. Rao & B.B. Parulka, Energy Technology

CMC-506 (A) Polymer Technology

Unit-I

Polymerization Chemistry: Chain, step and miscellaneous polymerization reactions and polymerization technique. Polymerization kinetics: Free radical, cationic and anionic polymerization, poly-condensation and polymerization.

Unit-II

Polymerization Processes: Bulk solution, emulsion and suspension polymerization, thermoplastic composites, fiber reinforcement fillers, surface treatment reinforced thermo-set composites resins, fillers, additives.

Unit-III

Polymer reactions: Hydrolysis, acidolysis, aminolysis, hydrogenation, addition and substitution reactions, reactions of various specific groups, cyclyzation and cross linking reactions, reactions leading to graft and block copolymer

Unit-IV

Manufacturing processes of important polymers: Plastics- polyethylene, polypropylene polyvinyl chloride & copolymer, polystyrene; Phenol-formaldehyde, epoxides, urethane, Teflon, elastomers, robbers, polymeric oils - silicon fibers - cellulosic (Rayon), polyamides (6:6 Nylon), Polyesters (Dacron). Acrylic-olefin.

Unit-V

Composite materials - Ceramic and other fiber reinforced plastics, Polymer degradation - Thermal, Mechanical, Ultrasonic, Photo, High energy radiation, Ecology and environmental aspects of polymer industries. Rheological Sciences Equations, Uni-coelastic models - Maxwell.

References:

1. Rodringuez; Principles of polymer systems; TMH
2. Billmayer Jr, Fred W.; Textbook of polymer science; Wiley tappon
3. David J Williams; Polymer science & engineering; PHI
4. Mc. Keley, JH; Polymer processing; John Wiley

CMC-506 (B) Industrial Psychology and Human Resource Management

Unit-I

History and evolution of the concept of HRM. HRM: Definition, nature, scope, objectives and importance, Models of HRM, Policies, procedures and programs of HRM.

Unit-II

Human Resource Planning: Objectives, Importance, Process of HRP, Methods and techniques of HRP. Job Analysis: Nature and use of job analysis, methods of job analysis, Process of job analysis.

Unit-III

Recruitment: Definition, Process and methods, policies and procedures, limitations, external Vs. internal recruitment. Selection: Purpose, processes and methods.

Unit-IV

Induction and placement: Aims and objectives of placement, induction/orientation. Internal mobility: Concept, transfer and employee separations

Unit-V

Training: Need and significance. Executive development: Nature and concept, importance, the process of executive development, methods of conducting a executive development program Career Management: Nature and concept, stages of career management HRD in India: Evolution of the concept of HRD, Principles of HRD systems, HRD in Indian industry

References:

1. Dessler, G. (2009). A framework for human resource management, 5th ed. Pearson/Prentice Hall Publishing.
2. Rao, V.S.P. (2005). Human resource management: Text and cases, 2nd ed. Excel books.
3. Decenzo, D. A. & Robbins, S.P. , (2002). Human resource management. John Wiley and Sons.
4. 4Dessler, G. & Varkkey, B. Human resource management. 11th ed. Pearson Education

CMC-506 (C) Risk analysis & Hazard

Unit-I

Origin of process hazards, Laws Codes, Standards, Case Histories, Properties of Chemicals, Health hazards of industrial substances.

Unit-II

Toxicology: Toxic materials and their properties, effect of dose and exposure time, relationship and predictive models for response, Threshold value and its definitions, material safety data sheets, industrial hygiene evaluation.

Unit-III

Fire & explosion: Fire and explosion hazards, causes of fire and preventive methods. Flammability characteristics of chemical, fire and explosion hazard, rating of process plant. Propagation of fire and effect of environmental factors, ventilation, dispersion, purifying and sprinkling, safety and relief valves.

Unit-IV

Energy Hazards: Electrical hazards, noise hazard, radiation hazard in process operations, hazards communication to employees, plant management and maintenance to reduce energy hazards.

Unit-V

Risk Analysis: Component and plant reliability, event probability and failure, plant reliability, risk analysis, HAZOP AND HAZAN, event and consequence analysis (vapour cloud modelling) Designing for safety, measurement and calculation of risk analysis. Hazard Assessment: Failure distribution, failure data analysis, modeling for safety, safety training, emergency planning ad disaster management, case studies.

References:

1. Crawl D.A. and Louvar J.A, Chemical process safety fundamentals with applications.
2. Wentz, C.A, Safety health and environmental protection.
3. Smith, B.D, Design of equilibrium state process.
4. Van Winkle, Distillation.

CMC-601 Mass Transfer-II

Unit-I

Absorption: Absorption. Solvent selection for absorption. Material balance and concept of driving force and minimum solvent rates. Multistage absorption columns. Design of Plate columns. Absorption and Extraction in continuous contact columns, co-current, counter current and cross current contacting fluids, calculations of NTU and HTU, concept of HETP, Absorption and desorption factors.

Unit-II

Distillation: Introduction. Vapour liquid equilibria, Boiling point diagram, Relative volatility. Prediction of VLE from vapour pressure data using Raoult"s law. VLE for multicomponent systems. Non-ideal systems. Azeotropes. Steam distillation. Flash and simple distillation extractive distillation.

Unit-III

Multistage distillation: Multi-stage rectification column, McCabe Thiele, and Ponchon-Savarit methods for multistage operations, tray efficiencies, concept of reflux, minimum reflux ratio, optimum reflux, total reflux, Murphree plate efficiencies. Multicomponent distillation. Vacuum, molecular, extractive and azeotropic distillations. Fensky and underwood equation for minimum numbers of plate calculation.

Unit-IV

Liquid-liquid extraction: Ternary equilibrium. Solvent selection. Single stage. Multistage-cross-current, counter-current extraction. Equipment for liquid-liquid extraction, continuous contact extraction in packed towers.

Unit-V

Solid-Liquid Extraction (Leaching): Equipment for leaching. Preparation of solids for leaching. Equilibrium diagrams, ideal stage equilibrium, stage efficiencies, Calculation of single stage and multi-stage leaching operation.

References:

1. Treybal, R.E., Mass Transfer Operations, 3rd Edition, McGraw Hill, 1981
2. Richardson J. F. and Coulson J.M. "Chemical Engineering", Vol. I , II
3. McCabe and Smith, „Unit Operations in Chemical Engineering"
4. Henley E. J. and Seader H.K. "Stage wise Process Design" , McGraw Hill
5. A.L. Lyderson, "Mass Transfer in Engineering Practices", John Wiley
6. Coulson, J.M., Richardson, J.F. and Sinnott, R.K. , Chemical Engineering Vol I, II, IV and V,

1. 4th Edition, Pergmen Press, 1998.
7. Wankat P.C., Rate Controlled Separations, Elsevier, 1990.
8. Foust, A., Principals of Unit Operation, 2nd Edition, John Wiley, 1994.
9. Geankoplis, C. J, Transport Processes and Unit Operation, Prentice Hall(I, 2000.

List of Experiment:

1. To study steam distillation
2. Vapour liquid equilibrium
3. Liquid-liquid equilibrium for ternary system
4. Liquid – Liquid Extraction (single stage and multistage)
5. Characterization of Spray Extraction Column
6. Batch/ Continuous Leaching
7. To verify Rayleigh equation for differential distillation of binary system.
8. To study batch distillation.
9. To study continuous distillation.
10. Studies on packed tower distillation unit.
11. Studies on the sieve plate distillation unit.
12. Studies on bubble cap distillation column.
13. To study the absorption of a gas in a packed column and calculation of NTU and HTU.

CMC-602 Chemical Reaction Engineering-I

Unit-I

Introduction: Scope of Chemical Reaction Engineering, Classification of reactions, Rate equation and rate of reaction, Factors affecting rate of reaction. Chemical kinetics and Thermodynamics/Equilibrium, Temperature dependency of rate constant from Arrhenius, Collision and Transition state theories, activated complex theory, Mechanism of reaction series, Parallel and consecutive reaction, autocatalytic reactions, chain reaction, polymerization reaction.

Unit-II

Kinetics of Homogeneous Reactions: Defining a rate equation and its representation, single and multiple reactions, Autocatalytic reactions, molecularity and order of reactions, Integral method of Analysis of data, Irreversible, zero, first, second, and nth order reactions (Uni-molecular and bimolecular type), Overall orders from half-life method. **Non-elementary reactions:** Difference between elementary and non-elementary reactions. Kinetic models and mechanisms for non-elementary reactions, kinetic models for non-elementary reactions,

Unit-III

Design of ideal reactors: Concept of ideality. Development of design expressions for batch, tubular, and stirred tank reactors for both constant and variable-volume reactions, Design of Isothermal and non-isothermal batch, CSTR, PFR, reactors. **Comparison of ideal reactors:** General graphical comparison. Multiple Reactor Systems: Plug flow and/or Mixed flow reactors in Series, parallel and series parallel. Reactors of different types and sizes in series.

Unit-IV

Design of reactors for multiple reactions: Design of Batch reactor, Plug and Mixed flow reactors for Parallel, Series and Series-Parallel reactions, **Thermal characteristics of reactors:** Review of Calculations of heats of reactions and equilibrium constant with temperature dependency. General graphical design procedure for non-isothermal reactors. Optimum temperature Progression.

Unit-V

Basics of Non Ideal flow: Importance & interpretation of RTD, C, E & F curves & Statistical interpretation. RTD Dispersion model, evaluation of RTD characteristics, Tanks in series model, Conversion in non- ideal flow reactors for simple systems.

References:

1. Levenspeil, O., Chemical Reaction Engineering, 3rd Edition, John Wiley & Sons, 2001.
2. Fogler, H. S., Elements of Chemical Reaction Engineering, 3rd Edition, Prentice Hall, 2001.
3. Smith J.M; Chemical Engineering Kinetics; Mc Graw Hill.
4. Denbigh & Turner K.G; Chemical Reaction Theory An Introduction; United Press.
5. Copper & Jeffery"s GVJ; Chemical Kinetics And Reactor Engineering; Prentice Hall
6. Levenspiel O; Chemical Reaction Engg; Willey Eastern, Singapore.

7. Houghen Watson & Ragatz; Chemical Process Principles Part Iii; Asian Pub-House Mumbai
8. Laidler, K.J., Chemical Kinetics, Tata McGraw Hill, 1997.
9. Sharma M.M & L.K Doraiswamy, Heterogeneous Reactions, Vol 1
10. Fogler, H.S., Elements of Chemical Reaction Engineering, 4 ed.,PHI, 2008.

List of Experiment:

1. To determine velocity rate constant of the hydrolysis of ethyl acetate by sodium hydroxide.
2. To study the rate constant of hydrolysis of an ester-catalyzed by acid.
3. Determine the rate constant and order of reaction between Potassium per sulphate and
1. Potassium iodide.
4. To study temperature dependency of rate constant, evaluation of activation energy and
2. Verification of Arrhenius law.
5. To study a consecutive reaction system(hydraulic model)
6. To study a parallel reaction system (hydraulic model)
7. To study a homogeneous reaction in a semi-batch reactor under isothermal conditions.
8. Study of non catalytic homogeneous saponification reaction in CSTR.
9. To study a non-catalytic homogeneous reaction in a plug flow reactor.
10. To study the residence time distribution behavior of a back mix reactor.
11. To study the RTD behavior of a tubular reactor.
12. To study the RTD behavior of a packed bed reactor.
13. To study the behavior of a continuous flow reactor system-three reactor in series.
14. To study the kinetics of thermal decomposition of calcium carbonate.
15. To study a homogeneous catalytic reaction in a batch reactor under adiabatic conditions.
16. Study of non catalytic saponification reaction in a tubular flow reactor.

CMC-603 Chemical Engineering Thermodynamics – II

Unit-I

Non-Ideal behavior: Thermodynamic properties of homogeneous mixtures; property relationship for systems of variable compositions, partial molar properties their evaluation, Fugacity and fugacity coefficient of pure substances and components in solution, Generalized correlations for the fugacity coefficient, Lewis Randall rule, excess properties

Unit-II

Fundamentals of Phase Equilibria: Concept of equilibrium in phases, The theory of ideal and non-ideal solutions, Thermodynamic equations of Vapor Liquid Equilibrium for ideal and non-ideal solutions, Liquid-liquid and Solid-liquid equilibria. **Reaction Equilibria:** Concept of reaction equilibria, single and multiple reactions, Degrees of freedom for single and multiple reactions.

Unit-III

Refrigeration and Liquefaction: Principles of refrigeration, Theory of refrigeration, Vapor Absorption Refrigeration, Vapor Absorption Refrigeration, Carnot refrigerator, vapor compression cycle, absorption refrigeration. Liquefaction processes: Linde liquefaction process, Claude liquefaction process.

Unit-IV

Duct flow of compressible fluids: pipe flow, nozzles, throttling process, Turbines. Compression processes: compressors, pumps, introduction to ejectors. Chemical potential & its physical significance, effect of pressure & temperature on heat of reaction, concept of free energy Vant-Hoffs equation, Clausius-Clapeyron equation, Gibbs- Duhem relationship of free energy with equilibrium constant, equilibrium & its applications.

Unit-V

Methods for estimation of Thermodynamics properties: Estimation methods for critical parameters, Estimation method for Mixture Enthalpy and Entropy. Elements of statistical thermodynamics, counting the number of microstates for a given macro-state, the most probable macrostate, Boltzman distribution, evaluation of Lagrangian constants alpha, statistical interpretation of work & heat.

References:

1. Rao .Y.V.C, "Chemical Engineering Thermodynamics", University Press (I) Ltd., Hyderabad, 1997.
2. Kyle,B.G"Chemical and Process Thermodynamics", 3rd Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 20000.
3. Smith J.M and Van Ness- Introuction to Chemical Engg Thermodynamics – 6th edition
4. Daubert; chemical engg thermodynamic; TMH
5. Rathakrishnan E; Fundamentals of Engg Thermodynamics; PHI
6. Dodge B.F. Chemcail Engineering –Thermodynamics –McGraw Hill
7. Balzhiser Samules and Eliassen-Chemical Engg- Thermodynaics Prentic Hall
8. Sandler S.I Chemical Engg-Thermodynamics-John Wiley and son
9. Rastogi and Mishra-Chemical Engg Thermodynaics.

List of experiments:

1. To determine Steam Turbine Module.
2. To determine cycle-Pad is the first open source simulation software allowing the simulation of complex thermodynamic cycles.
3. To determine Brayton cycle depicts the air-standard model of a gas turbine power cycle.
4. To find large cooling towers that is connected to the air conditioning system.
5. The principle that makes Stirling engines possible is quite simple.
6. To Spark-Ignition Engine Performance Test.

CMC-604 (A) Bio Chemical Engineering

Unit-I

Introduction to Bioscience: Types of Microorganisms: Structure and function of microbial cells. Fundamentals of microbial growth, batch and continuous culture. Isolation and purification of Enzymes from cells. Assay of Enzymes. Functioning of cells and Fundamental Molecular.

Unit-II

Biology: Metabolism and bio-energetics, Photosynthesis, carbon metabolism, EMP pathway, tricarbocyclic cycle and electron transport chain, aerobic and anaerobic metabolic pathways. Synthesis and regulation of bimolecular, fundamentals of microbial genetics, role of RNA and DNA.

Unit-III

Enzyme Technology and Kinetics: Applications of enzymes in industry and medicine. Immobilization of enzymes, Kinetics of enzyme catalytic reactions involving isolated enzymes, Reversible inhibition. Reactions Catalysed By Enzymes.

Unit-IV

Reactors Analysis: Reactor Design and Analysis for soluble enzyme systems. Cofactor regeneration, Membrane reactor . Effect of mass transfer in immobilised enzyme particle systems. Reactors for immobilised enzyme systems. Bio Reactors, Effect of Transport Processes.

Unit-V

Introduction to Bioreactor design: Continuously Stirred aerated tank bioreactors. Mixing power correlation .Determination of volumetric mass transfer rate of oxygen from air bubbles and effect of mechanical mixing and aeration on oxygen transfer rate, heat transfer and power consumption. Multiphase bioreactors and their applications. Downstream processing and product recovery in bioprocesses.

References:

1. J. E. Bailey and D. F. Ollis, Biochemical Engineering Fundamentals.
2. Trevan, Boffey, Goulding and Stanbury, Biotechnology.
3. M. L. Shuler and F. Kargi, Bio Process Engineering: Basic concepts.
4. Inamdar S.T.A, Biochemical Engineering – Principles and Concepts.

CMC-604 (B) Fertilizer Technology

Unit-I

Introduction: Plant nutrients, different types of fertilizers and their production in India.

Unit-II

Nitrogenous Fertilizers: Different feed stocks. Synthesis gas production by steam-naptha reforming and gas purefication. Ammonia synthesis. Urea manufacturing processes. Manufacture of sulphuric acid and ammonium sulphate. Nitric acid and ammonium nitrate manufacture.

Unit-III

Phosphatic Fertilizers: Availability and grinding of rock phosphate, manufacturing processes for single and triple super- phosphate and phosphoric acid. Mixed Fertilizers: Availability and manufacture of muriate of potash.

Unit-IV

Mixed Fertilizers: Mono and di-ammonium phosphate, urea ammonium phosphates, NPK complex fertilizers, granulation techniques.

Unit-V

Engineering Problems: Fertilizers storage and handling. Corrosion problems in fertilizers industries. Fertilizer plant effluent treatment and disposal.

References:

1. Slack A.V, Chemistry and Technology of Fertilizers.
2. Austin G.T., and Shreve's, Chemical Processes Industries.
3. Waggaman W.H., Phosphoric Acid, Phosphates and Phosphatic Ferilizers.
4 Rao M.G. and Sittig M Dryden's, Outlines of Chemical Technology.

CMC – 604 (C) Petroleum Refinery Engineering

Unit-I

Primary Processing of Crude Oil, Classification of crude oil, Atmospheric distillation, Vacuum distillation of residue-Products and distillation practice.

Unit-II

Secondary Processing of Crude Oil: FCCU, Hydro cracking, Visbreaking, Thermal cracking, Coking, Reforming, Alkylation, Polymerisation and Isomerisation process.

Unit-III

Treatment Techniques: Treatment techniques for removal of objectionable gases, Odours, to improve performance, Storage stability.

Unit-IV

Extraction of aromatics, Olefins and recovery operations from petroleum products.

References:

1. W.L. Nelson, Petroleum Refinery Engineering.
2 B. K. Bhaskara Rao, Modern Petroleum Refining Processes.
4. G. D. Hobson and W. Pohl, Modern Petroleum Technology.
5. R. A. Meyers, Hand book of Petroleum Refining Processes.

CMC-605 (A) Pharmaceutical Technology

Unit-I

Practice of the following unit operation in pharmaceutical industries: Heat transfer, evaporation, distillation, dry, mixing size reduction, crystallization, filtration, size separation, conveying, humidification, air conditioning and refrigeration, Formulation, development of sterile dosage forms.

Unit-II

Production facilities, environmental control and personnel in the production of sterile dosage form, compounding, processing, filtration, sealing, sterilization, packing and labeling of sterile dosage forms. Quality control tests like sterility, pyrogen, clarify, safety and leakage testing, types of tablets. Manufacturing of tablets by wet granulation, dry granulation and direct compression. Tablet processing problems and defects, tablet standardization: hardness, friability, weights variation, disintegration, dissolution and content uniformity tests.

Unit-III

Capsules: Hard gelatin capsule, capsule size, formulation and preparation of filled hard gelatin capsules, soft gelatin capsule, soft gel – manufacturing procedures. Quality control of capsule.

Unit-IV

Cosmetics and Toiletries: Introduction, factors to be considered in the formulation of facial cosmetics, dentifrice's, deodorant, antiperspirants, shampoos, hairdressing and hair removers.

Unit-V

Pharmaceutical packing: Packing components, types of packing containers and closures, materials used for and their pharmaceutical specification, method of evaluation, stability aspects of packaging materials.

References:

1. Leon Lachman, H.A. Lieberman, J.L.K, The Theory and Practice of Industrial Pharmacy.
2 Ganderton, Unit Process in Pharmacy.
3 D. Hershey, Chemical Engineering in Medicine And Bodogy.
4. Chern. Engg. Prpgrer Syrnp Series, Chemical Engineering in Medicine.

CMC-605 (B) Corrosion Engineering

Unit-I

Basic concepts: Definition and importance; Electrochemical nature and forms of corrosion; Corrosion rate and its determination. Electrochemical thermodynamics and kinetics: Electrode potentials; Potential-pH (Pourbiax) diagrams; Reference electrodes and experimental measurements; Faraday's laws; Electrochemical polarization; Mixed potential theory; Experimental polarization curves; Instrumentation and experimental procedure.

Unit-II

Galvanic and concentration cell corrosion: Basic concepts; Experimental measurements, and determination of rates of galvanic corrosion; Concentration cells, Corrosion measurement through polarization techniques: Tafel extrapolation plots; Polarization resistance method; Instrumental methods and Errors in measurement of polarization resistance; Commercial corrosion probes; other methods of determining polarization curves.

Unit-III

Passivity: Basic concepts of passivity; Properties of passive films; Experimental measurement; Applications of Potentiostatic Anodic Polarization; Anodic protection. Pitting and crevice corrosion: Basic concepts; Mechanisms of pitting and crevice corrosion; Secondary forms of crevice corrosion; Localized pitting, Metallurgical features and corrosion: Inter-granular corrosion; Weldment corrosion; De-alloying and dezincification.

Unit-IV

Environmental induced cracking: Stress corrosion cracking; Corrosion fatigue cracking; Hydrogen induced cracking; Some case studies; Methods of prevention and testing; Erosion, fretting and Wear, Environmental factors and corrosion: Corrosion in water and Aaqueous Ssolutions; Corrosion in sulphur bearing solutions; Microbiologically induced corrosion; Corrosion in soil; Corrosion of concrete; Corrosion in acidic and alkaline process streams.

Unit-V

Atmospheric and elevated temperature corrosion: Atmospheric corrosion and its prevention; Oxidation at elevated temperatures; Alloying; Oxidising environments, Prevention and control of corrosion: Cathodic protection; Coatings and inhibitors; Material selection and design.

References:

1. An Introduction to Corrosion and Corrosion Inhibition S.N. Banerjee,
2. An Introduction to Metallic Corrosion and its Prevention Raj Narayan.

CMC-605 (C) Numerical Methods in Chemical Engineering

Unit-I

Systems of Linear Algebraic Equations: Overview of course Introduction to systems of linear equations Application: Mass balance on a simple separator, Matrix properties and algebra; Gaussian Elimination, Eigenvalue problems.

Unit-II

System of Non-Linear Algebraic Equations: Generalized Newton-Raphson Method Application: Multiple reactions in a CSTR, Numerical Integration.

Unit-III

MATLAB: Case Study: Multicomponent material balance for separation process with recycle, Tridiagonal Matrices Application: Liquid-liquid extractor. Solve generalized eigenvalue problems.

Unit-IV

Use Matlab to perform both symbolic and numeric integration of mathematical functions, Apply these numerical methods to the solution of Chemical Engineering problems, including batch reaction kinetics, heat transfer, mass transfer, and vapor-liquid equilibria calculations.

Unit-V

Use and understand the key differences between different function optimization methods, Solve basic problems in statistics and data regression for model parameter estimation, Prepare Matlab programs using user-defined functions and scripting files.

References:

1. Al-Malah, Kamal I. M.., Matlab Numerical Methods with Chemical Engineering Applications.
2. Steven C. Chapra and Raymond P. Canale, Numerical Methods for Engineers.
3. Beers, Kenneth J. Numerical Methods for Chemical Engineering: Applications in MATLAB.
4. Press, William H. Numerical Recipes in C: The Art of Scientific Computing. New York.
5. Recktenwald, Gerald W. Introduction to Numerical Methods with MATLAB.
6. Heath, Michael T. Scientific Computing: An Introductory Survey.

CMC-606 (A) Petrochemical Technology

Unit-I

Chemicals from methane and synthetic gas: Ammonia, Methanol and Hydrogen Cyanide.

Unit-II

Chemicals from olefins: Ethylene derivatives, Propylene derivatives and Butylenes derivatives, Chemical from Aromatics, synthetic fibres, Plastics and rubber.

Unit-III

Conversion of - Ethylene to ethylene oxide, ethylene glycol, ethanol amine Propylene to acrylic acid ,methyl ethyl ketone acrylonitrile.

Unit-IV

Conversions of – Butenes to iso and n butanols, MIBK, MTBE Aromatics to maleic and phathalicanhydride, DMT, phenols and acetones Cyclohexane to caprolactum, adipic acid.

Unt-V

Hydration: Technologies for production of alcohols such as ethanol, isobutyl alcohol and higher alcohols, Esterification: Process for production of few esters such as acrylates, terephthalates, ester for flavoring industries.

References:

1. Mall, I D, Petrochemical Process Technology.
2. Bhaskar Rao, Modern Petroleum Refining Processes.
3. Speight J, Chemistry & Technology of Petroleum.
4. Robert Mayer, Handbook of Petroleum Refining Processing.
5. N.N. Lebdev, Chemistry and technology of basic organic and petrochemical synthesis.
6. B.K. Bhaskarrao, A text on Petrochemicals, 2nd Ed, Khanna publishers, New Delhi.
7. G.N. Sarkar, Advanced Petrochemicals, 1st Ed, Khanna Publishers, New Delhi.

CMC-606 (B) Food Technology

Unit-I

Introduction: Current status of the Indian a) agriculture b) Food Industry c) Food processing industry.

Unit-II

Basic Food Biochemistry and Microbiology: Food Constituents, Water activity enzymes, Ambient Temperature Processing: Raw material preparation, Size reduction of solid fibrous foods and in liquid foods, Emulsification and Homogenization, Theory and equipment, Mixing and Forming, Extraction and expression,

Unit-III

Membrane concentration Fermentation: Theory, Types, Equipment Effect on foods.

Unit-IV

Heat Processing using Heat or water: Theory, Equipment, Effect on foods, blanching, extrusion, pasteurization, Heat Sterilization, In-container Ultra high temperature (UHT)/aseptic processes. Heat processing using Hot air: Theory, Equipment, Effect on foods, Dehydration, Baking and Roasting; Heat Processing using hot oils: Theory, Equipment, Effect on foods Frying.

Unit-V

Heat Processing by direct & radiated energy: Theory, Equipment, Effect on foods Dielectric heating microwave. Processing by removal of heat, Food Preservation & Storage Food contamination Modified Atmosphere Storage (MAS) Hurdle Technology; Post Processing Applications Packaging.

References:

1. Vijaya khader, Preservation of Fruits and Vegetables.
2. Viyaya khader, Food Processing and Preservation.
3. Srilakshmi. B, Food science, (2nd edition) & Food science & Nutrition.
4. Swaminathan. M, Essentials of Food and Nutrition , Vol. I & II.

CMC – 606 (C) Environmental Impact Assessments and Environmental Audit

Unit-I

Environmental acts - Their need, historical background, national and international acts; Genesis of environmental acts - General procedure followed in changing a bill into an act; implementation of an act using judiciary, executive and legislative powers and their limitations.

Unit-II

Main national acts - Environmental protection agency, air act, water act, water and sewerage Board's Factory act, Municipal acts, acts dealing with hazardous and infections wastes.

Unit-III

Environmental impact assessment, environmental audit, general procedures followed in preparing reports incorporating EIA ES and EA.

Unit-IV

Definitions and concepts, partial audit, compliance audit, methodologies and regulations, Introduction to ISO and ISO 14000. EMAS regulations.

Unit-V

Environmental and occupational health, industrial hygiene, risk assessment disaster management plan, epidemiology. Assessment of existing effluent treatment plants, trouble shooting, remedial measures.

References:

1. L. W. Canter, Environmental Impact Assessment, 2nd Ed., McGraw-Hill, 1997.
2. P. Judith and G. Eduljee, Environmental Impact Assessment for Waste Treatment and Disposal Facilities, John Wiley & Sons, 1994.
3. G. Burke, B. R. Singh and L. Theodore, Handbook of Environmental Management and Technology, 2nd Ed., John Wiley & Sons, 2000.
4. C. H. Eccleston, Environment Impact Statements: A Comprehensive Guide to Project and Strategic Planning, John Wiley & Sons, 2000.
5. R. Welford, Corporate Environmental Management - Systems and Strategies, Universities Press, 1996.
6. K. Whitelaw and Butterworth, ISO 14001: Environmental System Handbook, 1997.
7. The Economist Intelligence Unit, Best Practices - Environment, Universities Press, 1993.
8. R. Therivel, John Glasson, Andrew Chadwick, Introduction to Environmental Impact Assessment (Natural and Built Environment), Routledge, 2005.

Sri Satya Sai
University of Technology and Medical Sciences
(Established under Govt. of M.P. Registered under UGC 2(F) 1956)

Bhopal-Indore Road, Opp. Pachama oilfed plant, Pachama, Dist.-Sehore M.P.PIN-466001
Ph. 07562-223647, Fax : 07562-223644, Web: www.sssutms.co.in, info@sssutms.co.in

Name of Faculty : School of Engineering

Name of Department: **Chemical Engineering**

Minutes of Board of Studies Committee Meeting Dated on **03.06.2019**

The Board of Studies Committee Meeting was held in the room of Department of Chemical Engineering at 2:30 PM. on **03.06.2019**, Following members were present.

1. Dr. Anuradha Devi, Assoc. Prof. (Chemical Engineering), - Chairman
2. Dr. S. Suresh Assoc. Prof. (Chemical Engineering, MANIT Bhopal),-External Member
3. Dr. Neelu Jain, Prof. (Chemistry), Member
4. Mr. Manoj Kumar Gandwane, Asstt. Prof. (Chemical Engineering), Member
5. Mrs. Priyanka Jhavar, Asstt. Prof. (Mechanical Engineering), Member

The Chairman of Board of Studies Committee welcomes and appreciated the efforts put up by the faculty for progress of the departmental activities. The following Agenda points were discussed and resolved.

Agenda Preparation of syllabus and Scheme for VII and VIII Sem CBCS.

Discussion Scheme

Scheme and syllabus was put up before the member as per recent AICTE guidelines, It was discussed in detail by the members and some modification were suggested.

Resolution of the Discussion:

It was resolved that scheme and syllabus as proposed with some modification and may be accepted

SSUTMS SEHORE (M.P.)

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

The Chairman thanks the members for peaceful conduction of meeting.

Signature of All members (Including Chairman)

S.No.	BOS Members	Signature
1	Dr. Anuradha Devi, Assoc. Prof. (Chemical Engineering), - Chairman	
2	Dr. S. Suresh Assoc. Prof. (Chemical Engineering, MANIT Bhopal),-External Member	
3	Dr. Neelu Jain, Prof. (Chemistry), Member	
4	Mr. Manoj Kumar Gandwane, Asstt. Prof. (Chemical Engineering), Member	
5	Mrs. Priyanka Jhavar, Asstt. Prof. (Mechanical Engineering), Member	

Chairman

Registrar
Shri Satya Sai University of Technology
& Medical Sciences Sehore (M.P.)

SSSUTMS

Sri Satya Sai University of Technology & Medical Sciences, Sehore (M.P)

Scheme of Examination - CBCS Pattern

Academic Year 2019– 2020

Branch : Chemical Engineering **Semester - VII**

S.No.	Subject Code	Subject Name	Maximum Marks Theory Slot			Maximum Marks (Practical Slot)		Periods/ hour/ week			Credits	Total Marks
			End Sem. Exam.	Mid Tests	Assign-ments/Quiz	End Sem. Practical & Viva	Practical Record /Assignment/ Quiz / Presentation	L	T	P		
1	CMC - 701	Process Equipment Design - I	60	30	10	30	20	2	1	2	4	150
2	CMC - 702	Chemical Reaction Engineering - II	60	30	10	30	20	2	1	2	4	150
3	CMC - 703	Transport Phenomena	60	30	10	30	20	2	1	2	4	150
4	CMC - 704	Department Elective-I	60	30	10			2	1		3	100
5	CMC - 705	Department Elective-II	60	30	10			2	1		3	100
6	CMC - 706	Open Elective	60	30	10			2	1		3	100
7	CMC - 707	Industrial Training - II					100			4	2	100
TOTAL			**360**	**180**	**60**	**90**	**160**	**12**	**6**	**10**	**23**	**850**

Department Elective-I	CMC-704(A) Fluidization Engineering	CMC-704(B) Multi Phase Flow	CMC-704(C) Computer Aided Process Control & Design
Department Elective-II	CMC-705(A) Multiphase Reactions	CMC-705(B) Nanotechnology in Catalysis	CMC -705(C) Cleaner Technology in chemical Process Industries
Open Elective	CMC-706(A) Bio Energy Technology	CMC-706(B) Solid Waste Management	CMC-706(C) Advanced Analytical Techniques

SSSUTMS Library Engineering SEHORE (M.P.)

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

Sri Satya Sai University of Technology & Medical Sciences, Sehore (M.P)

Scheme of Examination - CBCS Pattern

Academic Year 2019– 2020

Branch : Chemical Engineering **Semester - VIII**

S.No.	Subject Code	Subject Name	Maximum Marks Theory Slot			Maximum Marks (Practical Slot)		Periods/ hour/ week			Credits	Total Marks
			End Sem. Exam.	Mid Tests	Assign-ments/Quiz	End Sem. Practical & Viva	Practical Record /Assignment/ Quiz / Presentation	L	T	P		
1	CMC - 801	Process Equipment Design - II	60	30	10	30	20	2	1	2	4	150
2	CMC - 802	Chemical Process Modeling and Simulation	60	30	10	30	20	2	1	2	4	150
4	CMC-803	Department Elective-I	60	30	10			2	1		3	100
5	CMC-804	Department Elective-II	60	30	10			2	1		3	100
6	CMC-805	Open Elective	60	30	10			2	1		3	100
7	CMC - 806	Industrial Training Project - II				50	100			8	4	150
8	CMC - 807	General Proficiency					100		2	-	2	100
TOTAL			**300**	**150**	**50**	**110**	**240**	**10**	**7**	**12**	**23**	**850**

Department Elective-I	CMC - 803(A) Process Piping Design	CMC - 803(B) Computational Fluid Dynamics		CMC - 803(C) Advanced Process Optimization
Department Elective-II	CMC - 804(A) Industrial Catalysis	CMC - 804(B) Fuels & Combustion		CMC - 804 (C) Sustainability & Green Chemistry
Open Elective	CMC-805(A) Hydrocarbon Technology	CMC-805(B) Industrial Safety & Hazard Management		CMC-805(C) Optimization Techniques

SSSUTMS School of Engineering SEHORE (M.P.)

CMC-701 PROCESS EQUIPMENT DESIGN-I

Unit I Bolted Flanges: Types of Flanges, and selection, Gaskets, Design of non- standard flanges, specifications of standard flanges. Mechanics of materials: Stress- Strain relationships of elastic materials subjected to tensile, compressive and shear forces, Elastic and plastic deformation.

Unit II Shell and tube heat exchanger- General design considerations- LMTD correction factor, fluid allocation, fluid velocities, stream temperatures, pressure drop, shell side and tube side heat transfer coefficients, Design of double pipe heat exchanger. Plate heat exchanger: advantages, disadvantages, design procedure, temperature correction factor, heat transfer coefficients, pressure drop.

Unit III Evaporators: classification, criteria for selection, design of evaporator. Condensers: heat transfer fundamentals, condensation outside horizontal tubes, condensation inside and outside vertical tubes, condensation inside horizontal tubes, condensation of mixtures. Reboilers: types, selection, boiling heat transfer fundamentals,

Unit IV Design Mass Transfer Equipments such as Distillation Columns, Dryers and Absorption column.

Unit V Design of Tall Vessels: Stresses in the shell of a tall vertical vessel, and period of vibration, vessel supports- introduction and classification of supports, design of skirt supports considering stresses due to dead weight, wind load, seismic load, design of base plate, skirt bearing plate, anchor bolts, bolting chairs and skirt shell plates, Design of saddle supports, ring stiffeners.

References:

1. L.E. Brownell and E. Young, John Wiley, New York, 1963, "Process equipment design".
2. B.C. Bhattacharya C.B.S. Publications, "Introduction to Chemical Equipment Design" .
3. M.V. Joshi, Mcmillan India, "Process Equipment Design".
4. J.M. Coulson, J.F. Richardson and R.K., Chemical Engineering Vol. 6".
5. Ludwig E.E., Gulf Publishing Company, "Applied Process Design for Chemical and
1. Petrochemical Plants" vol 1 and 2.
6. Walas S.M. Butterworth Heinamen, McGraw Hill book company, New York
7. Brownell, N.E and Young, H.E; Process Equipment Design; John Wiley
8. Perry RH; Hand book of Chemical Engrs; Mc Graw Hill

List of Experiments:

1. Evaluate the performance of a series of a piping system consisting of various fittings.
2. Evaluate the hydraulic performance of a bed of particles operated in three distinct modes of operation: Packed, Fluidized,
3. Evaluate the hydraulic performances of two towers filled with the same type, but different heights, of packing.
4. Evaluate the residence time distributions (RTDs) of two tubular flow vessels of identical volume but different length/diameter (L/D) ratios.
5. Estimation of the Reynolds number range over which CSTR behavior is approached

CMC- 702 Chemical Reaction Engineering –II

Unit-I Heterogeneous processes: Catalysis and adsorption; Classification of catalysts, Preparation of catalysts, Promoters and Inhibitors, General mechanism of catalytic reactions surface area and pore size distribution Rate equation of fluid solid catalytic reactions, Hougen - Watson & Poinule law models, Procurement and analysis of kinetic data, kinetics of catalyst deactivation.

Unit –II External transport processes and their effects on heterogeneous reactions yield and selectivity Reaction and diffusion in porous catalysts, Isothermal and non-isothermal effectiveness factors, Effect of intra-phase transport on yield, selectivity & poisoning, Global reaction rate.

Unit –III Design of catalytic reactors, Isothermal & adiabatic fixed bad reactor staged adiabatic reactors, Non isothermal, non adiabatic fixed bed reactors, Fluidized bed reactors, Slurry reactors, Trickle bed reactors.

Unit-IV Models for fluid - solid non-catalytic reactions, controlling mechanisms, Diffusion through gas film controls. Diffusion through ash layer controls, Chemical reaction controls, fluidized bed reactors with and without elutriation.

Unit – V Gas-liquid reactions and liquid-liquid reaction, Rate equation based on film theory, Reaction design for instantaneous reactions and slow reactions, Aerobic Fermentation, Application to Design Tools for Fast Reactions.

References:

1. Smiili J.M; Chemical engg. Kinetics; TMH
2. Denbig K.G & Turner KG; Chemical theory - an introduction to reactors; United press
3. Cooper G. & Jeffery JVJ; Chemical kinetics and reactor engg.; PHI
4. Rajaram J, Kuriacose JC; Kinetics and mech. of Chemical Transformations; MacMillan
5. Levenspiel O; Chemical reaction engg; Wiley Eastern Singapore.
6. Hougen, watson & Ragatz; Chemical process principles part 3
7. Fogler, HS; Elements of chemical reaction engg.; PHI

List of Experiments:

1. To determine the order and rate constant of saponification reaction at room temperature.
2. To determine the order and rate constant of esterification reaction at room temperature.
3. To study homogeneous catalytic reaction in a batch reactor under adiabatic conditions.
4. To study the kinetics of decomposition of H_2O_2 catalyzed by iodine ion.
5. To study the dissolution of benzoic acid on reaction with aqueous NaOH solution.
6. To study a non-catalytic homogenous reaction in a PFR.

CMC-703 Transport Phenomena

Unit- I Transport Properties: Continuum fluids, Newton's law of viscosity, Introduction to non-Newtonian fluids, pressure and temperature dependency of viscosity, Viscosity of gases at low density, Laminar flow, shell momentum balance, boundary conditions, selected applications.

Unit- II Momentum Transport: Equations of change for isothermal systems – Navier-Stokes equation, use of equations of change to set up steady state flow problems with Newtonian fluids.

Unit- III Microscopic mass, momentum and energy balance for isothermal systems, Bernoulli's equation, compressible flow, pipe flow. Introduction to Macroscopic momentum balances.

Unit- IV Energy Transport: Shell energy balances, Fourier's Law of heat conduction, boundary conditions. Application to steady and unsteady problems, convective heat transfer, heat transfer coefficients for forced convection around submerged objects, for free convection for condensation of pure vapors on solid surface. Introduction to Macroscopic energy balances.

Unit-V Mass Transport: Fick's Law of diffusion, analogy with heat transfer, shell mass balances, boundary conditions, applications, species continuity equation, conductive mass transfer, mass transfer coefficients, applications, correlations. Introduction to Macroscopic Mass Balances.

References:

1. Bird, R. B., Stewart, W. E. and Lightfoot, E. N., "Transport Phenomena," John Wiley, 1960.

2. Thomson, W. J., "Introduction to Transport Phenomena," Pearson Education Asia, 2000.

3. Brodkey, R. S. and Hershey, H. C.,"Transport Phenomena: A Unified Approach,"McGraw-Hill, NY, 1988.

4. Geancoplis; Transport processes & separation process principles; PHI learning.

List of Experiments:

1. Fundamentals of fluid dynamics
2. Fundamentals of conduction and convection heat transfer
3. Fundamentals of diffusion mass transfer
4. Fundamentals of design of experiments and data analysis

CMC -704 (A) FLUIDIZATION ENGINEERING

Unit-I Introduction: The phenomenon of fluidization; liquid like behaviour of a fluidized bed; Comparison with other contacting methods; Advantages and disadvantages of fluidized beds. Industrial applications of fluidized beds.

Unit-II Coal gasification; gasoline from other petroleum fractions; Gasoline from natural and synthesis gases; Heat exchange; Coating of metal objects with plastics; Drying of solids; Synthesis of phthalic anhydride; Acrylonitrile; Polymerization of olefins; FCCU; Fluidized combustion of coal; incineration of solid waste; Activation of carbon; gasification of waste; bio-fluidization.

Unit-III Fluidization and mapping of regimes: Minimum fluidization velocity; Pressure drop vs. velocity diagram; effect of temperature and pressure on fluidization; Geldart classification of particles; terminal velocity of particles; turbulent fluidization; pneumatic transport of solids; fast fluidization; solid circulation systems;

Unit-IV Voidage diagram; Mapping of regimes of fluidization. Bubbles in dense bed: Single rising bubbles; Davidson model for gas flow at bubbles; Evaluation of models for gas flow at bubbles, Bubbling Fluidized beds: Experimental findings; Estimation of bed porosities; Physical models: simple two phase model; K-L model.High velocity Fluidization: Turbulent fluidized bed; Fast fluidization pressure drop in turbulent and fast fluidization. Solids Movement, Mixing, Segregation and staging: Vertical movement of solids;

Unit-V Horizontal movement of solids; Staging of fluidized beds.Gas Dispersion and Gas interchange in Bubbling Beds: Dispersion of gas in beds; Gas interchange between bubble and emulsion; Estimation of gas interchange coefficients. Particle to Gas Mass Transfer: Experimental interpolation of mass transfer coefficients; Heat transfer; Experimental heat transfer from the bubbling bed model.

References:

1. Fluidization Engineering Kunil, Diazo and Octave Levenspiel
2. Fluidization Max Leva.
3. Fluidization Engineering O. Levenspiel and D. Kunii,
4. Gas-Liquid-Solid Fluidization Engineering Liang-Shih Fan,

CMC-704 (B) MULTI PHASE FLOW

Unit-I Introduction to the flow of multiphase mixtures: gas or vapor liquid, liquid-liquid, liquid-solid, gas-solid, solid-liquid-gas and gases carrying solids (pneumatic transport) stratification and dispersion, Flow regimes and flow patterns.

Unit-II Gas (Vapor) and Liquid Flows: Horizontal flow, Vertical flow, pressure, momentum and energy relations, methods of evaluating pressure drop, Lockhard - Martinell, Chisholm correlations, critical flow, non-Newtonian flow.

Unit-III Solid-Gas Flow: Effect of pipeline diameter, inclination, bends, valves and length, Liquid and its physico-chemical properties, rheology, corrosive nature, viscosity, Solid particle size, distribution phase, and density i.e. their factors effecting behavior in a fluid, Concentration of particles and the flow rates of both solids and liquid.

Unit-IV Solid-Gas Flow: Horizontal flow, Suspension mechanism, determination of voids, energy requirements for conveying, pressure drop and solid velocities in dilute phase flow, dense phase conveying, vertical transport.

Unit-V Bubble and drop formation: Phase holdups, Interfacial areas, mixing and pressure drops, multiphase (gas liquid solid) operations.

References:

1. The flow of complex mixtures in pipe Govier, G.W. and Aziz, K
2. Chemical engineering, Vol I, Coulson JM and Richardson J.F
3. Multiphase Flow Handbook Crowe, C.T.
4. Fundamentals of Multiphase Flow Brennen, C.E

CMC- 704 (C) COMPUTER AIDED PROCESS CONTROL & DESIGN

Unit-I Hardware: Analog and digital interfacing, sensors and transducers.

Unit-II System software: real time programming, Application software:

Unit-III Data logging, filtering, digital control: Z-transforms, discrete time dynamic systems, adaptive control,

Unit-IV Introduction to MIMO control systems. Laboratory exercises.

References:

1. Chemical Engineers Handbook Green DW and Malony, perrys

CMC-705(A) Multiphase Reactions

Unit-I Introduction: reaction kinetics for multiphase reactions, brief idea of multiphase reactors and design.

Unit-II Catalyst deactivation and regeneration, Review of reaction kinetics and reactor design.

Unit-III Industrial reactors: Trickle bed, Bubble column, segmented bed, fluidized bed and slurry reactor, models for analysis gas-liquid, gas-liquid-solid reactions.

Unit-IV RTD and macro mixing models, brief description of laboratory reactors.

Unit-V Intrinsic kinetics: catalysis, Langmuir-Hinshelwood models, catalyst pellets, effectiveness factors.

References:

1. Gas Liquid Reactor Design Y. T. Shaha .
2. Chemical Reactor Deign and Operation Westerterp K. R., Van Swaaji and Beevackers
3. Multiphase Chemical Reactor – Theory, Design, Scale-up Gianetta and Silverton
4. Heterogeneous Reactions Vol-I and II Sharma and Doraiswam

CMC-705 (B) NANO TECHNOLOGY IN CATALYSIS

Unit-I Introduction to nano-technology, definition, history. What makes the nanoscale so different from the other length scales by considering the underpinning science (i.e. nanoscience) and some key examples of nanotechnology.

Unit-II Methods of synthesis of nanomaterial's fabrication-—Top-downl vs. —bottom-upl approaches. Equipment and processes needed to fabricate nanodevices and structures.

Unit-III Fundamental understanding of catalysis at nano-scale. Wet chemical synthesis, preparation and properties of iron, platinum, gold, cadmium, silver, copper and nickel nano-particles.

Unit-IV Synthesis and properties of composite nano-particles and coated nano-particles.

Unit-V Characterization of nano particles by Scanning probe microscopes (Atomic Force Microscopy, Scanning Tunneling Microscopy), Transmission Electron Microscopy, Scanning Electron Microscopy.

References:

1. Nanotechnology: Principles and Practices, . S. K. Kulkarni .
2. Nano science and technology: novel structures and phenomena, Tang, Zikang and Sheng, Ping, Taylor and Francis,
3. Nanotechnology: Understanding small systems B. Rogers, S. Pennathur, J. Adams
4. Nanotechnology in Catalysis Pinzhan.

CMC-705 (C) Cleaner Technologies in Chemical Process Industry

Unit I Introduction to Cleaner Technology (CT), Technology adoption for Cleaner Production (CP), Cleaner Production: The basis, necessity and potential, C.P. tools, techniques, methodology and applications, Overview of Good House Keeping, Process Modification / Changes, Process Technology Innovations, Equipment Modification, Reuse and Recycle. Principles and Concepts of Green Chemistry.

Unit-II Thermodynamics and Reaction Engineering Principles for C.P., Role of Environmental Biotechnology in C.P.Use of Unit Operations – Adsorption, Absorption and Extraction in C.P.

Unit-III Energy Audit and Energy Conservation, Use of clean fuels inclusive of H2 as a clean fuel of tomorrow, Power Plants, C.P. & C.T. as Remedial Measures for Mitigating Climate Change, Ozone layer depletion and current practices to avoid depletion.

Unit-IV Resource recovery / by product recovery from manufacturing process by Cleaner Production Technology (CPT) with special reference to Small Scale Industries. Industrial waste minimization and Waste Minimization Circles, Hazard Prevention by C.P. Technology

Unit-V Alternatives, Designing Cleaner Production – Green Processes, Cleaner Production and Cleaner Technology implementation, Typical case studies.

Reference:

1. Cleaner Production: Training Resource Package, UNEP IE, Paris, 1996
2. Engineers Guide to Cleaner Production Technologies Paul M. Randall
3. Green Chemistry : Environmentally Benign Reactions V. K. Ahluvalia
4. Chemical Process Safety: Learning from case Histories, R. E. Sanders, Oxford

CMC-706 (A) BIO ENERGY TECHNOLOGY

Unit-I Sources and Classification. Chemical composition, properties of biomass. Energy plantations. Size reduction, Briquetting, Drying, Storage and handling of biomass.

Unit-II Feedstock for biogas, Microbial and biochemical aspects- operating parameters for biogas production. Kinetics and mechanism- High rate digesters for industrial waster water treatment.

Unit-III Thermo chemical conversion of lignocelluloses biomass. Incineration, Processing for liquid fuel production. Pyrolysis -Effect of particle size, temperature, and products obtained.

Unit-IV Thermo chemical Principles: Effect of pressure, temperature , steam and oxygen. Fixed and fluidized bed Gasifiers- Partial gasification of biomass by CFB.

Unit-V Combustion of woody biomass-Design of equipment. Cogeneration using bagasse- Case studies: Combustion of rice husk.

References:

1. Biotechnology and Alternative Technologies for Utilization of Biomass Chakraverthy A
2. Biogas Systems: Principles and Applications Mital K.M
3. Biomass Energy Systems Venkata Ramana P and Srinivas S.N
4. Gasification Technologies,A Primer for Engineers and Scientists Rezaiyan. J and N. P.

CMC-706 (B) SOLID WASTE MANAGEMENT

Unit-I Introduction- Philosophy and organization, Status of solid waste management, Compotation an integrated waste management strategy. Evolution of solid waste management.

Unit-II Legislation and Government agencies, Planning solid waste management progress. Generation of solid waste, Onsite handling, Storage and processing.

Unit-III Transfer and transport, Processing techniques and equipment. Recovery of resources-Conversion, Chemical and Biological methods.

Unit-IV Disposal of solid waste- Landfilling, Ocean disposing, Source reduction, Recycling, Composting. Hazardous waste and their management, Process management issues, Planning.

Unit-V Case studies on major industrial solid waste generation units- Coal fired power plant, Textile industry, Brewery, Distillery, Oil refinery, Radioactive generation units. Case studies on spills, Sludge lagooning and incineration.

References:

1. Handbook of Solid Waste b Frank Krieth
2. Solid Wastes, Martell
3. Solid Wastes, George Tchobanuglour, H.Theisen and R.Eliassen.
4. Solid Waste Management, Luis F. Diaz, George M. Savage, Linda L. Eggerth, Larry.

CMC-706 (C) ADVANCED ANALYTICAL TECHNIQUES

Unit-I Introduction to spectroscopic methods of analysis, electromagnetic radiation and quantitative spectroscopy.

Unit-II Molecular Spectroscopy, UV Spectroscopy, IR Spectroscopy.

Unit-III Atomic Spectroscopy: AAS Spectroscopy, Electrometric Methods of Analysis, XRD Analsyis.

Unit-IV Thermal Methods: DSC, DTA, Chromatographic Methods: GC, HPLC.

References:

1. Instrumental methods of analysis Willard, H.H., Merritt. I.I., Dean J.a., and Settle, F.A
2. Instrumental Methods of Analysis Sharma, B.K.,
3. Absorption spectroscopy of organic molecules Parikh V.M.,.
4. Fundamentals of Analytical Chemistry Skoog D.A. and West D.M.,
5. Fundamentals of molecular spectroscopy Banwell, G.

CMC-707 Industrial Training - II

The following objective should be fulfilled in industrial training–II, and student must participate in any Chemical, Petrochemical, Pharmaceutical, Oil and Gas industry where they can learn to apply the Technical knowledge in real Industrial situations.

- Gain experience in writing Technical reports/projects.
- Expose students to the engineer's responsibilities and ethics.
- Expose the students to future employers.
- Understand the social, economic and administrative considerations that influence the working environment of industrial organizations.

CMC – 801 Process Equipment Design-II

Unit I Scale up criteria and scale up of process equipment. Process design calculations for heat exchanges equipment shell and tube heat exchangers general description, heat transfer coefficients and pressure drop by Kerms & Bells methods rating on existing unit.

Unit II Design of a new system having one or more units in series: single effect evaporation, multiple effect evaporator with boiling point elevation.

Unit III Process design calculations for mass exchange equipment plate and packed column for distribution hand adsorption including column diameter and height.

Unit IV Detailed process and mechanical design, Flash drum , Kettle reloerler, condenser, cooling tower rotary drier.

References:

1. Perry, Robert etal; Perry□s Chemical Engg. Handbook; TMH
2. Chemical Engineering Vol-1 Coulson J.M. Richardson J.F .
6. Chemical Engineering Handbook Perry, Robert H., Green Don W
4. Applied Process Design in Chemical Petrochemical Plants E.E. Ludwig
5. Design of Equilibrium Stages. B.D. Smith
6. Kern D; Process Heat Transfer; TMH

List of Experiments:

1. Evaluate the hydraulic performances of two packed towers.
2. Evaluate the heat transfer characteristics of two steam condensers and one liquid/liquid exchanger.
3. Evaluate heat transfer in an agitated, jacketed vessel.
4. Evaluate the heat transfer in a batch (i.e. no flow) agitated vessel.
5. Evaluate the hydraulic performance of a bed of particles operated in packed modes of operation.
6. Evaluate the hydraulic performance of a bed of particles operated in Fluidized modes of operation

CM – 802 Chemical Process Modeling and Simulation

Unit I The role of analysis: chemical engineering problems, basic concepts of analysis; the analysis process, simple example of estimating an order, source of the model equations, conservation equations, constitutive equations, control volumes, dimensional analysis, system of units, dimensional consistency in mathematical descriptions, dimensional analysis and constitutive relationships, final observations.

Unit II Non-Reacting Liquid Systems: Introduction, equation of continuity, simple mass balance, application of the model equations, component mass balances, model behavior: steady state behavior, un-steady state behavior, density assumption, numerical integration methods of ordinary differential equation; Reacting Liquid Systems: Introduction, basic model equations for a tank-type reactor, reaction rate, batch reactor, pseudo first-order reactions, reversible reactions, multiple reactions; consecutive reactions, parallel reactions, complex reactions, constant density assumption, order and stoichiometry.

Unit III Treatment of experimental data: Introduction, criteria for Best Fit, Best Slope-I, Best Slope-II, Best straight line, physical property correlations, fitting a quadratic, simulation examples of gravity fluid flow, heat and mass transfer, Monte-Carlo simulation.

Unit IV Dynamic modeling of simple processes, sequential, simultaneous modular and equation oriented approaches, partitioning and tearing.

Unit V Computer programming of various iterative convergence methods such as Newton-Raphson, false position, Wegstein, Muller methods.

References:

1. Russell TWF; Introduction to Chemical Engineering Analysis - John Wiley & Sons
2. Luyben W.L; Process Modeling, Simulation And Control For Chemical Engineers; TMH
3. Jana ; Chemical process modeling and computer simulation; PHI Learning
4. Babu, B. V., Process plant simulation

List of Experiments:

1. To introduce students to solving process simulation problems using **MATLAB** and **Aspen-Plus.**
2. The first part of this course will focus on MATLAB, which is a powerful language for engineering applications.
3. The second part will cover process simulation using the **Aspen-Plus** package, which is an industry standard for process simulations.
4. Truncated Taylor's series & errors. Numerical differentiation and integration. ODE-IVP: Understanding Runge-Kutta Method. RK Method in Multiple Variables.
5. Solving and Application to Transient System Reactor simulations.
6. Introduction to Aspen Plus. Simulation of individual equipments.
7. Design specification and sensitivity analysis.
8. Equation oriented approach. Unsteady state simulation. Aspen properties.

CMC-803 (A) PROCESS PIPING DESIGN

Unit-I Classification of pipes and tubes, IS & BS codes for pipes used in chemical process industries and utilities. Pipes for Newtonian and non-Newtonian fluids, sudden expansion and contraction effects.

Unit-II Pipe surface roughness effects, pipe bends, Shearing characteristics. Pressure drop for flow Newtonian and non-Newtonian fluids through pipes. Resistance to flow and pressure drop. Effect of Reynolds and apparent Reynolds number.

Unit-III Pipes of circular and non-circular cross section – velocity distribution, average velocity and volumetric rate of flow. Flow through curved pipes (Variable cross sections). Effect of pipe-fittings on pressure losses.

Unit-IV Non-Newtonian fluid flow through process pipes, Shear stress, Shear rates behavior, apparent viscosity and its shear dependence, Power law index, Yield Stress in fluids, Time dependant behavior.

Unit-V Thixotropic and rheopetic behavior, mechanical analogues, velocity pressure relationships for fluids, line. Pipe line design and power losses in compressible fluid flow, Multiphase flow, gas-liquid, solid-fluid, flows in vertical and horizontal pipelines, Lockhart Martinelli relations, Flow pattern regimes.

References:

1. Chemical Engineering – Vol I , Coulson JM and Richardson J.F.
2. The flow of Complex Mixtures In Pipe Govier, G.W. and Aziz K
3. Process Piping Design, , Volume 2, Rip Weaver

CMC-803 (B) COMPUTATIONAL FLUID DYNAMICS

Unit-I Conservation equations for mass, momentum and energy; Comparison of various numerical techniques for CFD.

Unit-II Review of finite difference and finite element methods; Solution to discretised algebric equation;

Unit-III Finite-volume method for diffusion problems; Finite-volume method for convection and diffusion problems – pressure velocity coupling.

Unit-IV Construction of geometry and discreation using Gambit-Fluent's manuals; Commercial CFD solvers; Turbulance modeling; Implementation of boundary conditions.

Unit-V Introduction to multiphase flow; Customizing commercial CFD solver; Unsteady state simulations.

References:

1. Computational Fluid Dynamics: The Basics with Application Anderson, J.D
2. Computational Methods for Fluid Dynamics Ferziger, J.H. and Peric, M
3. An Introduction to Computational Fluid Dynamics: The Finite Volume Methodl, H.K. and Malalasekera, W

CMC- 803 (C) ADVANCED PROCESS OPTIMIZATION

Unit-I Objective and Formulation of Optimization, Inequality and Equality Constrains in Models Formulation of the Objective Function, Lower and Upper Bounds, Selecting Functions to Fit Empirical Data, Factorial Experimental Designs, Degrees of Freedom.

Unit-II Economic Objective Functions, Measures of Profitability, Continuity of Function, NLP Problem Statement, Convexity and Its Applications, Quadratic Approximation, Necessary and Sufficient Conditions for an Extremum of an Unconstrained Function.

Unit-III Optimization of Unconstrained Functions: One-Dimensional Search Numerical Methods for Optimizing a Function of One Variable, Scanning and Bracketing Procedures, Newton and Quasi-Newton Methods of Unidimensional Search, Unconstrained Multivariable Optimization.

Unit-IV Linear Programming (LP) and Applications Geometry of Linear Programs, Basic Linear Programming Definitions and Results, Simplex Algorithm, Barrier Methods, Sensitivity Analysis, Linear Mixed Integer Programs, Application of the EXCEL Solver Spreadsheet for Optimisation, Formulation.

Unit-V Introduction to Nonlinear Programming with Constraints and Mixed-Integer Programming, Application of Optimization in Chemical Engineering, Examples of Optimization in Chemical Processes like optimizing recovery of waste heat, Optimal Shell and Tube Heat Exchanger Design, Optimal Design and Operation of binary Distillation Column, Optimal pipe diameter etc.

References:

1. Optimization of Chemical Processes D M Himmelblau and L S Lasdon
2. Optimization theory and practice G. S. Beveridge and R. S. Schechter
3. Optimization for engineering design: Algorithms and examples K. Deb
4. Mixed Integer and Non Linear Optimization C. A. Floudas, W D Seider, J D Seader and D R Lewin

CMC-804 (A) INDUSTRIAL CATALYSIS

Unit-I Review of Heterogeneous Catalysis: Role of catalyst components and other constituents, characterization of catalyst and its support.

Unit-II Transport Processes: Analysis of external transport processes in heterogeneous reactions in fixed bed, fluidized bed and slurry reactors. Intrapellet mass transfer, heat transfer, mass transfer with chemical reaction and simultaneous mass and heat transfer with chemical reaction.

Unit-III Catalyst Selectivity: Effect of intrapellet diffusion on selectivity in complex reactions, effect of external mass transfer on selectivity.

Unit-IV Catalyst Deactivation: Modes of deactivation – poisoning, fouling and sintering. Determination of deactivation routes, combined effect of deactivation and diffusion on reaction rates, effect of deactivation on selectivity.

Unit-V Reactor Design: Design calculation for ideal catalytic reactor operating at isothermal, adiabatic and non-adiabatic conditions. Deviations from ideal reactor performance. Design of industrial fixed-bed, fluidized bed and slurry reactors. Thermal stability of packed bed and fluidized bed reactors, Overview of various areas of Green chemistry, Successful approaches to Green Chemistry education.

References:

1. Chemical Engineering Kinetics Smith, J. M
2. Catalytic Reaction Engineering, Carberry, J. J .
3. Heterogeneous Catalytic Reactors Lee, H. H
4. Catalytic Reactor Design Tarhan, M. O .

CMC- 804 (B) FUELS AND COMBUSTION

Unit-I Energy crisis – Present position in India and the world. Origin and Chemical composition, Classification of fuels, Storage and general use of Industrial fuels, Comparison of various types of fuels, Calorific value of a fuel, LCV and HCV, meaning and definition.

Unit-II Determination of HCV and LCV for solid fuels, Bomb calorimeter, Gas calorimeter. Solid fuels: Wood and charcoal, Coals and their characteristics, combustion and availability of coals in India, Coal washing and blending. High and low temperature coal carbonization.

Unit-III Manufacture of coke and recovery of by products. Pulverized coal and its conduction. Liquid fuels: Petroleum, its origin and occurrence. Distillation, products of distillation, their characteristics and uses. Combustion, Chemistry of combustion, combustion calculations pertaining to different fuels and furnaces used in ceramic industries.

Unit-IV Theoretical air / fuel ratio, Excess air, Flue gas analysis calculations. Gaseous Fuels: Classification, merits and demerits of the gaseous fuels. N gas, LPG, coal gas, Oil gas, Produces gas, Water gas, Semi-water gas etc., their chemical composition.

Unit-V Manufacture and uses in detail. Nuclear fuels, their scope and classification, Types of nuclear fuels, method of generation of nuclear energy from the sources, etc., Nuclear reactor – classification and types Accessories and their study in detail. Nuclear fuel roads, Moderators, Heavy water etc., Alternate sources of energy, Renewable energy, Hydroelectric, Solar, Geothermal, Tidal, Wind and other types, Bio-gas, Bio-fuels, etc.

References:

1. .Fuels Technology Himus
2. Combustion Engineering and Fuels Technology Shaha
3. Principles of Energy conversion Gulp Jr. A.W.
4. Energy resources and supply McMullan, Morgan Murray

CMC- 804 (C) SUSTAINABILITY AND GREEN CHEMISTRY

Unit-I Introduction to Green Chemistry and Sustainability, the Chemistry behind Green Chemistry, Green Chemistry and Natural Resources.

Unit-II Energy Relationships: Energy sources, Energy conversions and renewable energy, potential of biofuels.

Unit-III Water: Properties, Life in, and Contaminants, Designing an Environmentally Safe Marine Antifoulant, Green Chemistry and Ecology.

Unit-IV The Biosphere, The Geosphere, Soil and Food, The Anthrosphere and Industrial Ecology Consumer products, DuPont Petretec Polyester Regeneration Technology.

References:

1. Green Chemistry an Introductory Text, Royal Society of Chemistry Lancaster, M.
2. Green Chemistry, Theory and Practice Anastas, P.T.; Warner, J. C.,
3. Introduction to Green Chemistry Matlack, A.S.,

CMC-805(A) Hydrocarbon Technology

Unit-I To impart knowledge of petroleum refining, hydrocarbon processing, and derived petrochemicals.

Unit-II New trends in refinery. Classification and Characterization: Classification of petroleum, Characterization of petroleum fractions. Atmospheric distillation and vacuum distillation units.

Unit-III Thermal conversion processes, Conventional vis-breaking and soaker visbreaking process, Coking processes, Catalytic conversion processes,

Unit-IV Fluid catalytic cracking, Catalytic reforming, Hydrocracking, Catalytic alkylation, Catalytic isomerization and catalytic polymerization. Finishing Processes:

Unit-V Sulphur conversion processes, Sweetening processes, Solvent extraction process, Hydrotreating process. Lube oil manufacturing Processes: Solvent extraction of lube oil fractions, Manufacture of petroleum wax, Hydrofinishing process.

References:

1. Bhaskara Rao, B.K. Modern Petroleum Refining Processes. Oxford & IBH Publishing Company Pvt. Ltd. New Delhi, (2007) 3rd Ed.
2. Nelson, W. L. Petroleum Refinery Engineering, Tata McGraw Hill Publishing Company Limited, (1958) 4th Ed.
3. Garry,J.H. Petroleum Refining Technology and Economics, Marcel Dekker Inc., (2001) 4 th Ed.
4. Wells G. M.Handbook of petrochemicals and processes, Ashgate Publishing Ltd, (1999) 2 nd Ed.
5. Spitz P. H. Petrochemicals: The rise of an industry, John Wiley & Sons, (1999).
6. Sarkar, G.N. Advanced Petroleum Refining, Khanna Publishers, (2000).

CMC-805 (B) INDUSTRIAL SAFETY & HAZARD MANAGEMENT

Unit-I Introduction: Safety program, Engineering ethics, Accident and loss statistics, Acceptable risk, Public perception, Toxicology: How toxicants enter biological organisms, How toxicants are eliminated from biological organisms.

Unit-II Industrial Hygiene: Government regulations, Identification, Evaluation, Control. Fires and Explosions: The fire triangle, Distinction between fire and explosions.

Unit-III Definitions, Flammability characteristics of liquids and vapors, MOC and inerting, ignition energy, Auto ignition, Auto oxidation, Adiabatic compression, Explosions.Designs to prevent fires and explosions: Inerting, Explosion proof equipment and instruments, Ventilations, Sprinkler systems.

Unit-IV Introduction to Reliefs: Relief concepts, Definitions, Location of reliefs, Relief types, Data for sizing reliefs, Relief systems. Relief Sizing: Conventional spring operated relief's in liquids.

Unit-V Conventional spring operated relief's in vapor or gas service, Rupture disc relief's in liquid, vapour or gas service. Hazards Identification: Process hazards checklists, Hazard surveys, Hazop safety reviews.

References:

1. Chemical Process Safety (Fundamentals with applications), D.A.Crowl & J.F.Louvar
2. Industrial Hygiene and Chemical safety
3. Safety and Accident Prevention in Chemical Operations, H.H.Fawcett and W.S.Wood
4. Chemical engineering Vol.6, Coulson and Richardson's

CMC- 805 (C) OPTIMIZATION TECHNIQUES

Unit-I Optimal problem formulation, Single variable optimization algorithms, Multi variable optimization algorithms including simplex search method; Cauchy"s steepest descent method; Levenberg Marquardt"s method.

Unit-II Constrained optimization algorithms including Khun-Tucker conditions, transformation methods; direct search methods; liberalized search techniques; feasible direction method, Specialized algorithms including Integer programming; geometric programming.

Unit-III Nontraditional optimization techniques including simulated annealing, genetic algorithms (GA), introduction to multi objective optimization problems. Application of all the aforesaid techniques with the help of the frequently used benchmark functions for engineering design.

Unit-IV Scope & Objective: Optimization has become a part of computer aided design activities where the goal is not only to achieve a feasible design but also a design objective. The course provides basic knowledge of deterministic algorithms as well as algorithms which are stochastic in nature with probabilistic transition rules, new methods in computational intelligence or „soft computing" inspired by evolutionary processes in nature, such as genetic algorithms.

Unit-V The course consists of lectures and a project component, which includes both model building and programming. This course also provides an opportunity to get conversant with optimization toolbox of MATLAB by the Mathworks, Inc.

References:

1. Engineering Optimization Theory & Practice, S. S. Rao,
2. Multi-Objective Optimization Using Evolutionary Algorithms K. Deb,
3. Process Plant Simulation, B.V. Babu
4. Optimization of Chemical Processes, T. F. Edgar, D. M. Himmelblau,

CMC- 806 INDUSTRIAL TRAINING PROJECT-II

The focus of the Industrial Training Project-II is on preparing a working system or some design or Understanding of a complex system using system analysis tools and submit it the same in the form of a write up i.e. detail project report. The student should select some real life problems for their project and maintain proper documentation of different stages of project such as need analysis market analysis, concept evaluation, requirement specification, objectives, work plan, analysis, design, implementation and test plan. Each student is required to prepare a project report and present the same at the final examination with a demonstration of the working system (if any).

Sri Satya Sai University of Technology & Medical Sciences, Sehore (M.P)
Scheme of Examination - CBCS Pattern
Academic Year 2016– 2017
Branch : Common to all

Semester - II

S.No.	Subject Code	Subject Name	Maximum Marks Theory Slot			Maximum Marks (Practical Slot)		Periods/ hour/ week			Credits	Total Marks
			End Sem. Exam.	Mid Tests	Assign-ments/Quiz	End Sem. Practical & Viva	Practical Record /Assignment/ Quiz / Presentation	L	T	P		
1	BEC - 201	Engineering Mathematics - II	60	30	10	-	-	2	1	-	3	100
2	BEC - 202	Applied Chemistry	60	30	10	30	20	2	1	2	4	150
3	BEC - 203	Basic Civil Engineering	60	30	10	30	20	2	1	2	4	150
4	BEC - 204	Basic Electrical & Electronics	60	30	10	30	20	2	1	2	4	150
5	BEC - 205	Enviornment and Ethics	60	30	10	30	20	2	1	2	4	150
6	BEC - 206 (A)	Energy Sources	60	30	10	-	-	2	1		3	100
	BEC - 206 (B)	Constitution of India										
	BEC - 206 (C)	Entrepreneurship Development										
7	BEC - 207	Workshop Practices				50	-			4	2	50
TOTAL			**360**	**180**	**60**	**170**	**80**	**12**	**6**	**12**	**24**	**850**

Note: Only one subject should be selected from BEC - 206 [A, B,C]

L= Lecture, T= Tutorial & P= Practical

BOS Members

SSSUTMS School of Engineering (M.P.)

Registrar Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P)

DEAN/HOD

Sri Satya Sai University of Technology & Medical Sciences, Sehore (M.P)

Scheme of Examination - CBCS Pattern

Academic Year 2016– 2017

Bachelor of Engineering B.E. (Common to all Disciplines) **Semester - I**

S.No.	Subject Code	Subject Name	Maximum Marks Theory Slot			Maximum Marks (Practical Slot)		Periods/ hour/ week			Credits	Total Marks
			End Sem. Exam.	Mid Tests	Assign-ments/Quiz	End Sem. Practical & Viva	Practical Record /Assignment/ Quiz / Presentation	L	T	P		
1	BEC - 101	Engineering Mathematics - I	60	30	10	-	-	2	1	-	3	100
2	BEC - 102	Applied Physics	60	30	10	30	20	2	1	2	4	150
3	BEC - 103	Engineering Machanics	60	30	10	30	20	2	1	2	4	150
4	BEC - 104	Communication Skills	60	30	10	30	20	2	1	2	4	150
5	BEC - 105	Engineering Graphics	60	30	10	30	20	2	1	2	4	150
6	BEC - 106 (A)	Principles of Management	60	30	10	-	-	2	1	-	3	100
	BEC - 106 (B)	Impact of Science & Technology on Society										
	BEC - 106 (C)	Basic Computer Programming										
7	BEC - 107	Computer Hardware and Practices	-	-	-	50	-	-	-	4	2	50
TOTAL			**360**	**180**	**60**	**170**	**80**	**12**	**6**	**12**	**24**	**850**

SSUTMS School of Engineering SEHORE (M.P.)

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P)

BEC 101
[ENGINEERING MATHEMATICS-I]

UNIT-I

DIFFERENTIAL CALCULUS: Expansion of functions by Maclaurin's and Taylor's theorem, Partial differentiation, Euler's theorem and its application in approximation and errors ,Definite Integrals, Definite Integrals as a limit of a sum, Its application in summation of series , Beta and Gamma Functions, Double and Triple integrals, Curvature : Radius of curvature , centre of curvature.

UNIT-II

DIFFERENTIAL EQUATIONS: Linear Differential Equations with Constant Coefficients, Clairaut's Equation, Cauchy's Homogeneous differential Equation, Simultaneous differential Equations, Method of Variation of Parameters,Numerical differentiation , Numerical integration by Trapezoidal rule, Solutions of one dimensional heat and wave equations.

UNIT-III

MATRICES: Rank of a matrix, Solution of Simultaneous equation by elementary transformation, Consistency of System of Simultaneous Linear Equation, Symmetric, skew-symmetric and orthogonal matrices, Determinants, Eigen Values and Eigen Vectors, Cayley-Hamilton Theorem and its Application to find the inverse.

UNIT-IV

FOURIER SERIES: Introduction of Fourier series, Fourier series for Discontinuous functions, Fourier series for even and odd function, Half range series, Fourier Transform, Definition and properties of Fourier transform, Sine and Cosine transform.

UNIT-V

LAPLACE TRANSFORM: Introduction of Laplace Transform, Laplace Transform of elementary functions, properties of Laplace Transform, Change of scale property, second shifting property, Laplace transform of the derivative, Inverse Laplace transform & its properties, Convolution theorem, Applications of L.T. to solve the ordinary differential equations.

REFERENCE BOOKS:

1. Higher Engineering Mathematics by B.S Grewal, Khanna Publication
2. Engineering Mathematics-I & II by D.K. Jain
3. Engineering Mathematics-I & II by D.C. Agarwal
4. Advanced Engineering Mathematics by Erwin Kreyszig, Wiley India OR D.G. Guffy

BEC 102
[APPLIED PHYSICS]

UNIT-I

Quantum Physics:

Concept of Quantum theory. Wave-particle duality, Matter waves, Group velocity, phase velocity and their relationship. Uncertainty principle with elementary proof and applications (determination of position of a particle by a microscope, non-existence of electron in nucleus, diffraction of an electron beam by a single slit).Compton effect and Compton scattering. Schrodinger wave equation: time independent & dependent, Eigen functions & Eigen values, particle in a box.

UNIT-II

Wave Optics: Interference:

Fresnel's biprism, Interference in thin films (due to reflected and transmitted light), interference from a wedge shaped thin film, Newton's rings and Michelson's interferometer, experiments and their applications. Concept of polarized light, Brewster's law, Double refraction, Nicol prism, quarter & half wave plate.

UNIT-III

Nuclear Physics:

Nuclear properties. Nuclear models: Nuclear liquid drop model (semi empirical mass formula), nuclear shell model, Nuclear fission and Nuclear fusion, Chain reaction. Linear Particle accelerators: Cyclotron, general description of Synchrotron, Synchrocyclotron, and Betatron. Geiger-Muller Counter, Uses of Bainbridge and Auston mass Spectrographs.

UNIT-IV

Material Science, Superconductivity & Semiconductors:

Dielectric materials, Polarization mechanisms, Dielectric Loss, Basic ideas of Dia, Para, Ferro & Ferri, Ferrites. Piezoelectricity and its Applications, Magnetostriction, its applications in production of Ultrasonic waves, Superconductivity, Meissner Effect, Type I & Type II superconductors. Distinction between conductor, semiconductor & insulator, conduction band, Intrinsic and extrinsic semiconductors. Pn junction diode, Zener diode, npn / pnp Transistors,

UNIT-V

Lasers & Fibre Optics:

Spontaneous & Stimulated emissions, Einstein's Coefficients, Population Inversion, Pumping Mechanisms, Components of a laser System, Three & four level laser systems; Ruby, He-Ne, CO2 and semiconductor Lasers. Introduction to Fibre Optics, Acceptance Angle, Numerical Aperture, Normalized frequency, Classification of optical fibres, Modes of propagation, material dispersion & pulse broadening in optical fibres. Applications of optical fibres.

REFERENCE BOOKS:

1. Quantum Physics by Satya Prakash
2. Engineering Physics, Malik; HK, Singh; AK, Tata McGraw Hill,
3. Materials Science & Engg., Raghvan V.,Prentice Hall of India.
4. Concepts of Modern Physics, Beiser; A., Mahajan; S., Choudhary; SR, Tata McGraw Hill.
5. Solid State Physics, Dan Wei, Cengage Learning.
6. Introduction to Solids, Azaroff LV, Tata Mc Graw Hill.

7. Physics; A calculus based approach (Vol. I & II) Serway;
8. Materials Science & Engineering, Callister; WD, John Wiley & Sons.
9. Lasers & Optical engineering, Dass; P, Narosa Publishers.
10. Optical Fibre system, Technology, Design & Applications, Kao; CK, McGraw Hill.
11. Laser Theory & Applications, Thygrajan; K, Ghatak; AK, Mc Millan India Ltd.
12. Handbook of Electronics, V.K.Mehta

LIST OF EXPERIMENTS:

1. Newton's Rings.
2. Resolving Powers- Telescope, Microscope and Grating.
3. Spectrometers-R.I., Wavelength, using prism and grating
4. Experiments connected with diodes and transistor.
5. Measurement of energy band gap of semiconductor.
6. Photometer
7. A.C. Mains

BEC 103
[ENGINEERING MECHANICS]

UNIT I

Fundamentals of Mechanics: Mechanics and its relevance, concepts of forces, laws of mechanics - parallelogram law, Lami's theorem, law of polygon, concept of free-body diagram, centroids, center of gravity, area moment of inertia, mass moment of inertia – simple and composite planes.

UNIT II

Friction: Laws of friction, static friction, rolling friction, application of laws of friction, ladder friction, wedge friction, body on inclined planes, simple screw jack – velocity ratio, mechanical advantage, efficiency.

UNIT III

Statics: Principles of statics, types of forces, concurrent and non-concurrent forces, composition of forces, forces in a plane and space, simple stresses and strains, elastic coefficients, trusses and Indeterminate trusses.

UNIT IV

Kinematics: Fundamentals of rectilinear and curvilinear motion, application of general equations, concept of relative velocity, analytical and graphical techniques.

UNIT V

Dynamics Principles of dynamics, D'Alembert's principle, conservation of momentum and energy, vibrations of simple systems.

REFERENCE BOOKS:

1. Popov, E. P., Engineering Mechanics of Solids, Pub.: Prentice Hall, 1998.
2. Shames, I. H. and Rao, G. K. M., Engineering Mechanics – Static and Dynamics, Pub.: Pearson Education, 2009.
3. Beer, F. P., and Johnson Jr. E. R., Vector Mechanics for Engineers, Pub.: McGraw Hill, Year of publication: 2009.
4. Rao, J. S. and Gupta, K., Introductory Course on Theory and Practice of Mechanical Vibrations, Pub.: New Age International, 1999.
5. Kumar, K. L., Kumar, V. Engineering Mechanics, Pub.: Tata McGraw Hill, 2011.
6. Palanichamy, M. S., and Nagan, S., Engineering Mechanics – Statics & Dynamics, Pub.: Tata McGraw Hill, 2002.
7. Timoshenko, S. and Young, D. H., Engineering Mechanics, Pub.: McGraw Hill, 2006.

BEC 104
[COMMUNICATION SKILLS]

UNIT-I

Communication: Meaning, process, barriers to communication. Importance of communication skills for engineering students and job seekers. Verbal and nonverbal communication. Role of body language in one's personality.

UNIT-II

Review of English Grammar: Tense [teaching and learning by practice]. Sentence completion. Verbal analogies. Verbs of daily use [at least a vocabulary of 500 words]. Advance vocabulary for GRE, GATE, IELTS, TOEFL and Pearson's Test, SAT. Variety of spoken English [with special emphasis on pronunciation]. Reading Comprehension

UNIT-III

Writing Skills: Letter writing: formal and informal. Applications, Report writing, Note writing, Email etiquette, Resume making

UNIT-IV

Listening Skills: Introduction to listening. Difference among listening, hearing and overhearing Traits of a good listener. Barriers to effective listening and tips for effective listening.

UNIT-V

Presentation skills: Introduction to presentation and its importance, Purposes of presentation, Analyzing audience, Effective presentation through visual aids and proper body language. Interview skills.

References Books:

1. Fluency in English - Part II, Oxford University Press, 2006.
2. Business English, Pearson, 2008.
3. Language, Literature and Creativity, Orient Blackswan, 2013.
4. Language through Literature (forthcoming) ed. Dr. Gauri Mishra, Dr Ranjana Kaul, Dr Brati Biswas

BEC 105
[ENGINEERING GRAPHICS]

UNIT I

Scales: Representative factor, plain scales, diagonal scales, scale of chords. **Conic sections**: Construction of ellipse, parabola, hyperbola by different methods; Normal and Tangent. **Special Curves**: Cycloid, Epi-cycloid, Hypo-cycloid, Involutes, Archimedean and logarithmic spirals.

UNIT II

Projection: Types of projection, orthographic projection, first and third angle projection, **Projection of points and lines** , Line inclined to one plane, inclined with both the plane, True Length and True Inclination, Traces of straight lines.

UNIT III

Projection of planes and solids : Projection of Planes like circle and polygons in different positions; Projection of polyhedrons like prisms, pyramids and solids of revolutions like cylinder, cones in different positions.

UNIT IV

Section of Solids: Section of right solids by normal and inclined planes; Intersection of cylinders. **Development of Surfaces** : Parallel line and radial - line method for right solids.

UNIT V

Isometric Projections: Isometric scale, Isometric axes, Isometric Projection from orthographic drawing. **Computer Aided Drafting (CAD)**: Introduction, benefit, software's basic commands of drafting entities like line, circle, polygon, polyhedron, cylinders; transformations and editing commands like move, rotate, mirror, array; solution of projection problems on CAD.

Reference Books:

1. Visvesvaraya Tech. University; A Premier on Computer Aided Engg drawing; VTU Belgaum
2. Bhatt N.D.; Engineering Drawing, Charotar
3. Venugopal K.; Engineering Graphics; New Age
4. John KC; Engg. Graphics for Degree; PHI.
5. Gill P.S.; Engineering Drawing; kataria
6. Jeyopoovan T.; Engineering drawing & Graphics Using AutoCAD; Vikas
7. Agrawal and Agrawal; Engineering Drawing;TMH

Elective

BEC 106 (A)
[PRINCIPLES OF MANAGEMENT]

UNIT-I

Overview of Management: Definition - Management - Role of managers - Evolution of Management thought- Organization and the environmental factors – Trends and Challenges of Management in Global Scenario.

UNIT-II

Planning: Nature and purpose of planning - Planning process - Types of plans – Objectives - Managing by objective (MBO) Strategies - Types of strategies - Policies – Decision Making - Types of decision - Decision Making Process - Rational Decision Making

UNIT-III

Organizing: Nature and purpose of organizing - Organization structure - Formal and informal groups *I* organization - Line and Staff authority - Departmentation - Span of control Centralization and Decentralization - Delegation of authority - Staffing Selection and Recruitment - Orientation - Career Development - Career stages – Training Performance Appraisal.

UNIT-IV

Directing: Creativity and Innovation - Motivation and Satisfaction - Motivation Theories - Leadership Styles - Leadership theories - Communication - Barriers to effective communication - Organization Culture - Elements and types of culture – Managing cultural diversity.

UNIT-V

Controlling: Process of controlling - Types of control - Budgetary and non-budgetary control Q techniques - Managing Productivity - Cost Control - Purchase Control – Maintenance Control - Quality Control - Planning operations.

Reference books:

1. Hellriegel, Slocum & Jackson, ' Management - A Competency Based Approach', Thomson South Western, 10th edition, 2007.
2. Harold Koontz, Heinz Weihrich and Mark V Cannice, 'Management - A global
3. Stephen P. Robbins and Mary Coulter, 'Management', Prentice Hall of India, 8th edition.
4. Charles W L Hill, Steven L McShane, 'Principles of Management', Mcgraw Hill Education, Special Indian Edition, 2007.

SSSUTMS SEHORE (M.P.)

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

BEC 106 (B)
[IMPACT OF SCIENCE & TECHNOLOGY ON SOCIETY]

UNIT-I

Human-Centered Social Framework/Human Capital: This theme combines the focus on new economic theory and human capital with the role of entrepreneurship and innovation, placing them in a wider theoretical context. Human Capital is a central unifying theme of the Academy's work and also a central strategy for breaking out of the narrow conceptions and stifling economic policies that prevail now. The theme also focuses on the catalytic role of the individual in social change, exemplified in economy by the role of entrepreneurs. It also encompasses the issue of human rights and economic rights, including the right to employment.

UNIT-II

The Network Society: This theme focuses on Social Capital and is a complement to the one on Human Capital. Organization is a determinant of social productivity and human welfare. The theme here is the creative role of organization in social development, the enormous productive potential generated by advances in social organization and the opportunities to utilize innovative organizational models and delivery systems to accelerate social progress in business, education, scientific research and governance. Traditional economic theory and contemporary preoccupation with fiscal and monetary policy ignore the tremendous potential for organizational innovation as a stimulus to social change. A comprehensive strategy for addressing social problems needs to give sufficient prominence to this aspect.

UNIT-III

Economic theory and real economy: The Newtonian view of economics, in particular, and social science in general ignores important theoretical advances in the physical sciences and critical aspects of economic reality. This theme could actually encompass a wide range of issues related to economic theory in an intellectually challenging manner which would include contributions from non-economists. **Re-valuing Nature:** Current theories based on the efficiency of markets overlook the gross inefficiency of economic systems that seek to maximize return to investors by wastefully consuming natural resources or grossly undervaluing and underutilizing human capital. Economic thought and practice are reoriented to take into account the real value of natural and human resources to present and future generations and formulate effective public policies designed to optimize the efficiency of the overall social system. This theme should re-examine the concept of economic value and its role in promoting sustainable human welfare and well-being. Energy plays the central role in society's relationship with the environment: this theme can also highlight the potential for new and alternative energy sources.

UNIT-IV

The Global Workplace or Global Employment Challenge: Like climate change, the challenge has become global and requires a wider understanding of the multiple factors affecting job creation and retention, including trade, demography, aging, migration, technological development, tax policies, Internet, global sourcing, production strategies, outsourcing, resource depletion, etc. The notion of regional and global economies raised here has direct relevance to the Euro zone and EU.

SSSUTMS School of Engineering SEHORE (M.P.)

Registrar Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

Recognizing Talents and Genius -- education for the 21st Century: A comprehensive social strategy must give a central place to the role of education and training in preparing youth for productive engagement in a rapidly changing and increasingly complex and sophisticated world. The Internet is set to become the main delivery system for expansion of the global educational system to meet the rapidly expanding needs of developing countries. It also has an essential role to play in vocational training to close the gap between the need and availability of skilled individuals in the workforce. One of the challenges will be to prepare youth for entrepreneurship and self-employment.

UNIT-V

Sharing Knowledge, Innovation & Creativity for Human Welfare: This theme covers the broad issue of how to make available to industrial applications the existing large amount of scientific knowledge and technical innovations. Particular emphasis will be given to the development of a sustainable human welfare, including the field of health care, which is one of the world's fastest growing industries, accounting for more than ten percent of the economy in most developed nations. The general awareness is increasing on this topic, but the management of S&T needs to develop instruments and a consensus to promote data sharing and economic exploitation in developing countries. **Freedom and equality:** This theme, that should address the lack of balance between developed and developing countries, is very much in keeping with the programmes of the International Higher Education and Research Centers operating in Trieste, often in close collaboration with UNESCO, such as the International Centre for Theoretical Physics, which hosted the Forum.

References books:

1. Bijker, W. E., Hughes, T. P., Pinch, T. and Douglas, D. G., The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology, MIT Press, Cambridge, 2012
2. Bohman, James (1998). "The Coming of Age of Deliberative Democracy". The Journal of Political Philosophy. 6 (4): 400–425
3. Feenberg, Andrew (1995). Alternative Modernity : The Technical Turn in Philosophy and Social Theory. University of California Press.
4. Goldman, Steven L. "No Innovation Without Representation: Technological Action in a Democratic Society." New Worlds, New Technologies, New Issues (1992): 148-60.
5. Allison, Bill, and Sarah Harkins. "Fixed Fortunes: Biggest Corporate Political Interests Spend Billions, Get Trillions." Sunlight Foundation Blog. Sunlight Foundation, 17 Nov. 2014. Web. 21 Apr. 2015.

SSUTMS School of Engineering SEHORE (M.P.)

BEC 106 (C)
[BASIC COMPUTER ENGINEERING]

UNIT I

Introduction To Computers: Classification, Generations, Applications, Basic blocks of a digital computer. Number Systems: Decimal, Binary, Octal, Hexadecimal – Conversions. Logic Gates: Definition symbols and truth tables of NOT.AND, OR, NAND, NOR, EXOR Gates, Simple application in developing combinational logic circuits.

UNIT II

Personal/ Micro Computers: Computer Peripherals (Monitor, Keyboard, Mouse, Speaker, CD/DVD ROM), Inside CPU Box: Motherboard, I/O Cards, Cables, HDD, CD-Drive. Mother Board In Detail: Nomenclature, technology, standards CPUs(AMD,INTEL, Cyrix), CPUs: CPU over clocking, troubleshooting, CPU problems, Chip Sets(AMD, Intel, VIA, SIS,OPTI).

UNIT III

Memory: Basic Concept, Types of Memory, Memory Chips(RAM, ROM), Logical and Physical organization of memory in computer, Cache Memory. Pc-Assembly And CMOS Setup and Troubleshooting: SMPS, Identification of cables and computers Ports, Mounting Motherboard in cabinet, Fitting of cabinet, CMOS – Setup Troubleshooting.

UNIT IV

Basic of Printers & Scanner:-Types of printers and printing mechanism, Dot Matrix printers, laser printer, Ink jet printer, line printer, Installation of a printer driver, Troubleshooting printers. Working principles of Scanner, Barcode Scanner.

UNIT V

LAPTOP: Introduction of laptop and comparison of various Laptops, Block diagram of laptop & description of all its sections, Study of parts of a laptop, Input system: Touchpad, Trackball, Track point, Docking station, Upgrade memory, hard disk, replacing battery, Configuring wireless internet in a laptop.

References :

1. Hardware bible By : Winn L Rosch, Techmedia publications
2. Trouble shooting, maintaining and repairing PCs By : Stephon J Bigelow Tata McGraw Hill Publication
3. Modern All about printers By : Manohar Lotia, Pradeep Nair, Bijal Lotia BPB publications.
4. Charles H.Roth Jr. Fundamentals of Logic design – 4th edition – Jaico publishing house
5. Hayes – Computer Architecture and organization – TMH 1998

Practical Work

1. Switch Board Wiring and Testing

2. Soldering and De-Soldering Practice
3. Voltage Measurement of Different Circuits
4. Testing and Measurement of SMPS
5. Assembling of a Computer
6. Installation of different Operating Systems
7. Installation of different device drivers
8. Installation of different Application Software
9. Installation and Troubleshooting of Printer
10. Installation and Troubleshooting of Scanner
11. To Repair and Troubleshooting of SMPS, Monitor and Motherboard
12. Identification of Ports and Cables used in PC
13. Troubleshooting PC (Step by Step)
14. Wireless network configuration in laptop

BEC - 201
ENGINEERING MATHEMATICS-II

UNIT-I

Ordinary Differential Equations: Second Order linear differential equation with variable coefficients, Methods one integral is known, removal of first derivative, changing of independent variable and variation of parameter, Solution by Series method, Solution of ordinary differential Equation (Taylor Series, Picard Method, Modified Euler's Method, Runge-Kutta Method, Milne's Predictor & Corrector Method)

UNIT-II

Functions of complex variables : Analytic functions, Harmonic Conjugate, Cauchy-Riemann Equations, Line Integral, Cauchy's Theorem, Cauchy's Integral Formula(without proof), Singular Points, Poles & Residues, Residue Theorem , Application of Residues theorem for evaluation of real integrals.

UNIT- III

Numerical Analysis : Errors & Approximations, Solution of Algebraic & Trancedental Equations (Regula Falsi, Newton-Raphson, Iterative, Secant Method), Solution of simultaneous linear equations by Gauss Elimination, Gauss Jordan, Crout's methods, Jacobi's and Gauss-Siedel Iterative methods.

UNIT-IV

Probability and Statistics : Probability Mass function, Probability density function. Discrete Distribution, Binomial, Poisson's, Continuous Distribution, Normal Distribution, Exponential Distribution ,Gamma Distribution, Beta Distribution, Baye's Theorem ,Testing of Hypothesis [Students t-test,Fisher's z-test, Chi-Square Method], Correlation and Regression , Curve – Fitting (Method of Least square).

UNIT-V

Vector Calculus: Differentiation of vectors, scalar and vector point function, geometrical meaning of Gradient, unit normal vector and directional derivative, physical interpretation of divergence and Curl. Line integral, surface integral and volume integral, Green's, Stoke's and Gauss divergence theorem.

REFERENCE BOOKS

1. Higher Engineering Mathematics by B.S Grewal, Khanna Publication
2. Engineering Mathematics-II & III by D.K. Jain
3. Engineering Mathematics-II & III by D.C. Agarwal
4. Advanced Engineering Mathematics by Erwin Kreyszig, Wiley India OR D.G. Guffy

BEC -202
APPLIED CHEMISTRY

UNIT - I

Water : Specifications for water, analysis of water –alkalinity, hardness and its determination (EDTA method only). Water for domestic use, Water softening processes –Lime –Soda process, Ion exchange method, boiler feed water, boiler problems-scale, sludge, priming and foaming, caustic embitterment and corrosion, their causes and prevention, removal of silica, removal of dissolved gases, carbonate and phosphate conditioning, colloidal conditioning, calgon treatment, Numerical problems on alkalinity, hardness, Lime-Soda process and Ion exchange method, EDTA method.

UNIT - II

Fuels : Classification, combustion and chemical principles involved in it, calorific value: gross and net calorific values and their determination by bomb calorimeter.

Solid Fuels: Proximate and ultimate analysis of coal and their importance, High and low temperature carbonisation, Coke: Its manufacture by Otto Hoffman oven. Liquid Fuels: Conversion of coal into liquid fuels (Bergius process and Fisher-Tropsch Process) and mechanism, Petroleum: its chemical composition and fractional distillation, cracking of heavy oil residues–thermal and catalytic cracking, knocking and chemical structure, octane number and cetane number and their significance, power alcohol,Numerical on calorific value, combustion, proximate and ultimate analysis of coal.

UNIT - III

Environmental Pollution and Control: Air Pollution : Types of pollutants, source effects, sink and control of primary pollutants –CO, Nox, HC, Sox and particulates, effects of pollutants on man and environment –photochemical smog and acid rain. **Water Pollution:** Classification of pollutants, their sources, waste water treatment –domestic and industrial. **Soil Pollution:** Composition of soil, classification and effects of soil pollutants and their control. **Solid Waste Pollution:** Classification, waste treatment & Disposal methods (Composting, sanitary landfilling, thermal processes, recycling and reuse). **Hazardous Wastes:** Classification –radioactive, biomedical and chemical, treatment and disposal – physical, chemical and biological processes.

UNIT - IV

Polymers : Introduction to Polymer chemistry: Classification of Polymers and Types of polymerization Plastics: Constituents of plastics, Thermosets and Thermoplastics, Preparation, Properties and Uses of Polyethylene, Bakelite, Teflon, Teryleneand Nylon Elastomers: Natural rubber, Vulcanization, Synthetic rubber- Preparation, Properties and Applications of SBR, Buna-N, Butyl and Neoprene rubber. Fibers (nylon 6, nylon 66, cellulose fibers, Dacron) Glass: Introduction, Definition of glass, its Properties, Manufacturing of glass, Importance of annealing in glass making, Types of silicate glasses and their commercial uses.

UNIT – V

Materials Chemistry: Lubricants: Principles and function of lubricants - Types of Lubrication and Mechanism - Thick Film or Hydrodynamic Lubrication, Thin Film or Boundary Lubrication, Extreme Pressure Lubrication, Viscosity, Redwood Viscometer, Viscosity, flash and fire point, cloud and pour point, aniline point, Neutralization Number and mechanical.Mechanism of lubrication, solid and liquid lubricant, Properties of lubricants, Numerical problems based on viscosity index.

Cement: Definition, composition, basic constituents and their significance Manufacturing of Portland cement by Rotary Kiln technologyChemistry of setting and hardening of cement (reactions). **Refractory:** Definition, classification, Properties of good refractory detailed study of silica and fire clay refractory and their applications.

Reference Books:

1. Chemistry in Engineering & Technology (Vol I & II) (Latest ed.), By J.C. Kuriacose& J. Rajaram
2. Environmental Chemistry & Pollution Control (Latest ed.), By S.S. Dara
3. Applied Chemistry (Latest ed.), By H.D. Gesser
4. Engineering Chemistry(Latest ed.), By Jain & Jain
5. Basics of Engineering Chemistry(Latest ed.),By S.S. Dara
6. Text of Engineering Chemistry by S.S. Dara&Mukkati S. Chand &Co,New Delhi(2006)
7. Engineering Chemistry by B. Siva Shankar Mc.Graw Hill Publishing Company Limited,NewDelhi.
8. Engineering Chemistry J.C. Kuriacase& J. Rajaram, Tata McGraw Hills co., New Delhi.
9. Chemistry of Engineering Materials by CV Agarwal,C.P Murthy, A.Naidu, BS Publications.
10. Chemistry of Engineering Materials by R.P Mani and K.N.Mishra, cengagelearning.
11. Applied Chemistry –A text for Engineering & Technology –Springar (2005).
12. Text Book of Engineering Chemistry – Shasi Chawla, Dhantpat Rai publishing Company ,NewDelhi.
13. Engineering Chemistry – R. Gopalan, D. Venkatappayya, and D.V. SulochanaNagarajan– VikasPublishers.

LIST OF EXPERIMENTS :

NOTE: At least 10 of the following core experiments must be performed during the session.

1. WATER TESTING

(i) Determination of Total hardness by Complex metric titration method.

(ii) Determination of mixed alkalinity

(a) OH^- & CO_3^{--}

(b) CO_3^{--} & HCO_3^{--}

(iii) Chloride ion estimation by Argent metric method.

2. FUELS & LUBRICANT TESTING

(i) Flash & fire points determinatio n by
(a) Pensky Martin Apparatus,
(b) Abel's Apparatus,
(c) Cleveland's open cup Apparatus.
(d) Calorific value by bomb calorimeter
(ii) Viscosity and Viscosity index determination by
(a) Redwood viscometer No. 1
(b) Redwood viscometer No. 2
(iii) Proximate analysis of coal
(a) Moisture content
(b) Ash content
(c) Volatile matter content
(d) Carbon residue

BEC - 203
BASIC CIVIL ENGINEERING

UNIT- I

Overview of Civil Engineering : Types of Infrastructures, Effect of infrastructure facilities on economy and environment, Role of Civil Engineers in the infrastructural Development Introduction to sub-domains of Civil Engineering, Size of Infrastructure Industry, emerging trends in infra spending through public and public-private partnership (PPP), talent shortage, and global trends in workforce mobility and skill-demands.

UNIT - II

Stages in the life of construction : Design, Construction, Maintenance, Repair, Demolition/Recycling; an overview of Indian Standards, units and conversion factors for Lengths, Areas, Volumes and Weights; Opportunities and challenge of India's Infrastructure, Interdisciplinary nature of Civil Engineering Projects.

UNIT - III

Roads : Types of Roads, Nagpur Road Plan, Components of Road and their function; Bridges: Important parts of bridges, classification of bridges; Types of Dams.

UNIT - IV

Properties and classification of building materials : Stones, Bricks, Sand, Limes, Cement, Mortar, Concrete, Steel.

UNIT - V

Overview of Indian Road Congress: National Highway Authority of India (NHAI) and American Society of Civil Engineers (ASCE), Emerging areas and new technologies in the field of civil engineering.

REFERENCES

1. Elements of Civil Engineering by MD Saikia, B Mohan Das, MM Das, PHI Learning Private Limited, 2015
2. Prakash M.N. Shesha, Ganesh B., A Textbook on Elements of Civil Engineering, PHI Learning Pvt. Ltd. Study material provided by the instructor
3. "Basic Civil Engineering", Ramamrutham. S, Dhanpat Rai Publishing Co. (P) Ltd.

List of Practicals :

1. To perform leveling exercise by height of instrument of Rise and fall method.
2. To measure horizontal and vertical angles in the field by using Theodolite.
3. To determine (a) normal consistency (b) Initial and Final Setting time of a cement Sample.
4. To determine the workability of fresh concrete of given proportions by slump test or compaction factor test.
5. To determine the Compressive Strength of brick .
6. To determine particle size distribution and fineness modulus of course and fine Aggregate.
7. To verify bending moment at a given section of a simply supported beam.

SSSUTMS School of Engineering SEHORE (M.P.)

BEC - 204
BASICS ELECTRICAL & ELECTRONICS ENGINEERING

UNIT I

Introduction : Sources of energy Circuit Concepts - Concepts of network, Active and passive elements, Voltage and current sources, Concept of linearity and linear network, Unilateral and bilateral elements - R, L and C as linear elements, Source transformation Kirchhoff's laws; Loop and nodal methods of analysis; Delta-star and star-delta conversion; Network theorems - Superposition theorem, Thevenin's theorem, Norton's theorem and Maximum Power Transfer theorem.

UNIT II

Single Phase AC Circuits : Single phase EMF generation, average and effective values of sinusoids, j operations, complex representation of impedances, phasor diagrams, power factor, power in complex notation, solution of series and parallel circuits. Introduction to resonance in series RLC circuit, Numerical problems; Introduction to domestic wiring. Three Phase AC Circuits: Three-phase systems: Star and delta connections, three-phase three wire and three-phase four-wire systems, analysis of balanced and unbalanced star and delta connected loads, power in three-phase balanced circuits. Numerical problems.

UNIT III

Measuring Instruments : Types of instruments, Construction and working principles of PMMC and Moving Iron type voltmeters & ammeters, Use of shunts and multipliers; dynamometer, wattmeter, AC watt-hour meter. Magnetic circuits: Ampere's circuital law, B – H curve, Hysteresis, Permeability and Reluctance, Solution of magnetic circuits, Hysteresis and eddy current losses.

UNIT IV

Single Phase Transformer : Transformers: Construction and operation of single phase transformer, EMF equation, ratings, phasor diagram on no load and full load, equivalent circuit, regulation and efficiency calculations, open and short circuit tests, single phase auto-transformer

UNIT V

Electric Machines : Working principle, Construction and applications of DC machines and AC machines, Single phase induction motors - split phase, capacitor start and capacitor start & run motors; EMF and Torque equations, Characteristics of DC generators and motors, Speed control of DC motors and DC motor starters.

REFERENCES :

1. E. Hughes, "Electrical Technology," Pearson Education, 2010.
2. I. J. Nagrath & D. P. Kothari, 'Basic Electrical Engineering' TATA McGraw Hill Edu.
3. V. Del Toro, "Electrical Engg Fundamentals," PHI Learning.
4. B. Dwivedi & A. Tripathi "Fundamentals of Electrical Engineering" Wiley India.
5. D. A. Bell, "Electric Circuits," 7th Ed., Oxford Higher Education.

LIST OF EXPERIMENTS:

1. To study the steady state response of series R-L circuit with AC supply and to find impedance, power and power factor of the circuit.
2. To study the steady state response of series R-C circuit with AC supply and to find impedance, power and power factor of the circuit.
3. (a) To verify "Thevenin's Theorem" by finding its Thevenin's equivalent circuit 5,10, 15V.
   (b) Determine the load current for RL = 120 Ohm, 1 K Ohm & 390 Ohm.
4. To study the construction and basic principle of working of a single-phase induction motor.
5. To verify the law of resistance connected in parallel circuit.
6. To verify the law of resistance connected in series.
7. To analyze a two Mesh circuit and to determine the current in each branch of the circuit.

BEC - 205
ENVIRONMENT AND ETHICS

UNIT I

ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY: Definition, scope and importance of Risk and hazards; Chemical hazards, Physical hazards, Biological hazards in the environment, concept of an ecosystem, structure and function of an ecosystem. Energy flow in the ecosystem. Ecological succession processes. Introduction to biodiversity, value of biodiversity. Biodiversity at global, national and local levels. In-situ and ex-situ conservation of biodiversity.

UNIT II

ENVIRONMENTAL POLLUTION: Definition – causes, effects and control measures of: (a) Air pollution, (b) Water pollution, (c) Soil pollution, (d) Marine pollution, (e) Noise pollution, (f) Thermal pollution, (g) Nuclear hazards. Role of an individual in prevention of pollution. Pollution case studies. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III

NATURAL RESOURCES : Forest resources: Use and over-exploitation, deforestation, Water resources: Use and overutilization of surface and ground water, dams-benefits and problems. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources. Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV

SOCIAL ISSUES AND THE ENVIRONMENT : From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization environmental ethics, Enforcement machinery involved in environmental legislation- central and state pollution control boards disaster management: floods, earthquake, cyclone and landslides. Public awareness.

UNIT V

HUMAN POPULATION AND THE ENVIRONMENT: Population growth, variation among nations – population explosion – family welfare programme – environment and human health, Environmental impact analysis (EIA)- -GIS-remote sensing-role of information technology in environment and human health, Public participation is an important aspect which serves the environmental Protection.

SSSUTMS SEHORE (M.P.)

Registrar
Sri Satya Sai University of Technolog
& Medical Sciences Sehore (M.P.)

REFERENCE BOOKS :

1. Trivedi R.K. „Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol. I and II, Enviro Media.
2. Cunningham, W.P.Cooper., T.H. Gorhani, „Environmental Encyclopedia", Jaico Publishing House, Mumbai, 2001.
3. Dharmendra S. Sengar, „Environmental law", Prentice hall of India PVT LTD, New Delhi, 2007.
4. Rajagopalan. R, „Environmental Studies - From Crisis to Cure", Oxford University Press, 2005.
5. Gilbert M.Masters, „Introduction to Environmental Engineering and Science", 2nd edition, Pearson Education,2004.
6. Benny Joseph, „Environmental Science and Engineering", Tata McGraw Hill, New Delhi, 2006.

SSSUTMS School of Engineering SEHORE (M.P.)

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

BEC - 206 (A)
Energy Sources

UNIT I

Introduction to Energy : Definition and units of energy, power, Forms of energy, Conservation of energy. Energy flow diagram to the earth. Origin of fossil fuels, time scale of fossil fuels, Renewable Energy Resources, Role of energy in economic development and social transformation.

UNIT II

Energy Scenario : Role of energy in economic development and social transformation: Energy & GDP, GNP and its dynamics. Indian Energy Scenario, Commercial and noncommercial forms of energy, Fossil fuels, Renewable sources including Bio-fuels in India, their utilization pattern in the past, present and future projections of consumption pattern. Development and Environment, Energy for Sustainable Development. Global Energy Issues, National & State Level Energy Issues.

UNIT III

Non-Conventional Source of Energy : Forms & characteristics of renewable energy sources, Solar energy, Thermal Applications of solar energy, Photovoltaics technology and applications. Energy from biomass, Thermochemical, Biochemical conversion to fuels, biogas and its applications. Wind Energy, Wind characteristics, Resource assessment, Horizontal & vertical axis wind turbines, Electricity generation and water pumping. Ocean Thermal Energy Conversion (OTEC), Geothermal, Tidal and Wave energies.

UNIT IV

Introduction Hydrogen & Nuclear Energy :

Hydrogen Energy: Hydrogen pathways introduction – current uses, General introduction to infrastructure requirement for hydrogen production, storage, dispensing and utilization, and hydrogen production power plants. Nuclear Energy: Introduction: Scope of nuclear energy (fission and fusion energy), Typical Nuclear reactions Basics Concepts: Binding Energy of a nuclear reaction, mass energy equivalence and conservation laws, nuclear stability and radioactive decay, radioactivity calculations.

UNIT V

Direct Energy Conversion Methods : Energy classification, Sources and utilization, Principle of energy conversion, Indirect / direct energy conversion, Basic principles of design and operations of (i) Thermoelectric (ii) Thermionic convertors (iii) Photovoltaic energy systems (iv) Fuel cells (v) Plasma diodes (vi) Magneto hydrodynamic Power generators and (vii) Advanced energy conversion systems.

Reference Books :

1. Energy for a sustainable world: Jose Goldenberg, Thomas Johansson, A.K.N.Reddy, Robert Williams (Wiley Eastern).
2. Energy policy for : B.V.Desai (Weiley Eastern)
3. Modeling approach to long term demand and energy implication : J.K.Parikh.
4. Energy Policy and Planning : B.Bukhootsow.
5. TEDDY Year Book Published by Tata Energy Research Institute (TERI)
6. World Energy Resources : Charles E. Brown, Springer2002.
7. 'International Energy Outlook' - EIA annual Publication
8. Non conventional energy sources, G.D.Rai Khanna Publishers
9. Non Conventional Energy Resources, D.S. Chauhan and S.K.Srivastava, New Age International Publishers.
10. Fundamentals of Renewable Energy Systems, D. Mukherjee and S. Chakrabarti, New Age International Publishers.
11. Heat and Thermodynamics – M.W. Zemansky (McGraw Hill Publication) 9. Principles of Energy Conversion: A.W. Culp (McGraw Hill Intern.

BEC - 206(B)
Constitution of India

UNIT – I

Constitution : Definition of Constitution and its Classification , Sources and Framing of the Indian Constitution , Salient features of Indian Constitution , Is Indian Constitution Federal in Nature ? , Parliament , Executive Power: Power of President and Governor

UNIT - II

Distribution of Powers between Centre and States : Legislative Relations between Union and the States, Administrative Relations between Union and the States , Financial Relations between Union and the States , Relevant Doctrines, Territorial Nexus , Harmonious Construction, Pith and Substance , Doctrine of Repugnancy , Colourable Legislation

UNIT - III

Fundamental Rights – I : Definition of 'State' for Enforcement of Fundamental Rights: Justifiability of Fundamentals Rights, Doctrine of Eclipse, Severability, Waiver Right to Equality (Articles14-18) Doctrine of 1Doctrine of Reasonable Classification and the Principle of Absence of Arbitrariness, Legitimate ExpectationExpectations, Principle of Compensatory Discrimination , Fundamental Freedom (Article 19): Freedom of Speech and Expression, Freedom of Press and Media; Expansion by Judicial Interpretation of Article19; freedom offfReasonable Restrictions(Article19 clause (2)to(5) ,Right to Life and Personal Liberty (Articles 20-22): Scope and Content (Expansive Iinterpretation-Right to Privacy, Gays' Rights, Live-in Relationshi ps, etc.) Right to Education (Article 21 RTE Act, 2009 ,Right against Exploitation (Articles 23- 24): Forced Labour, Child Employment and Human Trafficking Freedom of Religion and Cultural and Educational Rights of Minorities(Articles 25-30)

UNIT -IV

Right to Constitutional Remedies Writs: Habeas Corpus,Mandamus, Certiorari, Prohibition and Quo-warranto , Art. 32 and Art. 226 , Judicial Review , Writ Jurisdiction and Private Sector

UNIT - V

Directive Principles and Fundamental Duties : Nature and Justiciability of the Directive Principles Detailed Analysis of Directive Principles (Articles 37-51) Fundamental Duties , Inter-Relationship between Fundamental Rights and Directive Principles.

Books:

1. V.N. Shukla, Constitution of India, Eastern Book Agency, 2014
2. M.P. Jain, Indian Constitutional Law, Lexis Nexis, 2013
3. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 21st Edn., 2013.
4. H. M. Seervai, Constitutional Law of India, Universal Law

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

BEC - 206 (C)
ENTREPRENEURSHIP DEVELOPMENT

UNIT-I

CONCEPT OF ENTREPRENEURSHIP - Entrepreneurship and small scale industry, need for promotion of entrepreneurship, entrepreneurship development programmes (EDP), personality characteristics of entrepreneur, Infrastructure facilities available for entrepreneurship development in India.

UNIT-II

IDENTIFICATION OF INVESTMENT OPPORTUNITIES - Governmental regulatory framework, industrial policy, industrial development and regulation act, regulation of foreign collaboration and investment, foreign exchange regulation act, incentives for export oriented units, incentives for units in industrially backward areas, incentives for small scale industry, government assistance to SSI, how to start SSI, list of items reserved for SSI, Scouting for project ideas, preliminary screening, project identification for an existing company, Characteristics of MSME, Financial assistance to MSME, Role of MSME in developing countries.

UNIT - III

MARKET AND DEMAND ANALYSIS - Information required for market and demand analysis, market survey, demand forecasting, uncertainties in demand forecasting.

UNIT- IV

COST OF PROJECT AND FINANCIAL MANAGEMENT - Cost of project, means of financing, planning the capital structure of a new company, Term loan financial institutions, cost of production. Concept and definition of financial management, types of capital, finance, reserve and surplus, concepts and liabilities, profit and loss statement and break even analysis.

UNIT-V

PRODUCT DESIGN & SMALL SCALE INDUSTRIES - Elements of concurrent engineering, Infrastructure facilities in small scale industries , Role and scope of small scale industries, Steps in launching own venture procedure for registration of small scale industries, various developmental agencies-their functions and role in industrial and entrepreneurship development, Introduction, Requirement of a good product design, product development approaches, Product development process, product licensing, patenting and Quality function development.

REFERENCE BOOKS:

1. E.D.I. Ahmedabad, Publication regarding Entrepreneurship.
2. Project Preparation, Appraisal Budgeting and Implementation, Prasanna chandra,TMH
3. Entrepreneurship, NITTR
4. Entrepreneurial Development, C.S.Gupta & N.P.Srinivasan.
5. Entrepreneurship Development Practice & Planning, S.Chand.
6. Entrepreneurship of Small Scale Industries. M.U.Deshpanda C.B.I.

7. Engineering Economics-By Tarachand
8. Industrial Engineering and Production Management - By Telsang Martand T.
9. Industrial Engineering and Management-By O.P. Khanna

BEC - 207
WORKSHOP PRACTICES

UNIT I

INTRODUCTION : Log out of various basic engineering shapes. Basic fundamentals of cutting tools, Basic metrology and precautions to be taken in engineering workshop.

UNIT II

CARPENTRY SHOP: Introduction of Timber ,Type, Qualities of timber disease, Timber grains, Structure of timber, Timber, Timber seasoning, Timber preservation ,Wood Working tools: Wood working machinery, joints & joinery. Various operations of planning using various carpentry planes sawing & marking of various carpentry joints.

UNIT III

FITTING SHOP: Study and use of Measuring instruments, Engineer steel rule, Surface gauges caliper, Height gauges, feeler gauges, micro meter. Different types of files, File cuts, File grades, Use of surface plate, Surface gauges drilling tapping Fitting operations: Chipping filling, Drilling and tapping .

Suggested Jobs :-Preparation of job piece by making use of filling, sawing and chipping , drilling and tapping operations.

UNIT IV

FOUNDRY: Pattern Making: Study of Pattern materials, pattern allowances and types of patterns. Core box and core print

MOULDING: Properties of good mould & Core sand, Composition of Green , Dry and Loam sand. Methods used to prepare simple green and bench and pit moulding

UNIT V

Welding : Study and use of tools used for Brazing, Soldering, Gas & Arc welding. Preparing Lap & Butt joints using gas and arc welding methods, Study of Safety precautions.

REFERENCE BOOKS:

1. Bawa HS; Workshop Practice, TMH
2. Rao PN; Manufacturing Technology- Vol.1& 2, TMH
3. John KC; Mechanical workshop practice; PHI
4. Hazara Choudhary; Workshop Practices -, Vol. I & II.
5. Jain. R.K. Production Technology.

LIST OF PRACTICALS :

1. To prepare a cross Lap Joint.
2. To prepare Butt Weld and Lap weld.
3. To perform Drilling & Tapping on a square 50 x 50 Meld Steel Plate.
4. To prepare Green Sand Mould.
5. To develop a gripper mechanism by wooden link.
6. To develop useful origami structure.
7. To develop linkage mechanism of shaper machine.
8. To develop a scaled size furniture using gas welding technology.

Sri Satya Sai
University of Technology and Medical Sciences

(Established under Govt. of M.P. Registered under UGC 2(F) 1956)

Bhopal-Indore Road, Opp. Pachama oilfed plant, Pachama, Dist.-Sehore M.P.PIN-466001
Ph. 07562-223647, Fax : 07562-223644, Web: www.sssutms.co.in, info@sssutms.co.in

Name of Faculty: **School of Engineering**

Minutes of Board of Studies Committee Meeting held on Dated **11/06/2018**

The Board of Studies Committee Meeting was held in the Board Room at **2:30 PM**. on **11/06/2018**. Following members were present.

1. Dr. G.R.Selokar, Professor (Mechanical), Chairman
2. Dr. Sanjay Rathore, Professor (Physics), Member
3. Mr. Vijay Prakash Singh, Associate Professor (Electronics and Communication), Member
4. Dr. Ajay Swarup Associate Professor (Civil Engineering), Member
5. Mr. Sanjay Kalraiya, Associate Professor (Mechanical Engineering), Member
6. Dr. Prabodh Khampariya, Associate Professor (Electrical and Electronics Engineering), Member
7. Mr. Kailash patidar , Assistant Professor (Computer Science and Engineering), Member
8. Ms. Alka Thakur, Associate Professor (Electrical Engineering), Member
9. Mr. Anil Verma, Assistant Professor (Mechanical Engineering), Member
10. Mr. Manoj Kumar Gandwane, Assistant Professor (Chemical Engineering), Member
11. Mr. Prashant Singh, Assistant Professor (Aeronautical Engineering), Member
12. Mr. Devendra Patle, Assistant Professor (Electronics and Communication), Member

All the member elected Dr. G.R.Selokar chairman for today's Board of Studies Meeting The Chairman welcomed the members of all department of SOE and appreciated the efforts put up by the faculty for progress of the departmental activities. The following Agenda points were discussed.

Agenda: - Preparation of Syllabus and Scheme for BE First Year. As Per AICTE Norms

Registrar
Sri Satya Sai University of Technology & Medical Sciences, Sehore (M.P.)

SSSUTMS School of Engineering SEHORE (M.P.)

Discussion:

Committee member discussed the first (I) and second (II) Semester scheme and syllabus. It is decided that first year scheme should be applicable in group manner that is I Semester for Group A (July to December) and II Semester for Group B (July to December) student similarly for January to June session that is II nd Semester for group A and first Semester for group B

Scheme and syllabus was put up before the committee members as per guidelines of ALCTE, It was discussed in detail and some modification was suggested. So as to finalized the scheme

Resolution:

It is unanimously resolved that scheme and syllabus prepared on the guideline of AICTE New Delhi may be applicable w.e.f 2018-2019

The Chairman thanks to the members for peaceful conduction of meeting.

Signature of All members (Including Chairman)

1. Dr. G.R. Selokar, Professor (Mechanical), Chairman
2. Dr. Sanjay Rathore, Professor (Physics), Member
3. Mr. Vijay Prakash Singh, Associate Professor (Electronics and Communication), Member
4. Dr. Ajay Swarup Associate Professor (Civil Engineering), Member
5. Mr. Sanjay Kalraiya, Associate Professor (Mechanical Engineering), Member
6. Dr. Prabodh Khampariya, Associate Professor (Electrical and Electronics Engineering), Member
7. Mr. Kailash patidar , Assistant Professor (Computer Science and Engineering), Member
8. Ms. Alka Thakur, Associate Professor (Electrical Engineering), Member
9. Mr. Anil Verma, Assistant Professor (Mechanical Engineering), Member
10. Mr. Manoj Kumar Gandwane, Assistant Professor (Chemical Engineering), Member
11. Mr. Prashant Singh, Assistant Professor (Aeronautical Engineering), Member
12. Mr. Devendra Patle, Assistant Professor (Electronics and Communication), Member

Chairman

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

SSSUTMS School of Engineering

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Undergraduate Degree Courses in Engineering & Technology

Department of Chemical Engineering

***Definition of Credit:**

1 Hr. Lecture (L) per week	1 Credit
1 Hr. Tutorial (T) per week	1 Credit
1 Hr. Practical (P) per week	0.5 Credit
2 Hours Practical (Lab)/week	1 Credit

(09) Scheme of Exanimation (Chemical Engineering) Academic Year 2019-20

I Semester

S. No.	Subject Code	Subject Name	Maximum Marks Theory Slot			Maximum Marks (Practical Slot)		Total Marks	Periods/ hour/ week			Credits
			End Sem. Exam.	Mid Tests	Assign-ments/Quiz	End Sem. Practical & Viva	Practical Record /Assignment/ Quiz / Presentation		L	T	P	
1	BEBSC-101	Mathematics-I	60	30	10	-	-	100	3		-	3
2	BEBSC- 202	Engineering Physics	60	30	10	30	20	150	2	1	2	4
3	BEESC-203	Basic Computer Engineering	60	30	10	30	20	150	3	-	2	4
4	BEESC-204	Basic Mechanical Engineering	60	30	10	30	20	150	2	-	2	3
5	BEESC-205	Basic Civil Engineering & Mechanics	60	30	10	30	20	150	3	-	2	4
6	BEHSMC-206	Language Lab	-	-	-	30	10	40	-	-	2	1
7	BELC-107	Self Study / GD Seminar					10	10			2	1
		Total	**300**	**150**	**50**	**150**	**100**	**750**	**13**	**1**	**12**	**20**

SSSUTMS (School of Engineering)

Registrar
Sri Satya Sai University of Technology & Medical Sciences, Sehore (M.P.)

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Undergraduate Degree Courses in Engineering & Technology

Department of Chemical Engineering

II Semester

S. No.	Subject Code	Subject Name	Maximum Marks Theory Slot			Maximum Marks (Practical Slot)		Total Marks	Periods/ hour/ week			Credits
			End Sem. Exam.	Mid Tests	Assign-ments/Quiz	End Sem. Practical & Viva	Practical Record /Assignment/ Quiz / Presentation		L	T	P	
1	BEBSC-201	Mathematics-II	60	30	10	-	-	100	3		-	3
2	BEBSC-102	Engineering Chemistry	60	30	10	30	20	150	3		2	4
3	BEHSMC-103	English for Communication	60	30	10	30	20	150	3	-	2	4
4	BEESC-104	Basic Electrical Engineering	60	30	10	30	20	150	2	-	2	3
5	BEESC-105	Engineering Graphics	60	30	10	30	20	150	2	1	2	4
6	BEESC-106	Manufacturing Practices	-	-	-	30	10	40	-	-	2	1
7	BELC-207	Industrial Training					10	**10**	**-**	**-**	**2**	**1**
		Total	**300**	**150**	**50**	**150**	**100**	**750**	**13**	**1**	**12**	**20**

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

S.S.S.U.T.M.S. School of Engineering SEHORE (M.P.)

(10) Course Content

Semester- I

BEBSC-101 Mathematics-I

BEBSC-101	**Mathematics-I**	**3L:0T:0P**	**3 credits**	**3Hrs/Week**

Preamble:-

The Preamble of this foundational course is to review mathematical concepts already learnt in higher secondary. This course will also introduce fundamentals of mathematical functions, derivatives and aspects of calculus to students. This course deep understanding of matrix, differential equations, Sequences and series, Vector Space as well as a strong sense of how useful the subject can be in other disciplines of learning.

Outcome:-

Course work is designed to provide students the opportunity to learn key concepts of mathematical functions, key concepts of matrix , Vector Spaces as well as fundamentals and applications of integral calculus.

Unit-I Calculus (10Hrs):

Rolle's theorem, Mean Value theorems, Expansion of functions by Mc. Laurin's and Taylor's for one variable; Taylor's theorem for function of two variables, Partial Differentiation, Maxima & Minima (two variables), Method of Lagrange's Multipliers.

Unit-II Integral (6 Hrs):

Definite Integral as a limit of a sum and Its application in summation of series; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas, Multiple Integral, Change the order of the integration, Applications of multiple integral for calculating area and volumes of the curves.

Unit-III Sequences and series (6 Hrs):

Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions; Fourier series: Half range sine and cosine series, Parseval's theorem.

Registrar
Sri Satya Sai University of Technology & Medical Sciences, (M.P.)

SSSUTMS School of Engineering SEHORE (M.P.)

Unit-IV Vector Spaces (6 Hrs):

Vector Space,Vector Sub Space, Linear Combination of Vectors, Linearly Dependent, Linearly Independent, Basis of a Vector Space,Linear Transformations.

Unit-V Matrices (10 Hrs):

Rank of a Matrix, Solution of Simultaneous Linear Equations by Elementary Transformation, Consistency of Equation, Eigen Values and Eigen Vectors, Diagonalization of Matrices, Cayley-Hamilton theorem and its applications to find inverse.

References:-

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition,Pearson, Reprint, 2002.

2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.

4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11thReprint, 2010.

5. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.

6. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P)

SSSUTMS School of Engineering (M.P.)

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for
Undergraduate Degree Courses in Engineering & Technology
Department of Chemical Engineering

BEBSC-102 Engineering Chemistry

BEBSC-102	Engineering Chemistry	3L:0T:0P	3 credits	3Hrs/Week

Preamble:

1. To acquire knowledge about hardness of water and importance of water in industrial purpose.
2. To understand the concept of molecular spectroscopy.
3. To gain the knowledge of about polymeric material and biodegradable substances.
4. To understand the mechanism of lubricant and properties of lubricant.

Outcomes:

1. Develop innovative methods to produce soft water for industrial use.
2. Identify the structure of unknown / new compounds with the help of spectroscopy.
3. Substitute metal with conducting polymers and produce cheaper biodegradable polymers to reduce environmental pollution.
4. Apply their knowledge for use and protect to industrial and domestic equipment.

UNIT-I Atomic and molecular structure (6Hrs)

Schrodinger equation. Particle in a box solutions and their applications for conjugated molecules and nanoparticles. Molecular orbitals of diatomic molecules and plots of the multicentre orbitals. Equations for atomic and molecular orbitals. water treatment- Introduction, hardness of water, Units of hardness, disadvantage of hard water, scale and sludge formation in boilers, boilers troubles.

UNIT-II Spectroscopic techniques and applications (10Hrs)

Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterisation techniques. Diffraction and scattering.

UNIT-III Intermolecular forces and potential energy surfaces (6Hrs)

Ionic, dipolar and van Der Waals interactions. Lubricant-Introduction, mechanism of lubricant, classification of lubricant, properties of lubricating oils.

UNIT-IV Use of free energy in chemical equilibria (10Hrs)

Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. High Polymers-Introduction,

nomenclature, types of polymerization, classification of polymers, plastics-important, thermo-plastic resins and thermo setting resin.

UNIT-V Periodic properties (10Hrs)

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries.

REFRENCES:

1. University chemistry, by B. H. Mahan
2. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
   Fundamentals of Molecular Spectroscopy, by C. N. Banwell
3. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S.
4. Physical Chemistry, by P. W. Atkins
5. engg. Chemistry jain.jain
6. engg. Chemistry shashi chawla.

BEBSC-102	**Engineering Chemistry**	**0L:0T:1P**	**1 credits**	**2Hrs/Week**

LIST OF EXPERIMENTS:

1. Determination of surface tension and viscosity
2. Determination of chloride content of water
3. Determine the change of viscosity of given lubricating oil with change in temperature by Redwood Viscometer No. 1.
4. Determine the change of viscosity of given lubricating oil with change in temperature by Redwood Viscometer No. 2.
5. To determine the flash and fire point of given lubricating oil by Cleveland's open cup apparatus.
6. To determine the flash and fire point of given lubricating oil by Abel's closed cup apparatus.
7. To determine the flash and fire point of given lubricating oil by Pensky Marten's apparatus.
8. To determine the total hardness of given water sample by titrating it against EDTA solution using EBT as an indicator.

Registrar
Sri Satya Sai University of Technology
& Medical Sciences Sehore (M.P.)

School of Engineering

Laboratory Outcomes:

The students will learn to:

- Estimate rate constants of reactions from concentration of reactants/products as a function of time
- Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc
- Synthesize a small drug molecule and analyse a salt sample

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

SSSUTMS School of Engineering

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for
Undergraduate Degree Courses in Engineering & Technology
Department of Chemical Engineering

BEHSMC-103 English for Communication

BEHSMC-103	**English for Communication**	**3L:0T:0P**	**3 credits**	**3Hrs/Week**

Preambles

- To enhance Professional competence in reading, writing, listening and speaking.
- To modify the tactic of providing information about the language by using several techniques.
- To minimize the Grammar Translation Method of ELT by replacing it with Direct Learning Method.
- To Introduce Communicative Method of ELT and focusing the teaching pedagogy to the student-centered learning rather than the teacher-centered learning.
- To develop the skills to master three major forms of communications which are vital in academic and professional settings namely professional presentations, interviews and group communications respectively.
- To provide a deep insight of techniques for delivering effective presentations, appealing job interviews, and actively participating in various forms of group communication.

Course Outcomes:

At the end of this course students will have:

- Ability to design a language component or process to meet desired need within Realistic, Constraints such as economic, environmental, social, political, ethical Scenario.
- Ability to analyze the usage of English words in different contexts.
- An understanding of technical and academic articles' comprehension.
- The ability to present oneself at multinational levels knowing the type of different Standards of English

UNIT-I Identifying Common errors in writing (6 Hrs):

Articles, Subject-Verb Agreement, Prepositions, Active and Passive Voice, Reported Speech: Direct and Indirect, Sentence Structure.

UNIT-II Vocabulary building and Comprehension (6 Hrs)

Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives, synonyms, antonyms, Reading comprehension.

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

SSUTM School of Engineering SEHORE (M.P.)

UNIT-III Communication: (10 Hrs)

Introduction, Meaning and Significance, Process of Communication, Oral and Written Communication, 7 c's of Communication, Barriers to Communication and Ways to overcome them, Importance of Communication for Technical students, nonverbal communication.

UNIT-IV Developing Writing Skills (10 Hrs)

Planning, Drafting and Editing, Precise Writing, Précis, Technical definition and Technical description. Report Writing: Features of writing a good Report, Structure of a Formal Report, Report of Trouble, Laboratory Report, Progress Report.

UNIT-VBusiness Correspondence (10 Hrs):

Importance of Business Letters, Parts and Layout; Application, Contents of good Resume, guidelines for writing Resume, Calling/ Sending Quotation, Order, Complaint, E-mail and Tender.

References:-

1. 'Technical Communication : Principles and practice', Meenakshi Raman and Sangeeta Sharma (Oxford)
2. 'Effective Business Communication', Krizan and merrier (Cengage learning)
3. 'Communication Skill, Sanjay Kumar and pushlata, OUP2011
4. "Practical English Usage Michael Swan OUP, 1995.
5. "Exercises in spoken English Parts I-III CIEFL, Hyderabad, Oxford University Press
6. On writing well, William Zinsser, Harper Resource Book 2001.
7. Remedial English Grammar, F.T. Wood,Macmillan2007.

BEHSMC-103	English for Communication	0L:0T:1P	1 credits	2Hrs/Week

List of Experiments:-

1. Listening Comprehension.
2. Pronunciation, Intonation, Rhythm
3. Practicing everyday dialogues in English
4. Interviews.
5. Formal Presentation

Registrar
Sri Satya Sai University of Technology & Medical Sciences, Sehore (M.P.)

SSSUTM Scholar

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for
Undergraduate Degree Courses in Engineering & Technology
Department of Chemical Engineering

BEESC-104 Basic Electrical Engineering

BEESC-104	**Basic Electrical Engineering**	**2L:0T:0P**	**2 credits**	**2Hrs/Week**

Course Preambles:

Impart a basic knowledge of electrical quantities such as current, voltage, power, energy and frequency to understand the impact of technology in a global and societal context and to provide students the working knowledge for the analysis of basic DC and AC circuits used in electrical and electronic devices.

Course Outcomes

- To understand and analyze basic electric and magnetic circuits
- To study the working principles of electrical machines and power converters.
- To introduce the components of low voltage electrical installations

Unit-I Electrical circuit elements (10 Hrs):

Electrical circuit elements (R, L and C), Concept of active and passive elements, voltage and current sources, concept of linearity and linear network, unilateral and bilateral elements, Kirchhoff"s laws, Loop and-delta transformation, nodal methods, Superposition of a theorem, Thevenin theorem, Norton theorem.

Unit-II AC Circuits (10 Hrs):

Representation of Sinusoidal waveforms –Average and effective values, Form and peak factors, Concept of phasors, phasor representation of sinusoidally varying voltage and current. Analysis of single phase AC Circuits consisting of R, L, C, RL, RC, RLC combinations (Series and Parallel), Apparent, active & reactive power, Power factor, power factor improvement. Concept of Resonance in series & parallel circuits, bandwidth and quality factor. Three phase balanced circuits, voltage and current relations in star and delta connections.

Unit-III Magnetic circuit (6 Hrs)

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

Unit-IV Machines (10 Hrs):

DC machines: Principle & Construction, Types, EMF equation of generator and torque equation of motor, applications of DC motors (simple numerical problems)

Three Phase Induction Motor: Principle & Construction, Types, Slip-torque characteristics, Applications (Numerical problems related to slip only)

Single Phase Induction motor: Principle of operation and introduction to methods of starting, applications.

Three Phase Synchronous Machines: Principle of operation of alternator and synchronous motor and their applications.

Unit-V Components of LT Switchgear: (6 Hrs)

Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Importance of earthing. Types of Batteries, Important characteristics for Batteries.Elementary calculations for energy consumption and savings, battery backup.

Reference's: -

1. Ritu Sahdev, "Basic Electrical Engineering",
2. S. Singh, P.V. Prasad, "Electrical Engineeri
3. D. P. Kothari and ElectricalI.J.Nagrath,Engineering","Basic Tat
4. D. C. Kulshreshtha, "Basic Electrical Engine
5. E. Hughes, "Electrical and Electronics Techn
6. 6. S. Bobrow, "Fundamentals of Electrical En
7. 7.V. D. Toro, "Electrical Engineering Fundamen

BEESC-104	Basic Electrical Engineering	0L:0T:1P	1 credits	2Hrs/Week

Laboratory Preambles:

1. Read and demonstrate the rating of basic equipments used in electrical engineering
2. Connections of different components as per the rules
3. Application different components in electrical field

Laboratory Outcomes

1. Get an exposure to common electrical components and their ratings.
2. Make electrical connections by wires of appropriate ratings.
3. Understand the usage of common electrical measuring instruments.
4. Understand the basic characteristics of transformers and electrical machines.

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

SSSUTMS School of Engineering SEHORE (M.P.)

List of Experiments: -

1. Verification of Kirchhoff's laws
2. Verification of Superposition and Thevenin Theorem.
3. Measurement of power and power factor in a single phase ac series inductive circuit and study improvement of power factor using capacitor
4. Study of phenomenon of resonance in RLC series circuit and obtain resonant frequency.
5. Connection and measurement of power consumption of a fluorescent lamp (tube light).
6. Measurement of power in 3- phase circuit by two wattmeter method and determination of its power factor for star as well as delta connected load.
7. Determination of parameters of ac single phase series RLC circuit
8. To observe the B-H loop of a ferromagnetic material in CRO.
9. Determination of (i) Voltage ratio (ii) polarity and (iii) efficiency by load test of a
10. single phase transformer

11. Determination of efficiency of a dc shunt motor by load test
12. To study running and speed reversal of a three phase induction motor and record speed in both directions.
13. Demonstration of cut-out sections of machines: dc machine, three phase induction machine, single-phase induction machine and synchronous machine.

Registrar
Sri Satya Sai University of Technology
& Medical Sciences Sehore (M.P)

SSSUTMS School of Engineering SEHORE (M.P.)

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Undergraduate Degree Courses in Engineering & Technology

Department of Chemical Engineering

BEESC-105 Engineering Graphics and Design

BEESC-105	**Engineering Graphics and Design**	**3L:0T:0P**	**3 credits**	**3Hrs/Week**

Course Preambles

PREAMBLES:-

1. Increase ability to communicate with people.
2. Learn to sketch and take field dimensions.
3. Learn to take data and transform it into graphic drawings.
4. Learn basic Auto Cad skills.
5. Learn basic engineering drawing formats.
6. Prepare the student for future Engineering positions.

OUTCOMES: -

Student's ability to hand letter will improve.

1. Student's ability to perform basic sketching techniques will improve.
2. Students will be able to draw orthographic projections and sections.
3. Student's ability to use architectural and engineering scales will increase.
4. Students ability to produce engineered drawings will improve
5. Student's ability to convert sketches to engineered drawings will increase.
6. Students will become familiar with office practice and standards.
7. Students will become familiar with Auto Cad two dimensional drawings.
8. Students will develop good communication skills and team work.

UNIT-I Introduction to Engineering Drawing (10 Hrs):

Principles of Engineering Graphics and their significance, usage of Drawing instruments, Lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales –Plain, Diagonal and Venire Scales;

UNIT-II Orthographic Projections **(10 Hrs):**

Registrar
Sri Sathya Sai University of Technology & Medical Sciences Sehore (M.P.)

SSSUTMS (School of Engineering) SEHORE (M.P.)

Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes; Projections of Regular Solids those inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale

UNIT-III Sections and Sectional Views of Right Angular Solids (6 Hrs):

Prism, Cylinder, Pyramid, Cone –Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only).

UNIT-IV Isometric Projections: **(6 Hrs):**

Principles of Isometric projection –Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;

UNIT-V Overview of Computer Graphics: (10 Hrs):

Listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Objects, Isometric Views of lines, Planes, Simple and compound Solids; Customization & CAD Drawing consisting of set up of the drawing page and the printer, including scale settings, Setting up of Units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerance.

References:-

1.Bhatt N.D., Paschal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House

2.Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education

3.Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication

4.Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers

5.CAD Software Theory and User Manuals

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

SSSUTM School of Engineering

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Undergraduate Degree Courses in Engineering & Technology

Department of Chemical Engineering

BEESC-105	**Engineering Graphics and Design**	**0L:0T:1P**	**1 credits**	**2Hrs/Week**

List of Experiments:-

1. Sketching and drawing of geometries and projections based on above syllabus
2. Term work: A min. of 30 hand drawn sketches (on size A4 graphic sketch Book) plus 5 CAD-printouts on size A4 sheets plus 10 sheets of size A2 or 6 sheets of size A1, (50% marks to be allotted for this record + 25% marks for attendance +25%marks for Teachers Assessment

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

SSSUTMS

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Undergraduate Degree Courses in Engineering & Technology

Department of Chemical Engineering

BEESC-106 Manufacturing Practices

BEESC-106	**Manufacturing Practices**	**0L:0T:1P**	**1 credits**	**2Hrs/Week**

Course Preambles:

1. To understand process of cutting shaping.
2. To understand working principles for various machining processes.
3. To understand construction, working and applications of various machine tools.
4. To learn basic set up, working and applications of a few important non conventional machining processes to get hand on experience on various machine tools.

Course Outcomes:

1. The students will be able to understand the details about machines used in production.
2. The students will be able to understand the mechanics behind metal cutting.
3. The students will be able to understand the finishing and super finishing processes.
4. The students will be able to understand the Physics of material removal behind the various non-conventional machining processes.

Manufacturing is fundamental to the development of any engineering product. The course on Engineering Workshop Practice is intended to expose engineering students to different types of manufacturing / fabrication processes, dealing with different materials such as metals, ceramics, plastics, wood, glass etc. While the actual practice of fabrication techniques is given more weightage, some lectures and video clips available on different methods of manufacturing are also included.

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods
2. CNC machining, Additive manufacturing
3. Fitting operations & power tools
4. Carpentry
5. Plastic molding, glass cutting
6. Metal casting
7. Welding (arc welding & gas welding), brazing

List of Experiments:-

1. Carpentry Shop Experiment To Make a T-LAP joint with wood Pieces
2. Machine Shop Experiment To Perform Knurling on Iron Rod
3. WELDING SHOP (LAP Joint) , Tools, Accessories, Diagram And Explanation
4. SHEET METAL SHOP (Square Tray) , Parts, Accessories, Diagram And Explanation
5. FITTING SHOP (Make a Joint) , Parts, Accessories, Diagram And Explanation
6. CARPENTRY SHOP (T-Lap Joint) , Cutting Tools, Accessories, Diagram and Explanation
7. MACHINE SHOP (the lathe machine) , Parts, Accessories, Diagram and Explanation

BELC 207 Industrial Training

BELC 207	**Industrial Training**	**0L:0T:1P**	**1 credits**	**2Hrs/Week**

- Industrial environment and work culture.
- Organizational structure and inter personal communication.
- Machines/ equipment/ instruments - their working and specifications.
- Product development procedures and phases.
- Project planning, monitoring and control.

BEBSC-201 Mathematics-II

BEBSC-201	**Mathematics-II**	**3L:0T:0P**	**3 credits**	**3Hrs/Week**

Course Preambles

1. To introduce the basic concepts required to understand, construct, solve and interpret differential equations.
2. To teach methods to solve differential equations of various types.
3. To give an ability to apply knowledge of mathematics on engineering problems

Course Outcomes

The students will be able to :

1. Classify differential equations according to certain features.
2. Solve first order linear equations and nonlinear equations of certain types and interpret the solutions.
3. Understand the conditions for the existence and uniqueness of solutions for linear differential equations
4. Solve second and higher order linear differential equations with constant coefficients and construct all solutions from the linearly independent solutions
5. Find series solutions about ordinary and regular singular points for second order linear differential equations.
6. Solve initial value problems using the Laplace transform.
7. Solve systems of linear differential equations with methods from linear algebra

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

SSSUTMS

Unit - I Ordinary Differential Equations I (6 Hrs):

Differential Equations of First Order and First Degree (Leibnitz linear, Bernoulli's, Exact), Differential Equations of First Order and Higher Degree, Higher order differential equations with constants coefficients, Homogeneous Linear Differential equations, Simultaneous Differential Equations.

UNIT-II Ordinary differential Equations II (6 Hrs):

Second order linear differential equations with variable coefficients, Method of variation of parameters, Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.

Unit III Partial Differential Equations (10 Hrs)

Formulation of Partial Differential equations, Linear and Non-Linear Partial Differential Equations, Homogeneous Linear Partial Differential Equations with Constants Coefficients.

Unit IV Functions of Complex Variable (10 Hrs)

Functions of Complex Variables: Analytic Functions, Harmonic Conjugate, Cauchy-Riemann Equations (without proof), Line Integral, theorem ,Cauchy Integral formula (without proof), Singular Points, Poles & Residues, Residue Theorem, Application of Residues theorem for Evaluation of Real Integral

Unit V Vector Calculus (10 Hrs)

Differentiation of Vectors, Scalar and vector point function, Gradient, Geometrical meaning of gradient, Directional Derivative, Divergence and Curl, Line Integral, Surface Integral and Volume Integral, Gauss Divergence, Stokes and Green theorems.

References : -

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.

2. Erwin kreyszig , Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

3. W. E. Boyce and R. C. Dip Rima, Elementary Differential Equations and Boundary Value Problems, 9th End., Wiley India, 2009.

4. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.

5. E. A. Codington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.

6. E. L. Inca, Ordinary Differential Equations, Dover Publications, 1958.

7. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., McGraw Hill,

2004.

8. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

9. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

Registrar
Sri Satya Sai University of Technology & Medical Sciences (SSSUTMS)

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Undergraduate Degree Courses in Engineering & Technology

Department of Chemical Engineering

BEBSC- 202 Engineering Physics

BEBSC- 202	Engineering Physics	2L:1T:0P	3 credits	3Hrs/Week

Preambles

- A comprehensive, high-quality education in the physical sciences
- A flexible curriculum with multiple concentrations that allows students to tailor their education according to their specific interests
- The opportunity to experience the excitement of scientific discovery through direct participation in faculty research
- An increased awareness of the physical processes in the surrounding world
- The essential knowledge and analytical, mathematical and computational tools with which to pursue post-graduate education in a variety of physics-related and other fields
- The foundation and practical skillsets for eventual success in any of a broad array of careers
- The motivation for a lifelong love of learning

Outcomes

- An ability to apply knowledge of mathematics, science, and engineering.
- An ability to design and conduct experiments, as well as to analyze and interpret data.
- An ability to design a system, component, or process to meet desired needs within realistic constraints.
- An ability to function on multidisciplinary teams.
- An ability to identify, formulate, and solve engineering problems.
- An understanding of professional and ethical responsibility.
- An ability to communicate effectively.
- The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
- A recognition of the need for, and an ability to engage in life-long learning.
- A knowledge of contemporary issues.
- An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Unit I Relativistic Mechanics: (6 Hrs):

Frame of reference, Inertial & non-inertial frames, Galilean transformations, Michelson-Morley experiment, Postulates of special theory of relativity, Lorentz transformations, Length contraction, Time dilation, Velocity addition theorem, Variation of mass with velocity, Einstein's mass energy relation, Relativistic relation between energy and momentum, Massless particle.

Unit II Solid state & Nuclear physics (10 Hrs):

Free electron theory of metals, Qualitative discussion of Kronig-penny model and origin of energy bands. Intrinsic and Extrinsic Semiconductors. V-I Characteristics of PN junction diode, Zener diode, Hall-effect.

Introduction to Nuclear Physics , Static properties of Nucleus,Nuclear liquid drop model, Nuclear Shell Model, Linear particle accelelerator, Cyclotron, Betatron, Bainbridge mass sprectrograph.

Unit III Quantum Mechanics: (6Hrs):

Introduction to Quantum mechanics, Wave particle duality, Matter waves, Particle velocity, Phase velocity , Group velocity and their relation. Heisenberg's Uncertainty Principle. Time-dependent and time-independent Schrodinger wave equation, Solution to stationary state Schrodinger wave equation for one-Dimensional particle in a box, Compton effect.

Unit IV Wave Optics: (10 Hrs):

Interference :Coherent sources, Interference in uniform and wedge shaped thin films, Newton's Rings and its applications. Fraunhoffer diffraction at single slit and at double slit, Absent spectra, Diffraction grating, Spectra with grating, Dispersive power of grating, Rayleigh's criterion of resolution. Resolving power of grating and Prism.

Unit V Fibre Optics & Lasers: Fibre Optics(10 Hrs):

Introduction to fibre optics, Acceptance angle, Numerical aperture, Normalized frequency, Classification of fibre, Attenuation and Dispersion in optical fibres.

Laser: Absorption of radiation, Spontaneous and stimulated emission of radiation, Einstein's coefficients, Population inversion, Various levels of Laser, Ruby Laser, He-Ne Laser, Laser applications.

Reference Books: -

1. Concepts of Modern Physics - AurthurBeiser (Mc-Graw Hill)

2. Introduction to Special Theory of Relativity- Robert Resnick (Wiley)

3. Optics - Brijlal& Subramanian (S. Chand)

4. Engineering Physics: Theory and Practical- Katiyar and Pandey (Wiley India)

Registrar
Sri Satya Sai University of Technology & Medical Sciences, Sehore (M.P.)

SSSUTMS School of Engineering SEHORE

5. Applied Physics for Engineers- Neeraj Mehta (PHI Learning, New)

6. Engineering Physics-Malik HK and Singh AK (McGrawHill)

BEBSC- 202	Engineering Physics	0L:0T:1P	1 credits	2Hrs/Week

List of Experiments: -

1. To determine the wavelength of sodium light by Newton's ring experiment.

2. To determine the wavelength of different spectral lines of mercury light using plane transmission grating.

3. To determine the energy band gap of a given semiconductor material.

4. To determine the plank's constant with help of photocell.

5 .Resolving Power of Telescope.

6 .V-I Charecteristics of P-N Junction diode.

7. Zener diode characteristics.

8. To determine the dispersive power of prism.

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Undergraduate Degree Courses in Engineering & Technology

Department of Chemical Engineering

BTEESC-203 Basic Computer Engineering

BTEESC-203	**Basic Computer Engineering**	**3L:0T:0P**	**3 credits**	**3Hrs/Week**

Preamble:-

- Successfully practice computer engineering to serve state and regional industries, government agencies, or national and international industries.
- Work professionally in one or more of the following areas: computer hardware and software design, embedded systems, computer networks and security, system integration, and electronic design automation.
- Achieve personal and professional success with awareness and commitment to their ethical and social responsibilities, both as individuals and in team environments.
- Maintain and improve their technical competence through lifelong learning, including entering and succeeding in an advanced degree program in a field such as engineering, science, or business.

Outcome:-

- An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
- an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
- an ability to communicate effectively with a range of audiences
- an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts

Unit –I Computer: (6Hrs):

Definition, Classification, Organization i.e. CPU, register, Memory & Storage Systems, I/O Devices, and System & Application Software. Computer application E-Business, Bio-Informatics, health Care, Remote Sensing & GIS, Meteorology and, Computer Gaming, Multimedia and Animation etc.

Unit –II Introduction to Algorithms (6 Hrs):

Complexities and Flowchart, Introduction to Programming, Categories of Programming Languages, Program Design, Programming Paradigms, Characteristics or Concepts of OOP, Procedure Oriented Programming VS object oriented Programming.

Introduction to C, Character Set, Tokens, Precedence and Associativity, Program Structure, Data Types, Variables, Operators, Expressions, Statements and control structures, I/O operations, Array, Functions,

Unit – III Computer System Overview (10 Hrs):

Basic Elements, Instruction Execution, Interrupts, Memory Hierarchy, Cache Memory, Direct Memory Access, Multiprocessor and Multicore Organization. Operating system overview- Preambles and functions, Evolution of Operating System. - Computer System Organization- Operating System Structure and Operations- System Calls, System Programs, OS Generation and System Boot.

Unit IV Computer Networking (10 Hrs):

Introduction, Goals, OSI Model, Functions of Different Layers. Internetworking Concepts, Devices, TCP/IP Model. Topology, Introduction to Internet, World Wide Web, E• commerce Computer Security Basics: Introduction to viruses, worms, malware, Trojans, Spyware and Anti-Spyware Software, Different types of attacks like Money Laundering, Information Theft, Cyber Pornography, Email spoofing, Denial of Service (DoS), Cyber Stalking, ,Logic bombs, Hacking Spamming, Cyber Defamation, Security measures Firewall,

Unit V Data base Management System (10 Hrs):

Introduction, File oriented approach and Database approach, Data Models, Architecture of Database System, Data independence, Data dictionary, DBA, Primary Key, Data definition language and Manipulation Languages. Cloud computing: definition, cloud infrastructure, cloud segments or service delivery models (IaaS, PaaS and SaaS), cloud deployment models/ types of cloud (public' private, community and hybrid clouds), Pros and Cons of cloud computing

Reference books:

1. Introduction of computers: Peter Norton, TMH
2. Object oriented programming with c++ :E.Balaguruswamy,TMH
3. Object oriented programming in C++: Rajesh k.shukla ,Wiley India
4. Computer network: Andrew Tananbaum,PHI
5. Data base management system,Korth,TMH
6. Operating system-silberschatz and Galvin-Wiley India

BTEESC-203	Basic Computer Engineering	0L:0T:1P	1 credits	2Hrs/Week

List of Experiment:-

1. Study of input and output devices of computer systems .
2. Write a program of addition, subtract, multiplication and division by using C.
3. Write a program to check weather a number is prime or not.
4. Study of various types of Operating System.
5. Study and practice of basic Linux commands-ls, cp, mv, rm, chmod kill, ps etc.
6. Design color coding of straight & crossover cable.
7. Installation of oracle 10g. Also create a employee table.

BEESC-204 Basic Mechanical Engineering

BEESC-204	Basic Mechanical Engineering	2L:0T:0P	2 credits	2Hrs/Week

Preamble:

- To provide a comprehensive knowledge of basic mechanical systems.
- Basic concepts from mechanical engineering sciences,
- Basic concepts I.C Engine
- Modern engineering tools (machine-tools, laboratory instrumentation, Working principle of steam Engine), and related subjects to design mechanical engineering components

Outcome:

- After successful completion of this course students will able to
- To describe and use basic engineering concepts
- principles and components of mechanical equipment
- measuring & testing method of physical quantities

- Assessment of boiler component.

Unit I Materials (6 Hrs):

Classification of engineering material, Composition of Cast iron and Carbon steels, Iron Carbon diagram. Alloy steels their applications. Mechanical properties like strength, hardness, toughness ductility, brittleness , malleability etc. of materials , Tensile test- Stress-strain diagram of ductile and brittle materials ,

Unit II Measurement (10 Hrs):

Concept of measurements, errors in measurement, Temperature, Pressure, Velocity, Flow strain, Force and torque measurement, Vernier caliper, Micrometer, Dial gauge, Slip gauge, Sine-bar and Combination set. Production Engineering: Elementary theoretical aspects of production processes like casting, carpentry, welding etc Introduction to Lathe and Drilling machines and their various operations.

Unit III Fluids (6Hrs):

Fluid properties pressure, density and viscosity etc. Types of fluids , Newton's law of viscosity , Pascal's law , Bernoulli's equation for incompressible fluids, Only working principle of Hydraulic machines, pumps, turbines, Reciprocating pumps .

Unit IV Thermodynamics (10Hrs):

Thermodynamic system, properties, state, process, Zeroth, First and second law of thermodynamics, thermodynamic processes at constant pressure, volume, enthalpy & entropy.

Steam Engineering: Classification and working of boilers, mountings and accessories of boilers, Efficiency and performance analysis, natural and artificial draught, steam properties, use of steam tables.

Unit V Reciprocating Machines (10 Hrs) :

Working principle of steam Engine, Carnot, Otto, Diesel and Dual cycles P-V & T-S diagrams and its efficiency, working of Two stroke & Four stroke Petrol & Diesel engines. Working principle of compressor.

References : -

1- Kothandaraman & Rudramoorthy, Fluid Mechanics & Machinery, New Age . 2- Nakra & Chaudhary , Instrumentation and Measurements, TMH.

3- Nag P.K, Engineering Thermodynamics , TMH .

4- Ganesan , Internal Combustion Engines, TMH .

5- Agrawal C M, Basic Mechanical Engineering ,Wiley Publication. 6- Achuthan M , , Engineering Thermodynamics ,PHI.

BEESC-204	Basic Mechanical Engineering	0L:0T:1P	2 credits	2Hrs/Week

List of Experiments:-

1- Study of Universal Testing machines.

2- Linear and Angular measurement using, Micrometer, Slip Gauges, Dial Gauge and

3- Study of Lathe Machine.

4- Study of Drilling Machines.

5- Verification of Bernoulli's Theorem.

6- Study of various types of Boilers.

7- Study of different IC Engines.

8- Study of different types of Boilers Mountings and accessories.

BEESC-205 Basic Civil Engineering & Mechanics

BEESC-205	Basic Civil Engineering & Mechanics	3L:0T:0P	3 credits	3Hrs/Week

Course Preamble: The goal of this Engineering Mechanics course is to expose students to problems in mechanics as applied to plausibly real-world scenarios. Problems of particular types are explored in detail in the hopes that students will gain an inductive understanding of the underlying principles at work; students should then be able to recognize problems of this sort in real-world situations and respond accordingly.

The civil engineering program will serve Connecticut and the nation by providing a quality engineering education that enables students to enter a profession that can improve the civil infrastructure, and economic welfare. Our civil engineering program will maintain a strong emphasis on undergraduate education with the goal that our program will be recognized for quality instruction in civil engineering analysis and design

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

SSSUTMS School of Engineering

Outcomes:

- Demonstrate knowledge of various surveying methods.
- Conduct a chain survey.
- Conduct a compass survey.
- Conduct levelling survey and be able to do RL calculations.
- Demonstrate knowledge of properties of various building materials.
- Draw free body diagrams and determine the resultant of forces and/or moments.
- Determine the centroid and second moment of area of sections.
- Apply laws of mechanics to determine efficiency of simple machines with consideration of friction.
- Analyse statically determinate planar frames.

Unit I Building Materials & Construction (10 Hrs)

Stones, bricks, cement, lime, timber-types, properties, test & uses, laboratory tests concrete and mortar Materials: Workability, Strength properties of Concrete, Nominal proportion of Concrete preparation of concrete, compaction, curing. Elements of Building Construction, Foundations conventional spread footings, RCC footings, brick masonry walls, plastering and pointing, floors, roofs, Doors, windows, lintels, staircases – types and their suitability

Unit II Surveying & Positioning (10 Hrs):

Introduction to surveying Instruments – levels, theodolites , plane tables and related devices. Electronic surveying instruments etc. Measurement of distances – conventional and EDM methods, measurement of directions by different methods, measurement of elevations by different methods. Reciprocal levelling .

Unit III Basics of Engineering Mechanics covering (10 Hrs):

Force Systems Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces ,Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy

Unit IV Centroid and Centre of Gravity covering (10 Hrs):

Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia Definition, Moment of inertia of plane sections

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook.

Unit V Friction covering (10 Hrs):

Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, Basic Structural Analysis covering, Equilibrium in three dimensions; Method of Sections; Method of Joints; How to determine if a member is in tension or compression; Simple Trusses; Zero force members; Beams & types of beams; Frames

Reference Books:

1. S. Ramamrutam & R.Narayanan; Basic Civil Engineering, Dhanpat Rai Pub.

2. Prasad I.B., Applied Mechanics, Khanna Publication.

3. Punmia, B.C., Surveying, Standard book depot.

4. Shesha Prakash and Mogaveer; Elements of Civil Engg & Engg. Mechanics; PHI

BEESC-205	**Basic Civil Engineering & Mechanics**	**0L:0T:2P**	**1 credits**	**2Hrs/Week**

List of Experiments:-

1. To perform traverse surveying with prismatic compass, check for local attraction and determine corrected bearings and to balance the traverse by Bowditch's rule.

2. To perform leveling exercise by height of instrument of Rise and fall method.

3. To measure horizontal and vertical angles in the field by using Theodolite.

4. To determine (a) normal consistency (b) Initial and Final Setting time of a cement Sample.

5. To determine the workability of fresh concrete of given proportions by slump test or compaction factor test.

6. To determine the Compressive Strength of brick .

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

SSSUTMS School of Engineering SEHORE (M.P.)

7. To determine particle size distribution and fineness modulus of course and fine Aggregate.

8. To verify the law of Triangle of forces and Lami's theorem.

9. To verify the law of parallelogram of forces.

10. To verify law of polygon of forces

11. To find the support reactions of a given truss and verify analytically.

12. To determine support reaction and shear force at a given section of a simply Supported beam and verify in analytically using parallel beam apparatus.

13. To determine the moment of inertia of fly wheel by falling weight method.

14. To verify bending moment at a given section of a simply supported beam.

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Undergraduate Degree Courses in Engineering & Technology

Department of Chemical Engineering

BEHSMC-206 Language Lab and Seminar

BEHSMC-206	**Language Lab and Seminar**	**0L:0T:1P**	**1 credits**	**2Hrs/Week**

Course Preamble: This course intends to impart practical training in the use of English Language for

Communicative purposes and aims to develop students' personality through language Laboratory.

Topics to be covered in the Language laboratory sessions:

1. **1.** Introducing oneself, family, social roles.
2. 2.Public Speaking and oral skills with emphasis on conversational practice, extempore speech, JAM(Just a minute sessions), describing objects and situations, giving directions, debate, telephonic etiquette.
3. Reading Comprehension: Intensive reading skills, rapid reading, and reading aloud (Reading material to be selected by the teacher).
4. To write a book review. Standard text must be selected by the teacher.
5. Role plays: preparation and delivery topic to be selected by teacher/faculty.

BELC–207 Self Study / GD Seminar

BELC–207	**Self-Study / GD Seminar**	**0L:0T:1P**	**1 credits**	**2Hrs/Week**

Preamble

To improve the mass communication and convincing / understanding skills of students and it is to give student an opportunity to exercise their rights to express themselves. Evaluation will be done by assigned faculty based on group discussion and power point presentation.

Outcomes:

- Analytical thinking
- Lateral thinking
- constructive argument
- Communication skill
- Presentation of views

Students will discuss the course related and interdisciplinary topics for problem solving. They will improve the mass communication and convincing / understanding skills about subject and their related problem in a group of students.

Registrar
Sri Satya Sai University of Technology & Medical Sciences, Sehore (M.P.)

SSSUTMS School of Engineering SEHORE (M.P.)

Sri Satya Sai
University of Technology and Medical Sciences

(Established under Govt. of M.P. Registered under UGC 2(F) 1956)

Bhopal-Indore Road, Opp. Pachama oilfed plant, Pachama, Dist.-Sehore M.P.PIN-466001
Ph. 07562-223647, Fax : 07562-223644, Web: www.sssutms.co.in, info@sssutms.co.in

Name of Faculty: School of Engineering

Name of Department: **Chemical Engineering**

Minutes of Board of Studies Committee Meeting Dated on **03.06.2019**

The Board of Studies Committee Meeting was held in the room of Department of Chemical Engineering at 2:30 PM. on **03.06.2019**, Following members were present.

1. Dr. Satyendra Singh Tomar, Prof. (Chemical Engineering) - Chairman
2. Dr. S. Suresh Assoc. Prof. (Chemical Engineering, MANIT Bhopal),-External Member
3. Dr. Anuradha Devi, Asst. Prof. (Chemical Engineering), Member
4. Dr. Neelu Jain, Prof. (Chemistry), Member
5. Mr. Manoj Kumar Gandwane, Asst. Prof. (Chemical Engineering), Member
6. Mr. Pradeep Semil, Asst. Prof. (Chemical Engineering), Member
7. Mr. Nilesh Ahirwar Asst. Prof. (Chemical Engineering), Member
8. Mrs. Arpita Bhattacharya, Senior Manager, Bharat Refineries, Industry Expert

The Chairman of Board of Studies Committee welcomes and appreciated the efforts put up by the faculty for progress of the departmental activities. The following Agenda points were discussed and resolved.

Agenda Preparation of syllabus and Scheme for III and IV Sem as per AICTE.

Discussion Scheme

Scheme and syllabus was put up before the member as per recent AICTE guidelines. It was discussed in detail by the members and some modifications were suggested.

A new value added course entitled "Fundamentals of Green Chemistry and Technology" is proposed.

Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

S S U T M S School of Engineering SEHORE (M.P.)

Resolution of the Discussion:

It was resolved that scheme and syllabus as proposed with some modification and may be accepted.

The committee has approved the proposal for starting a new value added course entitled "**Cleaner Production& Sustainable Development**" for better understanding of the student's to the demand of current scenario.

The Chairman thanks the members for peaceful conduction of meeting.

Signature of All members (Including Chairman)

S. No.	BOS Members	Signature
1	Dr. Satyendra Singh Tomar, Prof. (Chemical Engineering) - Chairman	
2	Dr. S. Suresh Assoc. Prof. (Chemical Engineering, MANIT Bhopal),-External Member	
3	Dr. Anuradha Devi, Asst. Prof. (Chemical Engineering), Member	
4	Dr. Neelu Jain, Prof. (Chemistry), Member	
5	Mr. Manoj Kumar Gandwane, Asst. Prof. (Chemical Engineering), Member	
6	Mr. Pradeep Semil, Asst. Prof. (Chemical Engineering), Member	
7	Mr. Nilesh Ahirwar Asst. Prof. (Chemical Engineering), Member	
8	Mrs. Arpita Bhattacharya, Senior Manager, Bharat Refineries, Industry Expert	

Chairman

Registrar
Sri Satya Sai University of Technology
& Medical Sciences, Sehore (M.P.)

SSUTMS School of Engineering SEHORE (M.P.)

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Undergraduate Degree Courses in Engineering & Technology

Department of Chemical Engineering

III SEMESTER

S. No.	Subject Code	Subject Name	Maximum Marks Theory Slot			Maximum Marks (Practical Slot)		Total Marks	Periods/ hour/ week			Credits
			End Sem. Exam.	Mid Tests	Assign-ments/ Quiz	End Sem. Practical & Viva	Practical Record /Assignment/ Quiz / Presentation		L	T	P	
1	BEA-301	Mathematics -III	60	30	10	-	-	100	3	-	-	3
2	CMA-302	Chemical Engineering Thermodynamics	60	30	10	-	-	100	2	1	-	3
3	CMA-303	Advance Engineering Chemistry	60	30	10	30	20	150	3	-	2	4
4	CMA-304	Material & Energy Balance	60	30	10	30	20	150	2	1	2	4
5	CMA-305	Chemical Instrumentation	60	30	10	30	20	150	3	-	2	4
6	CMA-306	Computer Programming-I	-	-	-	30	20	50	-	-	2	1
7	CMA-307	Self Study /GD Seminar	-	-	-	-	50	50	-	-	2	1
TOTAL			**300**	**150**	**50**	**120**	**130**	**750**	**13**	**2**	**10**	**20**

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

S S S U T M S Sehore (M.P.)

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Undergraduate Degree Courses in Engineering & Technology

Department of Chemical Engineering

IV SEMESTER

S.No.	Subject Code	Subject Name	Maximum Marks Theory Slot			Maximum Marks (Practical Slot)		Total Marks	Periods/ hour/ week			Credits
			End Sem. Exam.	Mid Tests	Assign-ments /Quiz	End Sem. Practical & Viva	Practical Record /Assignment / Quiz / Presentation		L	T	P	
1	BEA-401	Energy, Ecology, Environment & Society	60	30	10	-	-	100	2	1	-	3
2	CMA-402	Fluid Particle Mechanics	60	30	10	30	20	150	2	1	2	4
3	CMA-403	Fluid Mechanics	60	30	10	30	20	150	3		2	4
4	CMA-404	Fuel Technology	60	30	10	30	20	150	3	-	2	4
5	CMA-405	Inorganic Process Technology	60	30	10	30	20	150	3	-	2	4
6	CMA-406	Computer Programming-II	-	-	-	30	20	50	-	-	2	1
7	CMA-407	Industrial Training-I	To be completed during fourth semester break. Its evaluation/credit to be added in fifth semester									
	TOTAL		**300**	**150**	**50**	**150**	**100**	**750**	**13**	**2**	**10**	**20**

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Undergraduate Degree Courses in Engineering & Technology

Department of Chemical Engineering

BEA-301 Mathematics-III

BEA-301	Mathematics-III	3L:0T:0P	3 credits	3Hrs/Week

Course Preambles:

To enable the students to apply the knowledge of Mathematics in various engineering fields by making them

- To understand the method of solving algebraic, transcendental equations and to determine the approximate value of the derivative & definite integral for a given data using numerical techniques.
- Able to expand the given periodic function defined in the given range in terms of sine and cosine multiple of terms as a Fourier series and to extremise the functional using integration technique and to solve the partial differential equation using different analytical techniques.

Course outcomes:

On completion of this course, students will be able to

- Solve field problems in Engineering involving PDEs.
- Use the root finding techniques to solve practical engineering problems.
- To apply the concept of numerical analysis to find the relative strengths and weaknesses of each computation method and know which are most applicable for given problem.
- To apply the analytical technique to express periodic function as a Fourier sine and cosine series.
- Estimate Laplace and Fourier transform and z transform.

Unit I: Numerical Methods (10 hours): Solution of polynomial and transcendental equations – Bisection method, Newton-Raphson method and Regula-Falsi method. Finite differences, Relation between operators, Interpolation using Newton's forward and backward difference formulae. Interpolation with unequal intervals: Newton's divided difference and Lagrange's formulae.

Unit II: Numerical Methods (7 hours): Numerical Differentiation, Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8 rules. Solution of Simultaneous Linear Algebraic Equations by Gauss's Elimination, Gauss's Jordan, Crout's methods, Jacobi's, Gauss-Seidal, and Relaxation method.,

Unit III: Numerical Methods (10 hours): Ordinary differential equations: Taylor's series, Euler and modified Euler's methods. RungeKutta method of fourth order for solving first and second order equations. Milne's and Adam's predicator-corrector methods. Partial differential equations: Finite difference solution two dimensional Laplace equation and Poission equation, Implicit and explicit methods for one dimensional heat equation (Bender-Schmidt and Crank-Nicholson methods), Finite difference explicit method for wave equation.

Unit IV: Transform Calculus (10 hours): Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem. Evaluation of integrals by Laplace transform, solving ODEs by Laplace Transform method, Fourier transforms.

Unit V: Concept of Probability (5 hours): Probability Mass function, Probability Density Function, Discrete Distribution: Binomial, Poisson's, Continuous Distribution: Normal Distribution, Exponential Distribution.

References:

1. P. Kandasamy, K. Thilagavathy, K. Gunavathi, Numerical Methods, S. Chand & Company, 2nd Edition, Reprint 2012.
2. S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005.
3. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2010.
5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
6. Veerarajan T., Engineering Mathematics, Tata McGraw-Hill, New Delhi, 2008.
7. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book
8. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
9. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley, 1968. Statistics.

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

S.S.S.U.T.M.S. School of Engineering SEHORE (M.P.)

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Undergraduate Degree Courses in Engineering & Technology

Department of Chemical Engineering

CMA-302 Chemical Engineering Thermodynamics

CMA-302	Chemical Engineering Thermodynamics	2L:1T:0P	3 credits	3Hrs/Week

Course Preambles:

Principles and application of first and second law of thermodynamics, and phase equilibria.

Course Outcomes:

- Apply mass and energy balances to closed and open systems
- Evaluate the properties of non-ideal gases
- Solve problems involving liquefaction, refrigeration and different power cycles.

Unit-I: Basic Concepts (10 hours): Basic concepts of work & heat system, properties and state of systems; first law of thermodynamics; application, batch flow processes; steady & unsteady state flow.

Unit-II: Properties (10 hours): Critical properties corresponding state compressibility, PVT behavior of pure fluids viral equation, cubic equation, generalized correlation & eccentric factor, behavior of liquid, second law of T.D, & its application. Adiabatic reactions, Equilibrium in homogeneous and heterogeneous reactions.

Unit-III: Carnot Cycle (8 hours): Carnot cycle, Carnot theorem, thermodynamics temperature scales, concept of entropy, calculation of entropy for various systems, entropy for real system.

Unit-IV: Effect of Pressure (5 hours): Effect of pressure on specific heat, Joule Thompson effect, third law of thermodynamics & its applications.

Unit-V: Compression & Expansion of Fluids (7 hours): Compression & expansion of fluids; single stage, multiple stage requirements & efficiency along with effect & engineering along with effects clearance, compression of real gas.

References:

1. Smith J.M and Van Ness-Introduction to Chemical Engg Thermodynamics –6th edition
2. Daubert; Chemical Engg thermodynamic; TMH
3. Rathakrishnan E; Fundamentals of Engg Thermodynamics; PHI
4. Dodge B.F. Chemical Engineering –Thermodynamics –McGraw Hill
5. Balzhiser, Samuels and Eliassen-Chemical Engg- Thermodynamics Prentice Hall
6. Sandler S.I Chemical Engg-Thermodynamics-John Wiley and son
7. Rastogi and Mishra-Chemical Engg Thermodynamics.

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

School of Engineering

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Undergraduate Degree Courses in Engineering & Technology

Department of Chemical Engineering

CMA-303 Advance Engineering Chemistry

CMA-303	Advance Engineering Chemistry	3L:0T:0P	3 credits	3Hrs/Week

Course Preambles:

- Concepts of quantum chemistry, bonding, stereochemistry, and those of Synthesis methodologies and reactivity of organic compounds.
- Concepts related to homogeneous and heterogeneous catalysis, mechanisms of industrially important reactions, spectroscopic methods for identification of compounds.

Course Outcomes:

Students taking the course will

- Get an understanding of the theoretical principles underlying molecular structure, bonding and properties.
- Know the fundamental concepts of structure and function in organic reactions, the use of kinetics and thermodynamics to elucidate mechanisms of reactions.
- Be able to predict reactivity patterns and propose reasonable mechanisms.

Unit-I: Ceramics (10 hours): Definition & Classification of ceramic materials based on composition, properties & applications, Electro-ceramics, magnetic ceramics, Fine ceramics & Glass-ceramics Natural ceramic minerals & materials such as Clay family, Quartz/Quartzite, Feldspar, Bauxite family, Dolomite, Magnesite.

Unit-II: Refractory (12 hours): Introduction, raw materials, Fabrication and firing, General manufacturing techniques, Properties and applications of following refractories: Acid (Silica) Refractories, Basic Refractories, Burnt refractories ,Sintered, fused refractories,and Insulating Refractories, Castables.

Unit-III: Glass (10 hours): Definition of glass, Thermodynamic study for glass formation, Glass transitions Conditions of vitrification; Glass processing: selection of raw materials, effects of different oxides on glass properties, batch preparation, melting in glass tank furnace, refining of glass, Forming process: Blowing, molding , shaping etc

Unit-IV: Oils and Fats (8 hours): Vegetable oils by solvent extraction, processing of animal fats, hydrogenation and esterification of oils; Soaps and Detergents Bathing & laundry soaps, cationic and anionic detergents;, surface active agents.

Unit-V: Chemical Kinetics (12 hours): Rate constant, order and molecularity of a reaction, zero, 1st, 2nd and 3rdorder reactions; , methods of determination of order of reactions; chemical equilibria Reaction rate theories, Arrhenius, parameters, Catalysis (including enzyme catalysis), effect of catalysis on reaction rate.

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

School of Engineering

References:

1. B.S.Bahl & G. D. Tuli- Essentials of physical Chemistry. S. Chand & Publishers.
2. Glasstone – Textbook on Physical Chemistry – Prentice Hall, India, New Delhi.
3. Dryden CE- Outlines of Chemical Technology- Prentice Hall, India, New Delhi
4. Levine; Physical Cheistry; TMH.
5. Sivasamkar; Engg Chemistry; TMH
6. Jain & Jain- Engineering Chemisry – Dhanpat Rai Publishing Company, Delhi.
7. 7.Austin G.T, Shreeves; Chemical Process Industry – McGraw Hill – Kogmina
8. Gupta OP; Fuel and Combustion; Khana Pub

CMA-303	**Advance Engineering Chemistry**	**0L:0T:1P**	**1 credits**	**2Hrs/Week**

List of Experiments:

1. To determine the viscosity of a viscous liquid by falling sphere method
2. Determination of saponification value of oil sample
3. Application of pH meter to find acidity and alkalinity of a solution.
4. To determine the % composition of a given binary liquid solution by polarimeter.
5. To determine the solubility of a sparingly soluble salt in water by conductance measurement.
6. Preparation of laundry soap and to determine its yield
7. Investigation of Appropriate Refractory Material for Laboratory
8. Manufacturing of glass and ceramics in laboratory scale.

Registrar
Sri Satya Sai University of Technology & Medical Sciences, Sehore (M.P.)

SSSUTMS (M.P.)

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Undergraduate Degree Courses in Engineering & Technology

Department of Chemical Engineering

CMA-304 Material & Energy Balance

CMA-304	Material & Energy Balance	2L:1T:0P	3 credits	3Hrs/Week

Course Preambles:

The course will serve as a basis for all further chemical engineering courses that are part of the curriculum.

Course Outcomes:

Students completing the course will

- Develop mastery over process calculations relevant to chemical engineering processes
- Bee able to handle elementary flow-sheeting, material and energy balance calculations without and with chemical reactions, and involving concepts like recycle, bypass and purge.
- Be familiar with equations of state and properties of gases and liquids, including phase transition

Unit-I: Mathematical and Engineering Calculation (10 hours): Units, different unit systems, conversion of unit from one system to other, dimensions, dimensional analysis, dimensional group, fundamental of mole concept, composition of solid, liquid and gases, Basic Stoichiometric calculation.

Unit-II: Ideal Gases & Vapor Pressure (8 hours): Introduction of ideal gas, behavior of ideal gases, real gas, Vander Waal equation, compressibility factor method to solve cubic equation , vapour pressure , Raoult's Law, Humidity, relative humidity, humid heat, humid volume ,dew point ,humidity chart and its use.

Unit-III: Material Balance without Chemical Reaction (12 hours): Fundamental of conservation of mass, Introduction of component balance, solving material balance without simultaneous equation for different unit operations, solving material balance at steady state and unsteady state, recycle, by pass and purge calculations. Aid of computer in solving material balance problems.

Unit-IV: Material Balance with Chemical Reaction (10 hours): Introduction of component balance, solving material balance with chemical reactions, recycles, by pass and purge calculation with chemical reactions, combustion calculations.

Unit-V: Energy Balance (08 hours): Laws of thermo chemistry Heat capacity, calculation of enthalpy changes, calculation of standard heat of reaction, heats of formation, combustion, solution, mixing etc., effect of pressure and temperature on heat of reaction, energy balance with chemical reaction.

References:

1. O.A. Hougen, K.M. Watson, R.A. Ragatz; Chemical Process Principles Part I –CBS pub.
2. David M. Himmelblau-Basic Principles and calculations in chemical Engineering –PHI
3. B. I. Bhatt, S.M. Vora; Stoichiometry; TMH.

CMA-304	Material & Energy Balance	0L:0T:1P	1 credits	2Hrs/Week

List of Experiments:

1. Determination of boiling point relation with respect to concentration of caustic soda and verify Dehring' rule.
2. Application of dry and wet bulb thermometer to find out atmospheric humidity.
3. Use of humidity chart to find enthalpy dew point humid heat and saturation.
4. Solubility at room temperature and boiling point of urea in water and verify the material balance.
5. Crystallization of copper sulfate in saturated solution by cooling and finding out the crystal yield.
6. To find out the heating value of coal using a calorimeter
7. Combustion of coal & performing the material balance
8. Proximate analysis of coal sample
9. Measurement of flame temp and compare actual & theoretical temp (Bunsen-Burner, Sprit Lamp, Kerosene Lamp.)
10. To find the heat of reaction using calcium oxide and water.

Registrar
Sri Sathya Sai University of Technology & Medical Sciences

School of Engineering

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Undergraduate Degree Courses in Engineering & Technology

Department of Chemical Engineering

CMA-305 Chemical Instrumentation

CMA-305	Chemical Instrumentation	3L:0T:0P	3 credits	3Hrs/Week

Course Preambles:

Objective of the course is to introduce the basics of instrumentation and process control through a hands-on practical experience. Principles of operation of different measuring devices for temperature, level, pressure, flow, pH, humidity, density, and viscosity will be introduced to impart knowledge of transmitters, transducers, converters, control valves, digital and analog components related to PLC, DCS, SCADA systems.

Course Outcomes:

Students will be well-familiar with instrumentation and automation as relevant to modern chemical plant operation.

Unit-I: Introduction (10 hours): Chemical process instrumentation, Choice of Instruments for a Specific Application Process variables, static and dynamic characteristics of instruments & their general classification, Elements of Measuring systems & their functions, True value ,Measured Value, Errors, Classification Of Errors and Methods of Reducing errors.

Unit-II: Temperature of Humidity Measurement (15 hours): Principle, construction and operation of instruments for the measurement of Temperature: Liquid filled thermometers, Vapour Pressure Thermometers, Thermometers based on solid expansion like bimetallic type, Thermocouples, Resistance thermometers, Radiation Pyrometers, Optical Pyrometers, Photo electric Pyrometers. Principle, construction and operation of instruments for the measurement of Humidity and moisture

Unit-III: Pressure Measurement (12 hours): Principle, construction and operation of instruments for the measurement of pressure and Vacuum: Mechanical Pressure sensors e.g. Bourdon Tube, Diaphragm Pressure Elements, Bellows, Electrical Pressure Measuring Devices e.g. capacitance Manometer, Strain Gauge Pressure Transducers, Piezo Resistive Pressure Transducers, Resistive Pressure Transducers, LVDT Pressure Transducer. Measurement Of vacuum e.g Mcleod Gauge , Pirani gauge, Ionization gauge.

Unit-IV: Flow Measurement (10 hours): Principle, construction and operation of instruments for the measurement of Flow e.g. Variable Head flow meters, Variable Area flow meters, Hot Wire Anemometer, Principle, construction and operation of instruments for the measurement of Level e.g. Float and Displacer type Devices, Hydrostatic Methods, Capacitance type Devices , Radiation type Devices. Principle,construction and operation of instruments for the measurement of Density and Viscosity.

Unit-V: Composition Measurement (10 hours): Principle, construction and operation of instruments for the measurement of Composition e.g. Thermal conductivity analyzers,

Paramagnetic Analyzers, Spectroscopic Methods, Gas Chromatograph, Process instrumentation diagrams and symbols, process instrumentation for process equipments such as Distillation column Absorption column, Heat Exchanger, Reactors, Evaporators, fluid storage vessels.

References:

1. Albert D. Cooper-Modern Electronic Instrumentation, PHI
2. Eckman-Industrial Instrumentation
3. H.S. Kalsi-Electronic Instrumentation
4. Curties Johnson-Process Control Instrumentation Technique, IV Edn, PHI
5. Harriot; Process control; TMH
6. Patranabis; Principles of process control; TMH
7. Jaggi, Mathur; Engineering Mathematics; Khanna Publisher.
8. B.G. Liptak-Instrument Engineering 'Handbook, Volume 1: Process Measurement
9. Austin E. Fribance-Industrial Instrumentation Fundamentals, New York: Mcgraw-Hill 1962
10. Ernest Doebelin-Measurement Systems: Application and Design, McGraw-Hill

CMA-305	Chemical Instrumentation	0L:0T:1P	1 credits	2Hrs/Week

List of Experiments:

1. Time constant of pH-meter
2. Study of Bourdon tube pressure gauge
3. Study of Bellow tube pressure gauge
4. Calibration of different instruments used in chemical processes
5. Study of electro-pneumatic transducers for pressure, flow, level
6. Measurement of water level using differential pressure meter
7. Measurement of flow using electromagnetic flow meter
8. Measurement of flow using differential pressure cell across orifice/ venturimeter.

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Undergraduate Degree Courses in Engineering & Technology

Department of Chemical Engineering

CMA-306 Computer Programming-I

CMA-306	Computer Programming-I	0L:0T:1P	1 credits	2Hrs/Week

Course Preambles:

- Programming in the Java programming language,
- Knowledge of object-oriented paradigm in the Java programming language,
- The use of Java in a variety of technologies and on different platforms.

Course Outcomes:

- Students will be able to solve simple problems in statistics, chemistry and physics using programming languages.
- To do coding of Java programming language for various programming technologies
- Knowledge of the structure and model of the Java programming language,
- Use the Java programming language for various programming technologies
- Develop software in the Java programming language

Unit-I Basic Java Features - C++ Vs JAVA, JAVA virtual machine, Constant & Variables, Data Types, Class, Methods, Objects, Strings and Arrays, Type Casting, Operators, Precedence relations, Control Statements, Exception Handling, File and Streams, Visibility, Constructors, Operator and Methods Overloading, Static Members, Inheritance: Polymorphism, Abstract methods and Classes

Unit-II Java Collective Frame Work - Data Structures: Introduction, Type-Wrapper Classes for Primitive Types, Dynamic Memory Allocation, Linked List, Stack, Queues, Trees, Generics: Introduction, Overloading Generic Methods, Generic Classes, Collections: Interface Collection and Class Collections, Lists, Array List and Iterator, Linked List, Vector. Collections Algorithms: Algorithm sorts, Algorithm shuffle, Algorithms reverse, fill, copy, max and min Algorithm binary Search, Algorithms add All, Stack Class of Package java. Util, Class Priority Queue and Interface Queue, Maps, Properties Class, Un-modifiable Collections.

Unit-III Advance Java Features - Multithreading: Thread States, Priorities and Thread Scheduling, Life Cycle of a Thread, Thread Synchronization, Creating and Executing Threads, Multithreading with GUI, Monitors and Monitor Locks. Networking: Manipulating URLs, Reading a file on a Web Server, Socket programming, Security and the Network, RMI, Networking, Accessing Databases with JDBC: Relational Database, SQL, MySQL, Oracle

Unit-IV Advance Java Technologies - Servlets: Overview and Architecture, Setting Up the Apache Tomcat Server, Handling HTTP get Requests, Deploying a web Application, Multitier Applications, Using JDBC from a Servlet, Java Server Pages (JSP): Overview, First JSP Example, Implicit Objects, Scripting, Standard Actions, Directives, Multimedia: Applets and Application: Loading, Displaying and Scaling Images, Animating a Series of Images, Loading and playing Audio clips

Registrar
Sri Sathya Sai University of Technology & Medical Sciences

School of Engineering

Unit-V Advance Web/Internet Programming (Overview): J2ME, J2EE, EJB, XML.

References:

1. Deitel & Deitel, "JAVA, How to Program"; PHI, Pearson.
2. E. Balaguruswamy, "Programming In Java"; TMH Publications
3. The Complete Reference: Herbert Schildt, TMH
4. Peter Norton, "Peter Norton Guide To Java Programming", Techmedia.
5. Merlin Hughes, et al; Java Network Programming, Manning Publications/Prentice Hall
6. Cay Horstmann, Big JAVA, Wiely India.

List of Program to be perform (Expandable):

1. Installation of J2SDK
2. Write a program to show Scope of Variables
3. Write a program to show Concept of CLASS in JAVA
4. Write a program to show Type Casting in JAVA
5. Write a program to show How Exception Handling is in JAVA
6. Write a Program to show Inheritance
7. Write a program to show Polymorphism
8. Write a program to show Access Specifiers (Public, Private, Protected) in JAVA
9. Write a program to show use and Advantages of CONTRUCTOR
10. Write a program to show Interfacing between two classes
11. Write a program to Add a Class to a Package
12. Write a program to show Life Cycle of a Thread
13. Write a program to demonstrate AWT.
14. Write a program to Hide a Class
15. Write a Program to show Data Base Connectivity Using JAVA
16. Write a Program to show "HELLO JAVA " in Explorer using Applet
17. Write a Program to show Connectivity using JDBC
18. Write a program to demonstrate multithreading using Java.
19. Write a program to demonstrate applet life cycle.

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Undergraduate Degree Courses in Engineering & Technology

Department of Chemical Engineering

CMA-307 Self Study /GD Seminar

EEA-307	Self-study /GD Seminar (Internal Assessment)	0L:0T:1P	1 credits	2Hrs/Week

The main Preamble of GD and seminar is to improve the mass communication and convincing / understanding skills of students and it is to give student an opportunity to exercise their rights to express themselves. Evaluation will be done by assigned faculty based on group discussion and power point presentation.

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for
Undergraduate Degree Courses in Engineering & Technology
Department of Chemical Engineering

BEA-401 Energy, Ecology, Environment & Society

BEA-401	Energy, Ecology, Environment & Society	2L:1T:0P	3 credits	3Hrs/Week

UNIT-1 Sources of Energy (6 hours): Renewable & Non Renewable, Fossil fuel, Biomass Geothermal, Hydrogen, Solar, Wind, hydal, nuclear sources.

UNIT-2 Segments of Environment (6 hours): Atmosphere, hydrosphere, Lithosphere, biosphere. Cycles in Ecosystem – Water, Carbon, Nitrogen. Biodiversity: Threats and conservation

UNIT-3 Air Pollution (10 hours): Air pollutants, classification, (Primary & secondary Pollutants) Adverse effects of pollutants. Causes of Air pollution chemical, photochemical, Green house effect, ozone layer depletion, acid Rain. Sound Pollution: Causes, controlling measures, measurement of sound pollution (deciblage), Industrial and non – industrial.

UNIT-4 Water Pollution (10 hours): Pollutants in water, adverse effects. Treatment of Domestic & Industrial water effluent. Soil Pollution – Soil Profile, Pollutants in soil, their adverse effects, controlling measures.

UNIT-5 Society, Ethics & Human Values (10 hours): Impact of waste on society. Solid waste management Nuclear, Thermal, Plastic, medical, Agriculture, domestic and e-waste). Ethics and moral values, ethical situations, objectives of ethics and its study . Preliminary studies regarding Environmental Protection Acts , introduction to value education, self exploration, sanyam & swasthya.

References:

1. Harris, CE, Prichard MS, Rabin's MJ, "Engineering Ethics"; Cengage Pub.
2. Rana SVS ; "Essentials of Ecology and Environment"; PHI Pub.
3. Raynold, GW "Ethics in information Technology"; Cengage.
4. Svakumar; Energy Environment & Ethics in society; TMH
5. AK De "Environmental Chemistry"; New Age Int. Publ.
6. BK Sharma, "Environmental Chemistry" ; Goel Publ. House.
7. Bala Krishnamoorthy; "Environmental management"; PHI

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

S.S.S.U.T.M.S. School of Engineering SEHORE (M.P.)

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for
Undergraduate Degree Courses in Engineering & Technology
Department of Chemical Engineering

CMA-402 Fluid Particle Mechanics

CMA-402	Fluid Particle Mechanics	2L:1T:0P	3 Credits	3Hrs/Week

Course Preambles:
Objective of this course is to introduce students to the numerous industrial operations dealing with the particulate solids, their handling in various unit operations, and those in which particle-fluid interactions are important. The course addresses fundamentals of fluid-particle mechanics, such as the notion of drag, and builds on those fundamentals to develop design concepts for various industrial processes like packed bed operation, fluidized operations, sedimentation, filtration, separation of solids and fluids, etc. Industrial applications are discussed. The course is concluded with an introduction to colloidal systems, soft materials and nanoparticles. Applications of these novel systems are discussed.

Course Outcomes:
Students will be able to

- Calculate drag force and terminal settling velocity for single particles
- Calculate pressure drop in fixed and fluidized beds
- Know the significance and usage of different particulate characterization parameters, and equipment to estimate them
- Describe Size reduction energy requirements, estimate performance of equipment, selection and sizing of equipment.
- Analyse filtration data and select systems based on requirements, estimate filtration area for given requirements, understand filter aids and their usage

Unit-I: Particulate Solid (8 hours): Properties of particulate solids, evaluation of size & shape, shape factor, surface and population of particles, standard screens and screen analysis of solids, screen efficiency, standard screen series.

Unit-II: Size Reduction (8 hours): Principles of communication, size reduction; crushing, grinding, pulverizing and ultra fining size reduction equipments, introduction to nano particles, power requirement in comminution.

Unit-III: Mixing and Separation (12 hours): Mixing of solids, mixing equipment's, design & power requirement of mixers, mixer effectiveness and mixing index. Principles of separation techniques for system involving solids, liquids & gases, classification, sedimentation and filtration, separation equipments, colloidal particles, flocculation and stabilization .

Unit-IV: Transportation and Handling (10 hours): Selection of conveying devices for solids: Belt, Chain, Screw – conveyors, Elevators and pneumatic conveying devices; elementary design aspects of the devices. visit to chemical engineering, industry engaged mainly with mechanical operation.

Unit-V: Fluidization (10 hours): Particulate & aggregative fluidization, characteristic of fluidized bed due to particle size, size distribution, shape and density, pressure drop through a fluidized bed and packed bed, character of dense phase fluidization as revealed by pressure drop fluctuations, up flow and down flow fluidization, fluid catalytic process, bed drying, mass transfer in fluidized beds.

References:

1. Perry RH & Don WG; Perry's Chemical Engineering Hand Book; Mc Graw Hill.
2. Nevers De; Fluid Mechanics for Chemical Engineers; TMH
3. Banchero Badker; Introduction to chemical engg; TMH
4. McCabe S, Harriot ; Unit Operations of Chemical Engg; TMH
5. Narayan CM, Bhattacharya BC; Mechanical operations for chemical eng.; PHI
6. Swain A.K., Hemlata Patra, G.K. Roy , Mechanical operation; TMH
7.

CMA-402	Fluid Particle Mechanics	0L:0T:1P	1 Credits	2Hrs/Week

List of Experiments:

1. To analyses the given sample by differential, cumulative methods using standard screen.
2. Determination of size & surface area of irregular particles using a measuring gauge.
3. To study crushing behavior & to determine the Rittinger's & Bond's constant of the given solid in a jaw crusher.
4. To determine the efficiency of a ball mill for grinding a material of known.
5. To determine the power consumption of the hammer mill.
6. To determine the specific cake resistance for the given slurry by leaf filter.
7. To determine the efficiency of a given cyclone separator.
8. To determine the efficiency of fluidized characteristic bed.
9. To study the Dorr type of thickener.
10. To study the plate & frame filter press.

Registrar Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

School of Engineering SSSUTMS SEHORE (M.P.)

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for
Undergraduate Degree Courses in Engineering & Technology
Department of Chemical Engineering

CMA-403 Fluid Mechanics

CMA-403	Fluid Mechanics	3L:0T:0P	3 Credits	3Hrs/Week

Course Preambles:

- The objective of this course is to introduce the mechanics of fluids (fluid statics and fluid dynamics), relevant to Chemical Engineering operations.
- The course will introduce students to forces on fluids, hydrostatic forces on submerged bodies, Eulerian and Lagrangian descriptions of flow, flow visualization, integral analysis involving mass and momentum balances, Bernoulli equation, flow through pipes and ducts, flow measurement and instruments, flow transportation - pumps, blowers and compressors.

Course Outcomes:

At the end of the laboratory course, students will be able to apply the principles of unit operations through experimentation and will demonstrate the ability to understand the various equipments used in chemical and allied process industry.

Unit-I: Review of Fluid Properties(12 hours): Engineering units of measurement, mass density, specific weight, specific volume, specific gravity, surface tension, capillarity viscosity, bulk modulus of elasticity, pressure & vapor pressure, fluid statics: pressure at a point, pressure variation in static fluid absolute & gauge pressure, manometers, dimensional analysis & dynamic similitude dimensional homogeneity, use of Buckingham pi-theorem, calculation of dimensionless numbers.

Unit-II: Kinematics of Flow (12 hours): Fluid flow phenomena, types of flow-ideal & real, steady & unsteady, uniform & nonuniform, one, two and three dimensional flow, path lines, streak lines, stream lines, stream tubes, continuity equation for one and three dimensional flow, rotational & irrotational flow, boundary layer theory, flow in boundary layer, flow past immersed bodies, packed bed, fluidized bed.

Unit-III: Dynamics of Flow (10 hours): Euler's equation of motion along with a streamline and derivation of Bernoulli's equation, application of Bernoulli's equation, energy correction factor, linear momentum equation for steady flow, momentum correction factor. The moment of momentum equation, forces on fixed and moving vanes and other applications.

Unit-IV: Fluid Measurements and Machines (10 hours): Velocity measurement (Pitot tube, Prandtl tube, current meters etc.) flow measurement (orifices, nozzles, mouth pieces, orifice meter, nozzle meter, venturi-meter, weirs and notches). Pumps, compressor, power & head requirement for pumps, piping system (K Factor), valves and joints.

Unit-V: Fluid Flow (6 hours): Introduction to laminar & turbulent flow, concept of Reynolds number & friction factor; friction factor for rough & smooth pipe loss of head due to friction in pipes & fittings.

References:

1. McCabe Smith;Unit Operation for Chemical Engg. TMH
2. Modi & Seth; Fluid Mechanics; Standard Book House, Delhi
3. Som and Biswas; Fluid Mechnics and machinery; TMH
4. Cengal; Fluid Mechanics; TMH
5. White; Fluid Mechanics; TMH
6. JNIK DAKE; Essential of Engg Hyd; Afrikan Network & Sc Instt. (ANSTI)
7. Douglas; Fluid Mechanics; Pearson
8. R Mohanty; Fluid Mechanics; PHI
9. Gupta; Fluid Mechanics; Pearson.
10. Rajpoot R. K. ;Fluid Mechanics and Hydrolic Machine.
11. Bansal R.K.; Fluid Mechanics and Hydrolic Machine

CMA-403	Fluid Mechanics	0L:0T:1P	1 Credits	2Hrs/Week

List of Experiments:

1. To determine the local point pressure with the help of pitot tube.
2. Calibration of venturimeter.
3. Determination of Cc, Cv, Cd of orifices.
4. Calibration of orifice meter.
5. Calibration of nozzle meter and mouth piece.
6. Reynolds experiment for demonstration of stream lines & turbulent flow.
7. Determination of metacentric height.
8. Determination of friction factor of a pipe.
9. To study the characteristics of a centrifugal pump.
10. Verification of impulse momentum principle.

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Undergraduate Degree Courses in Engineering & Technology

Department of Chemical Engineering

CMA-404 Fuel Technology

CMA-404	Fuel Technology	3L:0T:0P	3 Credits	3Hrs/Week

Course Preambles:

- To learn the characteristics of coal relevant to its preparation
- To identify the different unit operations used for the preparation of coal for its utilization in thermal power plants and coke ovens
- To get fundamental understanding of operation of industrial coal preparation plants.
- To train personnel in the method and development of fuel cell technology.

Course Outcomes:

- Appreciate the importance of coal and coal preparation for the Indian and global economies
- Understand the construction and operation of crushers and screens used for coal preparation
- Determine the expected yield and quality, and the expected difficulty of beneficiating a coal
- Understand the operation of beneficiation units for coarse coal and fine coal, in Indian context
- Carry out the performance analysis of coal beneficiation equipment
- Get orientation of industrial coal preparation flowsheets.

Unit-I: Solid Fuels & Coal Carbonization (10 hours): Coal & lignite reserves in India, classifications of coal, washing of coal, analysis of coal, proximate and ultimate analysis. Mechanism of low temperature carbonization and high temperature carbonization, byproduct recovery from coke oven, properties of coke coal, grinding, pulverization, briquetting of solid fuels.

Unit-II: Liquid Fuels (7 hours): Origin of petroleum production, distillation, thermal & catalytic cracking, coking, reforming, isomerizations, crude oil classification, reserves of hydrocarbon in India, introduction to petroleum refining and processing.

Unit-III: Petroleum Products Properties and Its Utilization (10 hours) : Petroleum product and their utilization, diesel, petrol, blending of petrol for octane number boosting, AVL (aviation liquid fuel), kerosene, fuel & furnace oil, testing of petroleum product: flash point, pore point, fire point, octane number, cetene number, viscosity and viscosity index, API.

Unit-IV: Gaseous fuels (6 hours): Natural gas, synthesis gas, producer gas, water gas, coal gas, LPG, CNG and hydrogen as a fuel, composition properties and uses.

Unit-V: Renewable Energy Sources and Fuel cell (6 hours): Types of solar cell and fabrication, wind energy, principles of tidal energy. Principle and working of fuel cell, various types, construction and its application.

References:

1. Sarkar S; Fuel and Combustion; Orient Long men Ltd.
2. Gupta OP; Fuel and Combustion; Khana Pub
3. Gary ; Refining of Petroleum Techonology
4. D.P. Kothari, K. C. Signal, R. Rajan, Renewable Energy Sources and Emerging technology, PHI Learning pvt. Ltd.
5. G.D. Roy, Non Conventional Energy Source, Khanna Publisher
6. J. Twidel, T Weir, Renewable Energy Sources, Taylor and Francis

CMA-404	Fuel Technology	0L:0T:1P	1 Credits	2Hrs/Week

List of Experiments:

1. To carry on proximate analysis of the given coal sample.
2. To determine the calorific value of the coal by Bomb-Calorimeter method.
3. To determine the viscosity of the given oil sample by Redwood Viscometer. No. 1 and No. 2
4. To determine the viscosity of a given oil sample by Saybolt viscometer.
5. To determine viscosity of a given coal tar with the help of tar viscometer.
6. To determine the flash and fire points of the given oil sample by Penskey Martin'sapparatus..
7. To determine the flash and fire points of the given oil sample by Abel's apparatus.
8. To determine the flash and fire points of the given oil sample by Cleveland apparatus.
9. To determine the carbon residue of the given oil by Conradson method.
10. To determine cloud and pour point of given oil sample (coconut) by cloud and pour point apparatus.

Registrar
Sri Sathya Sai University of Technology & Medical Sciences, Sehore (M.P.)

SSSUTMS School of Engineering SEHORE (M.P.)

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for
Undergraduate Degree Courses in Engineering & Technology
Department of Chemical Engineering

CMA-405 Inorganic Process Technology

CMA-405	Inorganic Process Technology	3L:0T:0P	3 Credits	3Hrs/Week

Course Preambles:
Objective of this subject is to expose students to understand the advancement in chemical process industries and its application to chemical engineering

Course Outcomes:
Students can synthesis production process of the required product.

Unit-I: Salts and Sodium Compounds (08 hours): Salts and sodium compounds, soda ash, caustic soda, chlorine and potassium salts.

Unit-II: Acids (06 hours): Hydrochloric acid, Sulphur and sulfuric acid, Phosphoric acid and phosphates.

Unit-III : Fertilizers (06 hours): Nitrogenous Industries, Ammonia and Nitric acid, Nitrogenous Fertilizer, mixed fertilizers, N-P-K Fertilizers and micronutrients.

Unit-IV: Cement (06 hours): Cement industries, Industrial gases: Nitrogen, Oxygen, Hydrogen, Helium and Argon.

Unit-V: Soaps and Detergents (10 hours): Inorganic chemicals, Bromine, Iodine and Fluorine, soaps and detergents, glass, ceramic and inorganic pigments.

References:

1. Austine G.T.and Shreeves; Chemicasl Process Industries; Mc GrawHill
2. Dryden C.E., M. Gopala Rao; Outlines Of Chemical Technology. Affiliated East-West Press
3. Pandey G.N.; Chemical Technology Volume- I; Lion Press, Kanpur.

CMA-405	Inorganic Process Technology	0L:0T:1P	1 Credits	2Hrs/Week

List of Experiments:

1. To determine the process flow diagram of salts and sodium compounds, soda ash, caustic soda.
2. To determine the process flow diagram of hydrochloric acid, sulphur and sulphuric acid, phosphoric acid and phosphate.
3. To determine the process flow diagram of nitrogenous industries, ammonia and nitric acid, nitrogenous fertilizer.

4. To determine the process flow diagram of cement industries and industrial gases.
5. To determine the process flow diagram of bromine, iodine, Fluorine, soaps and detergents, glass, ceramic and inorganic pigments.

CMA-406 Computer Programming –II

CMA-406	Computer Programming –II	0L:0T:1P	1 Credits	2Hrs/Week

Lab Preamble:

To introduce students

- Basics of software used in Chemical Engineering field
- Computer Aided Process Calculations in chemical field.

Lab Outcomes:

At the end of the lab the students will be able to

- Material Balance solution using Excel.
- Energy Balance Solution Using Excel
- Unit conversions of chemical process.

List of Experiments:

1. Introduction to Microsoft Excel.
2. Basic Operations
3. Using function
4. Unit conversions of chemical process.
5. Material Balance solution using Excel.
6. Energy Balance Solution Using Excel.

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Undergraduate Degree Courses in Engineering & Technology

Department of Chemical Engineering

CMA- 407 Industrial Training – I

CMA- 407	Industrial Training – I	0L:0T:0P	0 Credits	2Hrs/Week

Preambles:

The following objective should be fulfilled in industrial training –I, and student must participate in any Chemical, Petrochemical, Pharmaceutical, Oil and Gas industry where they can learn to apply the Technical knowledge in real Industrial situations.

Outcomes:

- Gain experience in writing Technical reports/projects.
- Expose students to the engineer's responsibilities and ethics.
- Expose the students to future employers.
- Understand the social, economic and administrative considerations that influence the working environment of industrial organizations.

Sri Satya Sai
University of Technology and Medical Sciences

(Established under Govt. of M.P. Registered under UGC 2(F) 1956)

Bhopal-Indore Road, Opp. Pachama oilfed plant, Pachama, Dist.-Sehore M.P.PIN-466001
Ph. 07562-223647, Fax : 07562-223644, Web: www.sssutms.co.in, info@sssutms.co.in

Name of Faculty: School of Engineering

Name of Department: **Chemical Engineering**

Minutes of Board of Studies Committee Meeting Dated on **08.06.2020**

The Board of Studies Committee Meeting was convened online on 2:30 PM. on **08.06.2020**,

Following members were present.

1. Dr. Anuradha Devi, Assoc. Prof. (Chemical Engineering), - Chairman
2. Dr. Satyendra Singh Tomar, Prof. (Chemical Engineering)
3. Dr. S. Suresh Assoc. Prof. (Chemical Engineering, MANIT Bhopal),-External Member
4. Dr. Neelu Jain, Prof. (Chemistry), Member
5. Mr. Manoj Kumar Gandwane, Asst. Prof. (Chemical Engineering), Member
6. Mr. Pradeep Semil, Asst. Prof. (Chemical Engineering), Member
7. Mr. Nilesh Ahirwar Asst. Prof. (Chemical Engineering), Member
8. Mrs. Arpita Bhattacharya, Senior Manager, Bharat Refineries, Industry Expert

The Chairman of Board of Studies Committee welcomes and appreciated the efforts put up by the faculty for progress of the departmental activities during pandemic COVID in session 2019-2020. The following Agenda points were discussed and resolved.

1. Preparation of syllabus and Scheme for V, VI, VII & VIII Sem as per AICTE guideline.

2. To discuss the examination pattern through online mode.

3. To discuss the internal marking system.

4. To implement Value added course "Drinking water analysis"

Resolution of the Discussion:

Registrer
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

SSUTMS Sehore (M.P.)

It was resolved that scheme and syllabus as proposed with some modification and may be accepted.

The online examination pattern has been adopted according to UGC guidelines.

Moreover the internal marking system also implemented according to UGC guidelines.

The committee has approved the proposal of starting new value added course "**Drinking water analysis**" for skill and employability enhancement of the students.

The online convening of BOS's meeting ended at 3:30 PM on 08.06.2020 with thanks to the chair.

Signature of All members (Including Chairman)

S. No.	BOS Members	Signature
1	Dr. Anuradha Devi, Assoc. Prof. (Chemical Engineering), - Chairman	
2	Dr. Satyendra Singh Tomar, Prof. (Chemical Engineering) , Member	
3	Dr. S. Suresh Assoc. Prof. (Chemical Engineering, MANIT Bhopal),-External Member	
4	Dr. Neelu Jain, Prof. (Chemistry), Member	
5	Mr. Manoj Kumar Gandwane, Asst. Prof. (Chemical Engineering), Member	
6	Mr. Pradeep Semil, Asst. Prof. (Chemical Engineering), Member	
7	Mr. Nilesh Ahirwar Asst. Prof. (Chemical Engineering), Member	
8	Mrs. Arpita Bhattacharya, Senior Manager, Bharat Refineries, Industry Expert	

Chairman

Registrar
Shri Satya Sai University of Technology & Medical Sciences Sehore (M.P)

SSSUTMS School of

Sri Satya Sai
University of Technology and Medical Sciences

(Established under Govt. of M.P. Registered under UGC 2(F) 1956)

COURSE NAME: CLEANER PRODUCTION& SUSTAINABLE DEVELOPMENT

DEPARTMENT OF CHEMICAL ENGINEERING
SCHOOL OF ENGINEERING
SSSUTMS, SEHORE

Course Objective

- Expertise in the field of cleaner production, energy auditing
- Ability to apply the principles and technical solutions to implement cleaner production
- Team working skills and reading specialized documents in English
- Consulting and implementing of cleaner production in manufacturing enterprises

Course outcomes

- Develop methodology of Cleaner Production
- Propose technical solutions in CP
- Select opportunities for cleaner production
- Calculate the material and energy balance
- Having teamwork skills
- Read specialized documents in English
- Implement of cleaner production in manufacturing enterprises

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

SSSUTMS Sehore (M.P.)

Bhopal-Indore Road, Opp. Pachama oilfed plant, Pachama, Dist.-Sehore M.P.PIN-466001
Ph. 07562-223647, Fax : 07562-223644, Web: www.sssutms.co.in, info@sssutms.co.in

Sri Satya Sai
University of Technology and Medical Sciences

(Established under Govt. of M.P. Registered under UGC 2(F) 1956)

Course Outline

S. No.	Course Contents	Hours
1	**Introduce to Cleaner Production**: Approach and the concept of cleaner production , Benefits of cleaner production, The implementation of cleaner production principles , The implementation of cleaner production techniques, Summary of Steps of CP in the industrial companies	6
2	**Methodology of Cleaner Production:** Methodology of Cleaner Production, The technical solutions to implement cleaner production, Balance of material and energy, The barrier in the process of cleaner production	6
3	**Establishing the CP monitoring system**: The baseline data, Monitoring Indicators, How to collect data, Analysis data	6
4	**Energy Audit:** History of energy usage, The concepts of energy audits, Energy management in the industrial enterprise, Use efficiency and save energy (boiler)	6
5	**Design for sustainable production :** What is sustainable design?, Why industry and society make D4S, Steps of D4S	6

Syllabus Prepared By

Manoj Kumar Gandwane

Approval (HoD)

Dr. Anuradha devi

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

SSSUTMS Scholar Indore (M.P.)

Bhopal-Indore Road, Opp. Pachama oilfed plant, Pachama, Dist.-Sehore M.P.PIN-466001
Ph. 07562-223647, Fax : 07562-223644, Web: www.sssutms.co.in, info@sssutms.co.in

Sri Satya Sai
University of Technology and Medical Sciences
(Established under Govt. of M.P. Registered under UGC 2(F) 1956)

COURSE NAME: DRINKING WATER QUALITY ANAYLSIS

DEPARTMENT OF CHEMICAL ENGINEERING
SCHOOL OF ENGINEERING
SSSUTMS, SEHORE

Course Description

Clean fresh water is one of the most vital natural resources. Since quality of water is susceptible to changes with time and other factors, continuous monitoring of water is essential. Water quality assessment provides the base line information on water safety. Qualitative and quantitative measurements are needed to guarantee the purity of water from various sources of supply. This course on water quality assessment is an attempt to equip students with theoretical background and practical skills to participate in water quality ensuring practices.

Course Objective

The course intends to prepare a student in acquiring skills on the art of water monitoring and quantitative analysis of critical water quality parameters. It also brings in those aspects of chemistry which are important for water quality management and pollution control.

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

SSSUTMS School of Engineering (M.P.)

Bhopal-Indore Road, Opp. Pachama oilfed plant, Pachama, Dist.-Sehore M.P.PIN-466001
Ph. 07562-223647, Fax : 07562-223644, Web: www.sssutms.co.in, info@sssutms.co.in

Course Outcome

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

- Explain the general properties of water and understand water resources and water conservation.
- Develop awareness about water quality criteria and standards, and their relation to public health and environment
- Understand important parameters for measuring water quality.
- Know about the methods for the determination of water quality parameters
- Learn how to run accurate water quality tests and to determine how the parameters relate to each other.

Course Content

I. Water Quality Fundamentals (8 hours)

Chemistry of water, Physical and chemical properties, Water recourses, water pollution, Important water Quality parameters and methods for their determination - turbidity, color, taste, pH, acidity, alkalinity, chemical constituents, hardness, dissolved oxygen etc., water sampling, standard for drinking water as per BIS specifications, household water treatment and safe storage.

II. Practical - Laboratory tests for water quality monitoring (15 hours)

Determination of pH and conductivity, Test for acidity and alkalinity, Test for total hardness, Test for chloride, calcium, iron etc., calculation of magnesium content and total solids.

III. Project (7 hours)

Quality assessment of water samples collected from different localities.

Syllabus Prepared By:
Mr. Manoj Kumar Gandwane

Approval (HoD)
Dr. Anuradha Devi

Bhopal-Indore Road, Opp. Pachama oilfed plant, Pachama, Dist.-Sehore M.P.PIN-466001
Ph. 07562-223647, Fax : 07562-223644, Web: www.sssutms.co.in, info@sssutms.co.in

COURSE NAME: ENVIRONMENTAL MANAGEMENT SYSTEM

DEPARTMENT OF CHEMICAL ENGINEERING
SCHOOL OF ENGINEERING
SSSUTMS, SEHORE

Course objectives

1. Understand environmental management system (EMS) definitions, concepts, and guidelines and requirements of the ISO 14001 standard

2. Understand the stages of EMS implementation learn best practice techniques, apply environmental management principles to achieve continual improvement in an organization

3. To provide a basic understanding of various tools and techniques such life cycle assessment, environmental audits, evaluation of environmental performance for environmental decision-making

Course outcomes

1. Acquainted with the environmental management system and its benefits

2. Able to identify and review audit-related documentation, prepare checklists and audit process

3. Able to apply tools such life cycle assessment, environmental audits, evaluation of environmental performance for environmental decision-making

4. To evaluate the effectiveness of systematic EMS monitoring processes.

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

SSSUTMS School of Engineering (M.P.)

Bhopal-Indore Road, Opp. Pachama oilfed plant, Pachama, Dist.-Sehore M.P.PIN-466001
Ph. 07562-223647, Fax : 07562-223644, Web: www.sssutms.co.in, info@sssutms.co.in

Course Outline

S No	Content	Hours
1.	The context of environmental management, overview of the state of the global environment, the earth's natural systems, sustainability and sustainable development–Case study	2
2.	Introduction to the evaluation tools, environmental management system (EMS), organizational barriers, management responsibility, elements and extent of application, EMS structure	4
3.	ISO 14000-Background, the ISO 14000 series, business and standards, voluntary standards and GATT/WTO, ISO 14000 and world practice, ISO 14000 in US, ISO Europe, international chamber of commerce principles, ISO in developing world; ISO 14001 & elements of EMS-environmental policy, planning, implementation and operation checking & correction action and management review–Case study	6
4.	Auditing Scope and objectives, standards for auditing, registration, implementing the audit, procedures, benefits, environmental auditing as a management tool-Case study	6
5.	Life Cycle Assessment Components of LCA, measuring environmental impact (life-cycle stages of product, boundaries, functional unit, issues at each life-cycle stage, benefits of LCA), strategic framework for LCA and LCA-a tool for sustainability-Case study	6
6.	Evaluating Environmental Performance Collecting data, analyzing data, evaluating information, reporting and communicating, reviewing–Case study	6

Syllabus Prepared By
Mr. Pradeep Semil

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

Approval (HOD)
Dr. Anuradha Devi

Bhopal-Indore Road, Opp. Pachama oilfed plant, Pachama, Dist.-Sehore M.P.PIN-466001
Ph. 07562-223647, Fax : 07562-223644, Web: www.sssutms.co.in, info@sssutms.co.in

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Undergraduate Degree Courses in Engineering & Technology

Department of Chemical Engineering

V SEMESTER

S.No.	Subject Code	Subject Name	Maximum Marks Theory Slot			Maximum Marks (Practical Slot)		Total Marks	Periods/ hour/ week			Credits
			End Sem. Exam.	Mid Tests	Assign-ments/Quiz	End Sem. Practical & Viva	Practical Record /Assignment / Quiz / Presentation		L	T	P	
1	CMA-501	Heat Transfer	60	30	10	30	20	150	2	1	2	4
2	CMA-502	Mass Transfer-I	60	30	10	30	20	150	2	1	2	4
3	CMA-503	Chemical Reaction Engineering-I	60	30	10	30	20	150	2	1	2	4
4	CMA-504	Program Elective-I	60	30	10	-	-	100	3	1	0	4
5	CMA-505	Open Core Elective - I	60	30	10	-	-	100	3	1	0	4
6	CMA-506	Industrial Training-II	-	-	-	150	100	250	-	-	4	2
	TOTAL		**300**	**150**	**50**	**240**	**160**	**900**	**12**	**5**	**10**	**22**

CMA-504, Program Elective-I	
CMA-504 (A)	Organic Process Technology
CMA-504 (B)	Oil & Paint Technology

CMA-505, Open Core Elective - I	
CMA-505 (A)	Petroleum Processing Technology
CMA-505 (B)	Conventional & Non-Conventional Energy Sources

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Undergraduate Degree Courses in Engineering & Technology

Department of Chemical Engineering

VI SEMESTER

S.No.	Subject Code	Subject Name	Maximum Marks Theory Slot			Maximum Marks (Practical Slot)		Total Marks	Periods/ hour/ week			Credits
			End Sem. Exam.	Mid Tests	Assign-ments/ Quiz	End Sem. Practical & Viva	Practical Record /Assignment/ Quiz / Presentation		L	T	P	
1	CMA-601	Mass Transfer-II	60	30	10	30	20	150	2	1	2	4
2	CMA-602	Chemical Reaction Engineering-II	60	30	10	30	20	150	2	1	2	4
3	CMA-603	Program Elective-II	60	30	10	-	-	100	3	1	0	4
4	CMA-604	Program Elective-III	60	30	10	-	-	100	3	0	0	3
5	CMA-605	Open Core Elective - II	60	30	10	-	-	100	3	0	0	3
6	CMA-606	Minor Project	-	-	-	180	120	300	-	-	4	2
	TOTAL		**300**	**150**	**50**	**240**	**160**	**900**	**13**	**3**	**8**	**20**

CMA-603, Program Elective-II	
CMA-603 (A)	Transport Phenomena
CMA-603 (B)	Bio Chemical Engineering

CMA-604, Program Elective-III	
CMA-604 (A)	Environmental Pollution & Pollution Control
CMA-604 (B)	Fertilizer Technology

CMA-605, Open Core Elective - II	
CMA-605 (A)	Nano Technology in Catalysis
CMA-605 (B)	Fluidization Engineering

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

SSSUTMS School of Engineering SEHORE (M.P.)

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Undergraduate Degree Courses in Engineering & Technology

Department of Chemical Engineering

VII SEMESTER

S.No.	Subject Code	Subject Name	Maximum Marks Theory Slot			Maximum Marks (Practical Slot)		Total Marks	Periods/ hour/ week			Credits
			End Sem. Exam.	Mid Tests	Assign-ments/Quiz	End Sem. Practical & Viva	Practical Record /Assignment/ Quiz / Presentation		L	T	P	
1	CMA-701	Process Control	60	30	10	30	20	150	3	0	2	4
2	CMA-702	Numerical Method in Chemical Engineering	60	30	10	30	20	150	3	0	2	4
3	CMA-703	Program Elective-IV	60	30	10	-	-	100	3	0	0	3
4	CMA-704	Open Core Elective - III	60	30	10	-	-	100	3	0	0	3
5	CMA-705	Project Stage-I	-	-	-	120	80	200	-	-	10	5
6	CMA-706	Self Study/GD/Seminar	-	-	-	-	200	200	-	-	2	1
	TOTAL		**240**	**120**	**40**	**180**	**320**	**900**	**12**	**0**	**16**	**20**

CMA-703, Program Elective-IV	
CMA-703 (A)	Polymer Technology
CMA-703 (B)	Multi-Phase Flow

CMA-704, Open Core Elective - III	
CMA-704 (A)	Food Technology
CMA-704 (B)	Optimization Methods

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

SUTMS

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Undergraduate Degree Courses in Engineering & Technology

Department of Chemical Engineering

VIII SEMESTER

S.No.	Subject Code	Subject Name	Maximum Marks Theory Slot			Maximum Marks (Practical Slot)		Total Marks	Periods/ hour/ week			Credits
			End Sem. Exam.	Mid Tests	Assign-ments/ Quiz	End Sem. Practical & Viva	Practical Record /Assignment/ Quiz / Presentation		L	T	P	
1	CMA-801	Chemical Process Modeling and Simulation	60	30	10	30	20	150	3	0	2	4
2	CMA-802	Program Elective-V	60	30	10	-	-	100	3	0	0	3
3	CMA-803	Open Core Elective - IV	60	30	10	-	-	100	3	0	0	3
4	CMA-804	Project Stage-II	-	-	-	240	160	400	-	-	16	8
	TOTAL		**180**	**90**	**30**	**270**	**180**	**750**	**9**	**0**	**18**	**18**

CMA-802, Program Elective-V	
CMA-802 (A)	Chemical Process Equipment Design
CMA-802 (B)	Novel Separation Technology

CMA-803, Open Core Elective - IV	
CMA-803 (A)	Safety and Risk Analysis
CMA-803 (B)	Petrochemical Technology

* Additional open electives can be provided as per the availability of faculty in the University and student should produce prior permission from Dean with a batch of at least 5 students.

SSSUTMS

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for
Undergraduate Degree Courses in Engineering & Technology
Department of Chemical Engineering

CMA-501	Heat Transfer	2L:1T:0P	3 credits	3Hrs/Week

Course Preambles:

- Basic Concepts of Heat Transfer
- Design and Rating of Heat exchangers with and Without Phase Change
- Design and Rating of Compact Heat Exchangers

Course Outcomes:

Students will be able to

- Identify and select type of shell and tube exchanger based on TEMA classification□
- Design double pipe heat exchanger, Shell and tube heat exchanger, finned tube and other compact heat exchangers.

Unit-I: Heat Transfer Fundamentals (8 Hours): Modes of heat transfer, thermal diffusivity and heat transfer coefficient; Differential equations of heat transfer.

Unit-II: Conductive heat transfer (8 Hours): One dimensional problems, heat transfer from extended surfaces, two and three dimensional problems. Insulation.

Unit-III: Convective heat transfer (10 Hours): Natural and forced convection; Dimensional analysis; Thermal boundary layer; Analogies and Correlations.

Unit-IV: Design of heat transfer equipment (15 Hours): Double pipe heat exchanger, concept of LMTD, DPHE sizing; shell and tube heat exchanger - Kern's method for design, effectiveness-NTU method, construction aspects in brief, Bell Delaware Method Design aspects of finned tube and other compact heat exchangers.

Unit-V: Basics of Heat transfer with phase change (15 Hours): Introduction to boiling, Introduction to condensation, Design aspects of Condensers, Reboilers and Evaporators, Heat Transfer to Agitated tanks, unsteady state heat transfer, Introduction to Radiative Heat Transfer, Design aspects of Furnaces.

Text / References:

1. R. Welty, C. E. Wicks, R. E. Wilson, G. Rorrer, Fundamentals of Momentum, Heat and Mass Transfer, 4th Ed.,Wiley (2007).
2. W. J. McCabe, J. Smith, P. Harriot, Unit Operations of Chemical Engineering, Sixth Edition, McGraw Hill (2005).
3. Holman, J. P., S. Bhattacharya, Heat Transfer, 10th Ed., Tata McGraw-Hill (2011).
4. D. Q. Kern, Process Heat Transfer, Tata-McGraw Hill (1997).
5. Bejan, A., A. D. Kraus, Heat Transfer Handbook, John Wiley (2003).

Registrar
Sri Satya Sai University of Technology & Medical Sciences, Sehore (M.P.)

SSSUTMS School of Engineering SEHORE (M.P.)

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Undergraduate Degree Courses in Engineering & Technology

Department of Chemical Engineering

CMA-501	**Heat Transfer**	**0L:0T:1P**	**1 credits**	**2Hrs/Week**

List of Experiment:

1. To determine the thermal conductivity of metal rod.
2. To determine the equivalent thermal conductivity of composite wall.
3. To determine heat transfer coefficient in force convection.
4. To determine heat transfer coefficient in Natural convection.
5. To determine heat transfer coefficient with the help of Stefan Boltzmann Apparatus.
6. To calculate emissivity of the test plate by emissivity measurement apparatus.
7. To determine heat transfer coefficient in double pipe heat exchanger.
8. To study the heat transfer characteristics of a shell and tube heat exchanger (heating/cooling) of water.
9. To determine heat transfer coefficient in parallel and counter flow heat exchanger.
10. To measure the rate of evaporation using an open pan evaporator.
11. To measure the rate of condensation of pure water vapour and to determine the heat Transfer coefficient.
12. Demonstrate the film-wise drop-wise condensation and determination of the heat transfer coefficient.
13. To study the single effect evaporator and find out the heat transfer coefficient.

Registrar
Sri Satya Sai University of Technology
& Medical Sciences, Sehore (M.P.)

SSSUTMS
School of Engineering
Sehore (M.P.)

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for
Undergraduate Degree Courses in Engineering & Technology
Department of Chemical Engineering

CMA-502	Mass Transfer-I	2L:1T:0P	3 credits	3Hrs/Week

Course Preambles:
Basic Concepts of Mass Transfer, Staged and Continuous Contact equipment design, gas absorption and distillation

Course Outcomes:
Students will be
• Able to design staged and continuous contactors□
• Familiar with special distillation techniques such as steam distillation and azeotropic distillation.

Unit-I: Fundamentals of Mass Transfer(10 Hours): Individual and film coefficients, overall mass transfer coefficient and their inter relationships; Analogies in transfer processes, determination of mass transfer co-efficient; two phase flow in packed beds, co-current and counter current processes flooding loading, column internals: types of trays/ plates and packing, point and plate efficiency.

Unit-II Diffusion phenomenon (15 Hours): Constitutive laws of diffusion unsteady state diffusion, Convective mass transfer, interphase mass transfer, mass transfer correlations, Mass transfer theories/models. Effect of chemical reaction on mass transfer Equilibrium stages and transfer units: number and height of transfer units; stage efficiency.

Unit -III Absorption (15 Hours): Solvent selection for absorption. Material balance and concept of driving force and minimum solvent rates. Gas absorption plate and packed column design; reactive absorption.

Unit-IV: Distillation (15 Hours): Introduction, Batch distillation; continuous binary fractionation, Azeotropic distillation; use of steam.

Unit-V Multistage distillation (10 Hours):: Introduction to multicomponent distillation, McCabe Thiele, and Ponchon-Savarit methods for multistage operations, tray efficiencies, concept of reflux, minimum reflux ratio, optimum reflux, total reflux, Murphree plate efficiencies.

Text / References:

1. Binay K.Dutta, Principles of Mass Transfer and Separation Processes,2nd edition, Prentice Hall of India,2007
2. R.E.Treybal, Mass Transfer Operations, 3rd Edition, McGraw Hill, New Delhi, 1983.
3. E.D. Cussler, Diffusion - Mass Transfer in Fluid Systems, Cambridge University Press, Cambridge 1984.
4. S. Foust, Principles of Unit Operations, 2nd Edition, Wiley, New York, 1980.
5. C.J. Geankoplis, Transport Processes and Unit Operations, 3rd Edition, Prentice Hall, India, 1993.

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for
Undergraduate Degree Courses in Engineering & Technology
Department of Chemical Engineering

CMA-502	**Mass Transfer-I**	**0L:0T:1P**	**1 credits**	**2Hrs/Week**

List of Experiment:

1. To study steam distillation
2. To study batch distillation.
3. Studies on packed tower distillation unit.
4. Studies on bubble cap distillation column.
5. To study the absorption of a gas in a packed column and calculation of NTU and HTU.
6. Liquid Diffusion – To calculate the Diffusion Coefficient for a liquid –liquid system
7. To study Solid in air Diffusion
8. Interphase Mass Transfer Coefficient – To calculate the individual and overall Mass Transfer Coefficient.

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Undergraduate Degree Courses in Engineering & Technology

Department of Chemical Engineering

CMA-503	Chemical Reaction Engineering - I	2L:1T:0P	3 credits	3Hrs/Week

Course Preambles:

- Basic Concepts of Kinetics and Rate Laws
- Design and Rating of Ideal Reactors including heat effects
- Interpretation of Rate data
- Design and Rating of Reactors involving multiple reactions including heat effects
- Analysis of Non-ideal flow Behavior in Reactors

Course Outcomes:

Students will be able to

- Design chemical reactors involving heat effects optimally using minimum amount of data
- Fix some problems related to operability and productivity
- Operate reactors in a safe manner for single and multiple reactions
- Analyse the non-ideality in the reactors

Unit-I: Reactions and reaction rates (10 Hours): Reactions and reaction rates - stoichiometry, extent of reactions, conversion, Selectivity Reaction rate fundamentals - elementary reaction sequences, steady state approximation and rate limiting step theory.

Unit-II Design of ideal reactors (15 Hours): Ideal reactors - generalized material balance, design equations, graphical interpretation, Design of Isothermal and non-isothermal batch, CSTR, PFR, reactors.

Unit -III Sizing and analysis (15 Hours): Sizing and analysis of ideal batch, mixed (CSTR), plug flow and recycle reactors - solving design equations for constant and variable density systems, reactors in series and parallel, Analysis and correlation of experimental kinetic data - data collection & plotting, linearization of rate equations, differential and integral method of analysis.

Unit-IV: Design of reactors for multiple reactions (15 Hours): Multiple reactions - conversion, selectivity, yield, series, parallel, independent and mixed series-parallel reactions.

Unit-V Basics of Non Ideal flow (15 Hours): RTD theory and analysis of non-ideal reactors. RTD Dispersion model, evaluation of RTD characteristics, Tanks in series model, Conversion in non- ideal flow reactors for simple systems.

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P)

SSSUTMS School of Engineering SEHORE (M.P.)

Text / References:

1. Elements of Chemical Reaction Engineering by H. Scott Fogler, 2nd Edition, Prentice Hall 2001
2. Chemical Reaction Engineering by Octave Levenspiel, 3rd Edition, John Wiley & Sons 2001
3. Smith J.M; Chemical Engineering Kinetics; Mc Graw Hill.
4. Denbigh & Turner K.G; Chemical Reaction Theory An Introduction; United Press.
5. Copper & Jeffery"s GVJ; Chemical Kinetics And Reactor Engineering; Prentice Hall

CMA-503	Chemical Reaction Engineering - I	0L:0T:1P	1 credits	2Hrs/Week

List of Experiment:

1. To study temperature dependency of rate constant, evaluation of activation energy and Verification of Arrhenius law
2. Study of non-catalytic homogeneous saponification reaction in CSTR.
3. To study a non-catalytic homogeneous reaction in a plug flow reactor.
4. To study the residence time distribution behavior of a back mix reactor.
5. To study the RTD behavior of a tubular reactor.
6. To study the RTD behavior of a packed bed reactor.
7. To study the kinetics of thermal decomposition of calcium carbonate.
8. To study a homogeneous catalytic reaction in a batch reactor under adiabatic conditions.
9. Study of non-catalytic saponification reaction in a tubular flow reactor.

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P)

SSSUTMS

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for
Undergraduate Degree Courses in Engineering & Technology
Department of Chemical Engineering

CMA-504 (A)	Organic Process Technology	3L:1T:0P	4 credits	3Hrs/Week

Course Preambles:
Objective of this subject is to expose students to understand the advancement in chemical process industries and its application to chemical engineering

Course Outcomes:
Students can synthesis production process of the required product.

Unit-I: Soaps and Detergents (10 Hours): Soaps and detergents, Difference between soaps and detergents, Classification of cleansing compounds, process of soap manufacture, Glycerol recovery, Manufacture of detergents: sulphated fatty alcohols and alkyl – aryl sulphonates.

Unit-II: Indian Sugar Industry (10 Hours): Important features of Indian sugar industry, Major unit operation of sugar industry, Alcohol fermentation, Raw materials for pulp making, Kraft and Sulphite pulping methods, Semi-chemical pulping, chemical recovery, stock preparation and paper making,

Unit-III: Petrochemicals (10 Hours): Important petrochemicals, Feed stock, Common unit processes: cracking, alkylation-dealkylation and hydroalkylation, halogenation, oxidation, hydrogenation-dehydrogenation; hydrationdehydration, nitration, amination, esterification, hydrolysis, hydroformylation process.

Unit-IV: Polymerization Reactions (10 Hours): Basic principles of polymerization reactions: bulk, solution, suspension and emulsion polymerisation, Synthesis of phenol formaldehyde, polyethylene, polystyrene and PVC, Dyes and Dye intermediates, insecticides and pesticides, nitration and nitrating agents.

Unit-V: Fibres (10 Hours): Natural and synthetic fibres, Fibre properties important in textile production, Manufacture of nylon 6,6 and nylon 6 fibres, viscose rayon and polyester fibres, polyamides.

Text / References:

1. Dryden C.E; Outlines Of Chemical Technology; Affilicted. East West press, New Delhi, 1997
2. G.T. Austin, Shreve's Chemical Process Industries, Mc Graw Hill.
3. Gupta VB & Kathari VK; Manufacturing Fibre Technology; Chapman Hall, Newyork I Edition
4. Kathari V.K.; Progress In Textile, Sciences Technology, Vol I & II; IAFL Publications, S-351 Greater Kailash part I New Delhi – 48 I Ed.
5. Austin, G.T; Shreeves Chemical Progress Industries; . Mc. Graw Hill New York

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

SSSUTMS School of Engineering SEHORE (M.P.)

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for
Undergraduate Degree Courses in Engineering & Technology
Department of Chemical Engineering

CMA-504 (B)	Oil & Paint Technology	3L:1T:0P	4 credits	3Hrs/Week

Course Preambles:
Painting companies of every size plan their future development and meet important revenue and profit targets. Painting companies decide where to focus their recruitment programs and their marketing resources.

Course Outcomes:

- To learn the basic ingredients required for paint formulation.
- The ability to understand the various factors to affect the stability of the paint.
- Students should be decided in the situation, and to decide the dosage of various additives in coating formulation.
- Basic knowledge of design paint formulation considering various ingredients.
- The ability to use different machinery and equipment in the laboratory and used on a commercial scale to handle.

Unit-I: Chemistry of Oils (10 Hours): Chemistry of Oils, Fats and Fatty Acids: i. Glycerides, ii. Fatty Acids, iii. Non Glyceride Components of Oils & Fats iv. Chemical Reactions of Fats and Fatty Acids.

Unit-II: Technology and Production of Oils & Fats (10 Hours): Technology and Production of Oils & Fats, Coconut, cotton seed, peanut, palm, sunflower, sesame, softlower, rice fran, rapeseed and mustard seed, linseed, soyabean, tung, casteroil lard and tallow. Minor Oils: Neem Oil and Salfat. a) Mechanical expression of oils, b) Solvent extraction of oilseed and oil bearing material, c) Fat splitting. Refining and Bleaching.

Unit-III: Degumming (10 Hours): Degumming, alkali refining (batch refining), Miscella refining, refining loses – Bleaching by absorption – continuous bleaching.

Unit-IV: Hydrogenation (10 Hours): Hydrogenation, Mechanism – selectivity as applied to the reaction and catalysis, Hydrogenation in practice (Batch & continuous) preparation of Raney Nickel catalyst, Soap manufacture, Raw materials required, selection of raw materials – full boiled process.

Unit-V: Utilization of refinery by-products (10 Hours): Utilization of refinery by-products (gums, soap stocks, deodorizer distillates, fatty acid, distillates, waxes, spent bleaching earth, etc.)

Text / References:

1. Feireidoon Shahidi, Bailey's Industrial Oil and Fat Products
2. E. Bernardini, Oils & fats Technology
3. W.M.Morgan, Outlines of Paint Technology
4. V.C.Malshe & Meenal Sikchi, Basics of Paint Technology, Part I & II.

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

SSSUTMS School of Engineering SEHORE (M.P.)

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for
Undergraduate Degree Courses in Engineering & Technology
Department of Chemical Engineering

CMA-505 (A)	Petroleum Processing Technology	3L:1T:0P	4 credits	3Hrs/Week

Course Preambles:

- An ability to apply acquired knowledge in the area of Petroleum Processing and Petrochemical Engineering
- To understand and know Origin, occurrence, Exploration, Drilling and Production of Crude Oil. Be aware of the challenges involved in refining from viewpoint of product specifications, economic considerations and environmental regulations.
- Provide students with a basic understanding of polymer processing techniques and rheological behavior.
- To understand standard testing methods for the evaluation of different properties.

Course Outcomes:

- An ability of creative thinking, critical analysis, problem solving and decision making specially in research and development
- Know the Origin, occurrence, Exploration, Drilling and Production of Crude Oil.
- Know the composition of crude oil and its products, along with its properties and characterization methods
- Understand the process of fractionation of crude oil and Identify the specifications required for good quality petroleum product

Unit-I: Petroleum Crude (10 Hours): Origin and occurrence of petroleum crude, status of petroleum refining in India; composition of petroleum, classification and physical properties of petroleum.; evolution of crude oil and petroleum products, future refining trends.

Unit-II: Crude Oil Distillation Process (10 Hours): Crude oil distillation process, pretreatment of crude, atmospheric and vacuum distillation process; secondary conversion processes; catalytic reforming, catalytic cracking and deep catalytic cracking.

Unit-III: Polymerization (10 Hours): Heavy residue up-gradation technologies; hydro-cracking, hydro-treating, vis-breaking and delayed coking alkylation, isomerisation, dehydrogenation processes, polymerization.

Unit-IV: Lubricating Oil (10 Hours): Lubricating oil, grease and bitumen: de-waxing and de-oiling, de-asphalting, lube hydro-finishing, bitumen air blowing, sweetening and desulphurization; hydro-desulphurisation of petroleum products.

Unit-IV: Introduction to major petrochemicals (10 Hours): Introduction to major petrochemicals like Synthesis gas, Acetaldehyde, Ethylene oxide, styrene, Acrylonitrile, Butadiene.

Text / References:

1. Nelson WL; Petroleum refinery engineering ; Mc. Graw hill
2. Hobson GD; Modern petroleum technology Part I & II; John Wiely & sons.

Registrar
Sri Satya Sai University of Technology & Medical Sciences, Sehore (M.P.)

SSSUTMS School of Engineering SEHORE (M.P.)

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for
Undergraduate Degree Courses in Engineering & Technology
Department of Chemical Engineering

CMA-505 (B)	Conventional & Non-Conventional Energy Sources	3L:1T:0P	4 credits	3Hrs/Week

Course Preambles:

- Non-conventional resources or renewable resources such as solar energy, wind energy, hydroelectricity, geothermal energy and tidal energy.
- Energy crisis and its solution by using non-conventional sources to maximum extent.

Course Outcomes:

- Understand the different non-conventional sources and the power generation techniques to generate electrical.
- The concept of solar energy and their applications in different fields.
- The ways to harness energy from non-conventional energy sources like geothermal, wind and ocean.

Unit-I: Global and National energy scenario (10 Hours): Global and National energy scenario, Conventional & renewable energy sources, need & development of renewable energy sources, types of renewable energy systems.

Unit-II: Energy and Development (10 Hours): Energy and development role of energy in industrial activity. Contemporary energy crisis, conventional and non-conventional energy sources, energy demand and availability. Energy audit need for energy conservation.

Unit-III: Solar Energy System (10 Hours): Solar energy system, introduction to wind energy conversion, Wind turbines, Wind farms, Bio energy system, design and constructional features.

Unit-IV: Thermal Renewable Energy Systems (10 Hours): Thermal renewable energy systems, appropriate energy technology for rural development, energy conservation, environmental aspects of renewable energy systems.

Unit-V: Energy Conservation (10 Hours): Fluidized bed combustion, Energy conservation in use of heat. Economical design of furnace, water treatment, drying, conditioning and industrial space heating, boiler accessories etc. Heat recovery in waste heat boilers: Conservation, integrated energy systems for industries.

Text / References:

1. Rakosh das begmudre, Energy conservation systems
2. GD Das, Non conventional energy sources
3. S.P. Sukhatme, Solar Energy by Padmashree
4. Harvey A., Dunn J.J, Solid waste Conversionto Energy
5. S. Rao & B.B. Parulka, Energy Technology

Registrar
Sri Satya Sai University of Technology & Medical Sciences, (M.P.)

SSSUTMS School of Engineering (M.P.)

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for
Undergraduate Degree Courses in Engineering & Technology
Department of Chemical Engineering

CMA-601	Mass Transfer-II	2L:1T:0P	3 credits	3Hrs/Week

Course Preambles:
To provide students the basic learning and understanding skills towards the problems related to separation & purification and in turn the approach to solve it by applying the concepts/principles learned in the curriculum and to increase the student's ability to apply the principles for the design of Mass Transfer Equipments and their application in process industries.

Course Outcomes:

- Students will be able to
- List situations where liquid–liquid extraction might be preferred to distillation□
- Explain the concept of breakthrough in fixed-bed adsorption□
- Design cooling towers
- Distinguish among micro-filtration, ultra-filtration, nano-filtration, and reverse osmosis

Unit-I: Liquid-liquid extraction (10 Hours): Liquid-liquid Extraction, Ternary equilibrium, Solvent selection, Single stage, multistage cross-current, counter-current extraction, equipment for liquid-liquid extraction, continuous Contact extraction in packed towers.

Unit-II Solid-Liquid Extraction (15 Hours): Leaching & Washing, Preparation of solids for Leaching, Equilibrium diagrams, ideal stage equilibrium, stage efficiencies, Calculation of single Stage and multi-stage leaching operation.

Unit -III Adsorption (15 Hours): Theories of adsorption, types of adsorbent, Isotherms, Break through curves, Stagewise operations, Adsorptions calculations and equipment's, Ion-Exchange; fixed bed absorbers, breakthrough.

Unit-IV: Humidification and Dehumidification (15 Hours): Principles, vapour-liquid equilibria, enthalpy of pure substances, basic definition of all humidification terms, methods of humidification and dehumidification, equipment like cooling towers, tray towers, spray chambers, spray ponds, cooling tower design – HTU, NTU concept, calculation of height of cooling tower.

Unit-V Drying (10 Hours): Drying Equilibria. Drying rate curves. Mechanism of drying. Calculation of batch and continuous drying. Drum dryers, spray and tunnel dryers. Membrane process, Ultrafiltration and Osmosis, Reverse Osmosis.

Text / References:

1. Binay K.Dutta, Principles of Mass Transfer and Separation Processes,2nd edition, Prentice Hall of India,2007
2. R.E.Treybal, Mass Transfer Operations, 3rd Edition, McGraw Hill, New Delhi, 1983.
3. AS. Foust, Principles of Unit Operations, 2nd Edition, Wiley, New York, 1980.
4. W.L. McCabe, J. Smith and P. Harriot, Unit Operations of ChemicalEngineering, 7th Edition, Tata McGraw Hill, India, 2014.
5. C.J. Geankoplis, Transport Processes and Unit Operations, 3rd Edition,Prentice Hall, India, 1993.

Registrar
Sri Satya Sai University of Technology
& Medical Sciences, (M.P.)

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for
Undergraduate Degree Courses in Engineering & Technology
Department of Chemical Engineering

CMA-601	**Mass Transfer-II**	**0L:0T:1P**	**1 credits**	**2Hrs/Week**

List of Experiment:

1. To prepare the drying rate curve for fluidized bed dryer.
2. To study the characteristics of spray dryer.
3. To study the characteristics of drum and Tunnel dryer.
4. To study the drying characteristics of a wet granular material using natural and forced circulation in tray dryer.
5. Tray Dryer – To calculate rate of Drying
6. Rotary Dryer – To study the Characteristics of Rotary Dryer
7. To study the characteristics of cooling tower
8. Humidifier and Dehumidifier – To study the Characteristics
9. Liquid-liquid equilibrium for ternary system
10. Liquid – Liquid Extraction (single stage and multistage)
11. Characterization of Spray Extraction Column

Registrar
Sri Satya Sai University of Technology
& Medical Sciences Sehore (M.P.)

SSSUTMS Sehore (M.P.)

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for
Undergraduate Degree Courses in Engineering & Technology
Department of Chemical Engineering

CMA-602	Chemical Reaction Engineering - II	2L:1T:0P	3 credits	3Hrs/Week

Course Preambles:

- Basic Concepts of Catalysis
- Kinetics and Mechanistic aspects of Catalysts
- Design and Rating of Catalytic Reactors
- Design Aspects of Gas-Liquid Reactors

Course Outcomes:

Students will be able to

- Design catalytic reactors
- Identify regions of mass transfer control and reaction rate control and calculate conversion

Unit-I: Catalysis (10 Hours): Introduction to Catalysis, homogeneous and heterogeneous catalysis. Preparation and characterisation of catalysts. Physical and chemical adsorption, Adsorption isotherms, Determination of BET surface area and pore volume of the Catalyst. Kinetics of solid catalyzed gas phase reaction.

Unit-II Design of catalytic reactors (15 Hours): Laboratory reactors for catalytic gas solid reactions. Design concepts, Isothermal & adiabatic fixed bad reactor staged adiabatic reactors, Non isothermal, non adiabatic fixed bed reactors.

Unit -III Non-catalytic gas-solid reactions (15 Hours): Non-catalytic gas-solid reactions, different model for gas-solid reactions, Mass transfer, Diffusion and Chemical reactions in catalysts. Effects of external mass transfer and heat transfer, Effectiveness factor. Design aspects of catalytic reactors.

Unit-IV: Gas liquid reactions (15 Hours): Gas liquid reactions, film and penetration theories, enhancement factor in gas-liquid reactions, gas-liquid reactors, Reaction design for instantaneous reactions and slow reactions.

Unit-V External transport processes (15 Hours): External transport processes and their effects on heterogeneous reactions yield and selectivity Reaction and diffusion in porous catalysts, Isothermal and non-isothermal effectiveness factors, Effect of intra-phase transport on yield, selectivity & poisoning, Global reaction rate.

Text / References:

6. Elements of Chemical Reaction Engineering by H. Scott Fogler, 2nd Edition, Prentice Hall 2001
7. Chemical Reaction Engineering by Octave Levenspiel, 3rd Edition, John Wiley & Sons 2001
8. Chemical and Catalytic Reaction Engineering, Carberry, J. J., Dover Books on Chemistry, 2001.

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

SSUTMS School of Engineering SEHORE (M.P.)

9. Chemical Reactor Analysis and Design Gilbert F. Froment, Kenneth B. Bischoff, Juray De Wilde, John Wiley & Sons, Incorporated, 2010

CMA-602	Chemical Reaction Engineering -II	0L:0T:1P	1 credits	2Hrs/Week

List of Experiment:

1. To determine the order and rate constant of saponification reaction at room temperature.
2. To determine the order and rate constant of esterification reaction at room temperature .
3. To study homogeneous catalytic reaction in a batch reactor under adiabatic conditions.
4. To study the rate constant of hydrolysis of an ester-catalyzed by acid.
5. Determine the rate constant and order of reaction between Potassium per sulphate and Potassium iodide
6. To study temperature dependency of rate constant, evaluation of activation energy and Verification of Arrhenius law
7. To study a homogeneous reaction in a semi-batch reactor under isothermal conditions.
8. Study of non-catalytic homogeneous saponification reaction in CSTR.
9. To study a non-catalytic homogeneous reaction in a plug flow reactor.
10. To study the residence time distribution behavior of a back mix reactor.

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for
Undergraduate Degree Courses in Engineering & Technology
Department of Chemical Engineering

CMA-603 (A)	Transport Phenomena	3L:1T:0P	4 credits	3Hrs/Week

Course Preambles:

- This course will highlight coupling between three transport phenomena with applications in various disciplines in engineering and science, and will demonstrate to the students the common mathematical structure of transport problems.
- The course will deal with flow problems involving Newtonian and non-Newtonian fluids, solid-state heat conduction, forced and free convection, binary diffusion with or without chemical reaction.

Course Outcomes:

On completion of the course, students would be familiar with

- Basics of vector and tensor analysis
- Be able to solve transport problems using shell balances
- Formulate and solve one-dimensional transport problems by using the conservation equations
- Formulate simple multi-dimensional transport problems

Unit-I: Introduction (10 Hours): Introduction to Transport Phenomena, Formulation of transport problems from nature, Vector and Tensor Analysis: Basic concepts.

Unit-II: Basics of momentum transport (10 Hours): Basics of momentum transport: Euler/Lagrangian viewpoint, laminar and turbulent flows, boundary layers, stress tensor.

Unit-III: Shell Momentum Balances (10 Hours): Shell momentum balances, equations of change, dimensional analysis, applications to isothermal flow of Newtonian & non-Newtonian fluids.

Unit-IV: Basics of energy transport (10 Hours): Basics of energy transport, conductive, convective and viscous dissipation energy fluxes, Equations of change for non-isothermal systems, dimensional analysis, and applications to steady-state conduction and convection, Basics of mass transport, mechanisms, and mass and molar fluxes.

Unit-V: Turbulence phenomena (10 Hours): Turbulence phenomena; phenomenological relations for transfer fluxes; time smoothed equations of change and their applications for turbulent flow in pipes; boundary layer theory; laminar and turbulent hydrodynamics thermal and concentration boundary layer and their thicknesses; analysis of flow over flat surface. Introduction to macroscopic balances for isothermal flow systems, non- isothermal systems and multicomponent systems.

Registrar
Sri Satya Sai University of Technology & Medical Sciences, Sehore (M.P.)

S S S U T M S
School of Engineering
SEHORE (M.P.)

Text / References:

1. R. B. Bird, W. E. Stewart, and E. S. Lightfoot. Transport Phenomena, 2nd ed., Wiley India Pvt. Ltd., 2002.
2. Welty, C. E. Wicks, R. E. Wilson, and G. L. Rorrer. Fundamentals of Momentum, Heat, and Mass Transfer. 5th ed., Wiley India Pvt. Ltd., 2007.
3. W. M. Deen, Analysis of Transport Phenomena, Oxford University Press, 1998.
4. W. J. Thompson, Introduction to Transport Phenomena, Prentice Hall, 2000.

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for
Undergraduate Degree Courses in Engineering & Technology
Department of Chemical Engineering

CMA-603 (B)	Bio Chemical Engineering	3L:1T:0P	4 credits	3Hrs/Week

Course Preambles:

1. To introduce the essential concepts of bioprocessing to traditional chemical engineers.
2. To make the student aware about advances in Biotechnology.
3. The Program encourages students to work in the field of biotechnology.

Course Outcomes:

The students will gain an ability to apply knowledge of mathematics, bioscience, and engineering. Students will learn to apply the principles of biology, engineering science, along with problem-solving skills and critical thinking to a broad spectrum of problems in biotechnology.

Unit-I: Introduction to Bioscience (10 Hours): Types of Microorganisms: Structure and function of microbial cells. Fundamentals of microbial growth, batch and continuous culture. Isolation and purification of Enzymes from cells. Assay of Enzymes. Functioning of cells and Fundamental Molecular.

Unit-II: Biology (10 Hours): Metabolism and bio-energetics, Photosynthesis, carbon metabolism, EMP pathway, tricarbocyclic cycle and electron transport chain, aerobic and anaerobic metabolic pathways. Synthesis and regulation of bimolecular, fundamentals of microbial genetics, role of RNA and DNA.

Unit-III: Enzyme Technology and Kinetics (10 Hours): Applications of enzymes in industry and medicine. Immobilization of enzymes, Kinetics of enzyme catalytic reactions involving isolated enzymes, Reversible inhibition. Reactions Catalysed By Enzymes.

Unit-IV: Reactors Analysis (10 Hours): Reactor Design and Analysis for soluble enzyme systems. Cofactor regeneration, Membrane reactor. Effect of mass transfer in immobilised enzyme particle systems. Reactors for immobilised enzyme systems. Bio Reactors, Effect of Transport Processes.

Unit-V: Introduction to Bioreactor design (10 Hours): Continuously Stirred aerated tank bioreactors. Mixing power correlation .Determination of volumetric mass transfer rate of oxygen from air bubbles and effect of mechanical mixing and aeration on oxygen transfer rate, heat transfer and power consumption. Multiphase bioreactors and their applications. Downstream processing and product recovery in bioprocesses.

Text / References:

1. J. E. Bailey and D. F. Ollis, Biochemical Engineering Fundamentals.
2. Trevan, Boffey, Goulding and Stanbury, Biotechnology.
3. M. L. Shuler and F. Kargi, Bio Process Engineering: Basic concepts.
4. Inamdar S.T.A, Biochemical Engineering – Principles and Concepts.

Registrar
Sri Satya Sai University of Technology & Medical Sciences, Sehore (M.P.)

SSSUTMS School of Engineering

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Undergraduate Degree Courses in Engineering & Technology

Department of Chemical Engineering

CMA-604 (A)	Environmental Pollution & Pollution Control	3L:0T:0P	4 credits	3Hrs/Week

Course Preambles:

The Pollution Control and the protection of the environmental quality with sustainable development The practice also helps in stopping pollution of water due to reduction in discharges of waste into water bodies and the receiving body.

Course Outcomes:

- Describe the effects of water pollution on aquatic ecosystems.
- Describe the effects of air pollution on the environment and on human health
- Describe the effects of water pollution on human health
- Describe some key principles that support pollution prevention and control

Unit-I: Environment (10 Hours): Interaction of man and environment, overall picture of environmental pollution, environmental air and water quality criteria, standards and acts, effects of pollution.

Unit-II: Air Pollution (10 Hours): dispersion of pollutant in the atmosphere, meteorological factors of air, stability and inversion of atmosphere, control of air pollution, air pollution control equipments. Methods of measuring and sampling of gaseous and particulate pollutants in ambient air and industrial waste gases.

Unit-III: Water Pollution (10 Hours): Sources, types of pollutants in liquid wastes of chemical industries, methods for the treatment of liquid wastes to control pollution, selection of pollution control equipment, Methods of sampling of waste water, Odour and its control.

Unit-IV: Solid Waste Disposal (10 Hours): Characterization of solid wastes, problems of collection and handling, various processing techniques used in solid waste management, solid waste as resource material,

Unit-V: Noise pollution (10 Hours): Noise pollution: noise control criteria, noise exposure index, Control.

Text / References:

1. C. S .Rao, Environment Pollution Control and Environmental Engg.
2. Peavy and Row, Environmental Engineering.
3. A.C. Stern, Air Pollution – Engg. Control of Air Pollution Vol IV.
4. J. O .M. Bockris, Environmental Chemistry.

Sri Satya Sai University of Technology & Medical Sciences, Sehore (M.P.)

SSSUTMS School of Engineering Sehore (M.P.)

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for
Undergraduate Degree Courses in Engineering & Technology
Department of Chemical Engineering

CMA-604 (B)	Fertilizer Technology	3L:0T:0P	4 credits	3Hrs/Week

Course Preambles:

- Provide exposure to Nitrogenous and Complex fertilizer production technologies.
- Overview to the most recent Nitrogenous fertilizer production technologies.
- Improve participants' technical knowledge over a varied range of fertilizer production techniques, understanding the best available technology options with cost effective, minimal energy consumption along with the best approaches to safety and environmental management.

Course Outcomes:

- Use reactions and unit operations steps in manufacturing of various fertilizers
- Characterize fertilizers on the basis of different properties.
- Identify engineering problems in fertilizer manufacturing.

Unit-I: Introduction (10 Hours): Introduction, Plant nutrients, different types of fertilizers and their production in India.

Unit-II: Nitrogenous Fertilizers (10 Hours): Different feed stocks, Synthesis gas production by steam-naptha reforming and gas purefication. Ammonia synthesis. Urea manufacturing processes. Manufacture of sulphuric acid and ammonium sulphate. Nitric acid and ammonium nitrate manufacture.

Unit-III: Phosphatic Fertilizers (10 Hours): Availability and grinding of rock phosphate, manufacturing processes for single and triple super- phosphate and phosphoric acid. Mixed Fertilizers: Availability and manufacture of muriate of potash.

Unit-IV: Mixed Fertilizers: (10 Hours): Mixed Fertilizers: Mono and di-ammonium phosphate, urea ammonium phosphates, NPK complex fertilizers, granulation techniques.

Unit-V: Manufacturing of organic fertilizer (10 Hours): Manufacturing of organic fertilizer, fertilizer produce by Vermi- compost.

Text / References:

1. Slack A.V, Chemistry and Technology of Fertilizers.
2. Austin G.T., and Shreve's, Chemical Processes Industries.
3. Waggaman W.H., Phosphoric Acid, Phosphates and Phosphatic Ferilizers.
4. Rao M.G. and Sittig M Dryden's, Outlines of Chemical Technology.

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

SSSUTMS

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for
Undergraduate Degree Courses in Engineering & Technology
Department of Chemical Engineering

CMA-605 (A)	Nano Technology in Catalysis	3L:1T:0P	4 credits	3Hrs/Week

Course Preambles:

- To give exposure to various types of equipment.
- Handing the instruments related to the separation process.
- Designing the experiments

Course Outcomes:

Synthesis of various nanoparticles are performed and their themal property using analytical equipments are done.

Unit-I: Generic methodologies for nanotechnology (10 Hours): Generic methodologies for nanotechnology: Introduction, classification and fabrication, Summary of the electronic properties of atoms and solids, Effects and importance of the nanometer length scale, Fabrication methods, Preparation, safety and storage issues, some key examples of nanotechnology.

Unit-II: Methods of Synthesis (10 Hours): Methods of synthesis of nanomaterial's fabrication-Top-down vs. bottom-upl approaches. Equipment and processes needed to fabricate nanodevices and structures.

Unit-III: Fundamental of Catalysis (10 Hours): Fundamental understanding of catalysis at nano-scale. Wet chemical synthesis, preparation and properties of iron, platinum, gold, cadmium, silver, copper and nickel nano-particles.

Unit-IV: Application in Chemical Technology (10 Hours): Synthesis and properties of composite nano-particles and coated nano-particles. Application in Chemical Technology: Polymer Nano composites-Synthesis, characterization, mechanical, thermal properties etc.

Unit-V: Characterization (10 Hours): Characterization of nano particles by Scanning probe microscopes (Atomic Force Microscopy, Scanning Tunneling Microscopy), Transmission Electron Microscopy, Scanning Electron Microscopy.

Text / References:

1. Nanotechnology: Principles and Practices, . S. K. Kulkarni .
2. Nano science and technology: novel structures and phenomena, Tang, Zikang and Sheng, Ping, Taylor and Francis,
3. Nanotechnology: Understanding small systems B. Rogers, S. Pennathur, J. Adams Nanotechnology in Catalysis Pinzhan.
4. Jurgen Schulte, Nanotechnology (strategies, industry trends, and applications, Willey, 1st Edition, England 2005

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for
Undergraduate Degree Courses in Engineering & Technology
Department of Chemical Engineering

CMA-605 (B)	Fluidization Engineering	3L:1T:0P	4 credits	3Hrs/Week

Course Preambles:

- To study the fluidization phenomena, fluidized bed regimes and models.
- Investigate effect of the size and density of spherical particles on the minimum fluidization velocity. At least three different particle sizes and three different densities should be considered.
- Investigate effect of fluid properties on the fluidization process by comparing air- and water-based fluidized beds.

Course Outcomes:

- Understand the fluidization phenomena and operational regimes.
- Design various types of gas distributors for fluidized beds and determine effectiveness of gas mixing at the bottom region.
- Analyze fluidized bed behavior with respect to the gas velocity.
- Develop and solve mathematical models of the fluidized bed.

Unit-I: Introduction (10 Hours): The phenomenon of fluidization; liquid like behaviour of a fluidized bed; Comparison with other contacting methods; Advantages and disadvantages of fluidized beds. Industrial applications of fluidized beds.

Unit-II: Coal gasification (10 Hours): Coal gasification; gasoline from other petroleum fractions; Gasoline from natural and synthesis gases; Heat exchange; Coating of metal objects with plastics; Drying of solids; Synthesis of phthalic anhydride; Acrylonitrile; Polymerization of olefins; FCCU; Fluidized combustion of coal; incineration of solid waste; Activation of carbon; gasification of waste; bio-fluidization.

Unit-III: Fluidization and Mapping of Regimes (10 Hours): Minimum fluidization velocity; Pressure drop vs. velocity diagram; effect of temperature and pressure on fluidization; Geldart classification of particles; terminal velocity of particles; turbulent fluidization; pneumatic transport of solids; fast fluidization; solid circulation systems;

Unit-IV: Single rising bubbles (10 Hours): Single rising bubbles; Davidson model for gas flow at bubbles; Evaluation of models for gas flow at bubbles.

Unit-V: Horizontal Movement of Solids (10 Hours): Horizontal movement of solids; Staging of fluidized beds.Gas Dispersion and Gas interchange in Bubbling Beds: Dispersion of gas in beds; Gas interchange between bubble and emulsion; Estimation of gas interchange coefficients.

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

SSSUTMS School of Engineering SEHORE (M.P.)

Particle to Gas Mass Transfer: Experimental interpolation of mass transfer coefficients; Heat transfer; Experimental heat transfer from the bubbling bed model.

Text / References:

1. Fluidization Engineering Kunil, Diazo and Octave Levenspiel Fluidization Max Leva.
2. Fluidization Engineering O. Levenspiel and D. Kunii,
3. Gas-Liquid-Solid Fluidization Engineering Liang-Shih Fan,

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

S S S U T M S
School of Engineering
SEHORE (M.P.)

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for
Undergraduate Degree Courses in Engineering & Technology
Department of Chemical Engineering

CMA-701	Process Control	3L:0T:0P	3 credits	3Hrs/Week

Course Preambles:

Objective is to introduce the fundamentals of process control with applications using P, PI, and PID controllers. The course will teach the students about mathematical models based on transfer function approach for single loop systems, how to obtain dynamic response of open loop and closed loop systems, stability analysis in transient and frequency domains, and controller tuning methods. The course would end with more advanced concepts like feed-forward control, ratio control, model-predictive control, ratio control, dead-time compensation, etc.

Course Outcomes:

Students will be able to

- Understand the importance of process dynamics (unsteady state operation)
- Tune a controller to reject disturbances or manage operating point transitions

Unit-I: Introductory Concepts (10 Hours): Need for control and automation, control logic, servo and regulatory control, block diagrams, control structures (feedback vs. feedforward), process and instrumentation diagrams.

Unit-II: Laplace transforms (10 Hours): Laplace transforms solution of ODEs using Laplace transform, Transfer function approach, response of first order systems: step, impulse and sinusoidal response, first order systems in series.

Unit-III: Second order systems (10 Hours): Second order systems, higher order systems, transportation lag and dead time, Linear closed loop systems, development of block diagrams, classical feedback controllers, Final control element such as Proportional, Integral, PD, PID controllers (control valves), block diagram reduction techniques.

Unit-IV: Closed loop response (10 Hours): Closed loop response, servo and regulatory problems, Stability analysis, Routh stability criterion, Root locus diagrams (rule based), Introduction to frequency response, notion of stability.

Unit-V: Bode diagrams (10 Hours): Bode diagrams, Nyquist plots, Bode and Nyquist stability criterion, Controller tuning: Ziegler-Nichols method, Cohen-Coon method, Introduction to advanced controllers: cascade control, feed forward control, ratio control, Smith-predictor, IMC, MPC, dead-time compensation, Introduction to digital control.

Text / References:

1. Coughanowr, D. R., LeBlanc, S. "Process Systems Analysis and Control", 3rd edition, McGraw-Hill (2008).
2. Seborg, D.E., Edgar, T.F., Mellichamp, D.A. "Process Dynamics and Control", 2nd edition, John Wiley (2003)
3. Stephanopoulos, G. "Chemical Process Control: An Introduction to Theory and Practice", Pearson Education (1984)

Registrar (Registrar) Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

S S S U T M S School of Engineering SEHORE (M.P.)

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Undergraduate Degree Courses in Engineering & Technology

Department of Chemical Engineering

CMA-701	**Process Control**	**0L:0T:1P**	**1 credits**	**2Hrs/Week**

List of Experiment:

1. To study the characteristics of control valves (linear, quick opening, etc)
2. To study the dynamics of liquid level systems of non-interacting and interacting types.
3. To study the response of mercury in glass thermometer with and without a thermowell.
4. To study the characteristics of an electronic PID controller.
5. To study the characteristics of a current to pneumatic converter.
6. To study the effectiveness of computer control of a distillation column.
7. To study the effectiveness of a computer control of a heat exchanger.
8. To study to effectiveness of a computer control of a chemical reactor
9. To study to dynamics of a pressure tanks.
10. To calibrate an air purged liquid level indicator.

Registrar
Sri Satya Sai University of Technology
& Medical Sciences, Sehore (M.P.)

SSSUTMS
School of Engineering
SEHORE (M.P.)

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for
Undergraduate Degree Courses in Engineering & Technology
Department of Chemical Engineering

CMA-702	Numerical Method in Chemical Engineering	3L:0T:0P	3 credits	3Hrs/Week

Course Preambles:

To introduce students to numerical methods used to solve engineering problems, in particular chemical engineering problems, using numerical methods and computer programming. Fundamentals of numerical methods/algorithms to solve systems of different mathematical equations (e.g. linear/ non-linear algebraic equations, ordinary /partial differential equations), will be introduced. The course would enable students to write their own computer programs using programming languages like C and commercial software like Matlab. Hands-on experience will be provided to apply these computer programs to solve problems in different areas of chemical engineering e.g. fluid flow, heat and mass transfer, chemical reaction engineering etc. Practicals to involved solving actual chemical engineering problems through computer programming and coding.

Course Outcomes:

Students will be able to solve chemical engineering problems involving

- Linear and non-linear equations
- Ordinary and partial differential equations using programming languages like C and softwares like MATLAB.

Unit-I: Introduction Error & Linear Algebraic Equations (10 Hours): Introduction, Approximation and Concept of Error & Error Analysis, Linear Algebraic Equations: Methods like Gauss elimination, LU decomposition and matrix inversion, Gauss-Siedel method, Chemical engineering problems involving solution of linear algebraic equations.

Unit-II: Non-Linear Algebraic Equations (10 Hours): Root finding methods for solution on non-linear algebraic equations: Bisection, Newton-Raphson and Secant methods, Chemical engineering problems involving solution of non-linear equations.

Unit-III: Interpolation (10 Hours): Interpolation and Approximation, Newton's polynomials and Lagrange polynomials, spline interpolation, linear regression, polynomial regression, least square regression.

Unit-IV: Numerical integration (10 Hours): Numerical integration, Trapezoidal rule, Simpson's rule, integration with unequal segments, quadrature methods, Chemical engineering problems involving numerical differentiation and integration.

Unit-V: Ordinary Differential Equations(10 Hours): Ordinary Differential Equations, Euler method, Runge-Kutta method, Adaptive Runge-Kutta method, Initial and boundary value problems, Chemical engineering problems involving single, and a system of ODEs, **Introduction to Partial Differential Equations:** Characterization of PDEs, Laplace equation, Heat conduction/diffusion equations, explicit, implicit, Crank-Nicholson method.

Registrar
Sri Satya Sai University of Technology & Medical Sciences, Sehore (M.P.)

SSSUTMS School of Engineering Sehore (M.P.)

Text / References:

1. Gupta, S. K., "Numerical Methods for Engineers, New Academic Science, 2012.
2. S.C. Chapra & R.P. Canale, "Numerical Methods for Engineers with Personal Computer Applications", McGraw Hill Book Company, 1985.
3. R.L. Burden & J. D. Faires, "Numerical Analysis", 7th Ed., Brooks Coles, 2000.
4. Atkinson, K. E., "An Introduction to Numerical Analysis", John Wiley & Sons, 1978.
5. Press, W. H. et al., "Numerical Recipes in C: The Art of Scientific Computing, 3rd Edition, Cambridge University Press, 2007.

CMA-702	Numerical Method in Chemical Engineering	0L:0T:1P	1 credits	2Hrs/Week

List of Experiment:

1. Introduction to use of computers for numerical calculations (1 practical turn)
2. Solution of linear algebraic equations using Gauss elimination, Gauss-Siedel etc. (2 practical turns)
3. Solution of a non-linear equations using bracketing and Newton-Raphson method (2 practical turns)
4. Interpolation and Approximation(2 practical turns)
5. Numerical integration(2 practical turns)
6. Euler method (1 practical turn)
7. Runge-Kutta methods for ODEs (2 practical turns)
8. Solution of system of ODEs using simple methods (1 practical turn)
9. Solution of simple PDEs (2 practical turns)

Registrar
Sri Satya Sai University of Technology & Medical Sciences Schore (M.P.)

SSSUTMS School of Engineering SEHORE (M.P.)

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for
Undergraduate Degree Courses in Engineering & Technology
Department of Chemical Engineering

CMA-703 (A)	Polymer Technology	3L:0T:0P	4 credits	3Hrs/Week

Course Preambles:

- To study industrial manufacturing process advantages disadvantages, process parameters of the thermoplastics like PVC Cellulosics Speciality polymers etc
- To give understanding of properties like physical mechanical thermal rheological etc and structure properties and relationship
- To make aware of practical applications of thermoplastics.
- To study basic processing methods coating applications related to of the thermoplastics

Course Outcomes:

- Explain central concepts within the fields of polymer physics and polymer technology
- Describe phenomena in terms of properties of polymer systems at molecular level
- Describe the relationship between microscopic and macroscopic levels for polymer systems
- Solve simple polymer-related problems arising in industrial contexts

Unit-I: Polymerization Chemistry (10 Hours): Chain, step and miscellaneous polymerization reactions and polymerization technique. Polymerization kinetics: Free radical, cationic and anionic polymerization, poly-condensation and polymerization.

Unit-II: Polymerization Processes (10 Hours): Bulk solution, emulsion and suspension polymerization, thermoplastic composites, fiber reinforcement fillers, surface treatment reinforced thermo-set composites resins, fillers, additives.

Unit-III: Polymer Reactions (10 Hours): Hydrolysis, acidolysis, aminolysis, hydrogenation, addition and substitution reactions, reactions of various specific groups, cyclyzation and cross linking reactions, reactions leading to graft and block copolymer

Unit-IV: Manufacturing Processes of Polymers (10 Hours): Manufacturing processes of important polymers: Plastics- polyethylene, polypropylene polyvinyl chloride & copolymer, polystyrene; Phenol-formaldehyde, epoxides, urethane, Teflon, elastomers, robbers, polymeric oils - silicon fibers - cellulosic (Rayon), polyamides (6:6 Nylon), Polyesters (Dacron). Acrylic-olefin.

Unit-V: Composite Materials (10 Hours): Composite materials - Ceramic and other fiber reinforced plastics, Polymer degradation - Thermal, Mechanical, Ultrasonic, Photo, High energy radiation, Ecology and environmental aspects of polymer industries. Rheological Sciences Equations, Uni-coelastic models - Maxwell.

Text / References:

1. Rodringuez; Principles of polymer systems; TMH
2. Billmayer Jr, Fred W.; Textbook of polymer science; Wiley tappon
3. David J Williams; Polymer science & engineering; PHI
4. Mc. Keley, JH; Polymer processing; John Wile

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

SSSUTMS School of Engineering SEHORE (M.P.)

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for
Undergraduate Degree Courses in Engineering & Technology
Department of Chemical Engineering

CMA-703 (B)	Multi-Phase Flow	3L:0T:0P	4 credits	3Hrs/Week

Course Preambles:

- The fallout of the multiphase flows is focused on: oil and gas industry, nuclear components and subsystems, chemical and petrochemical industry.
- Multiphase flow is important in many areas of chemical and process engineering. The behaviour of the material will depend on the properties of the components, the flow rates, and the geometry of the system.

Course Outcomes:

- Develops as the flow rate is increased whilst vapor flow is maintained at a low amount.
- Two phase flows are commonly found in ordinary life and in industrial processes.
- Gas-liquid flow also occurs in boiling and condensation operations.

Unit-I: Introduction (10 Hours): Introduction to the flow of multiphase mixtures: gas or vapor liquid, liquid-liquid, liquid-solid, gas-solid, solid-liquid-gas and gases carrying solids (pneumatic transport) stratification and dispersion, Flow regimes and flow patterns.

Unit-II: Gas (Vapor) and Liquid Flows (10 Hours): Horizontal flow, Vertical flow, pressure, momentum and energy relations, methods of evaluating pressure drop, Lockhard - Martinell, Chisholm correlations, critical flow, non-Newtonian flow.

Unit-III: Physical-Chemical Properties (10 Hours): Physical, chemical properties, rheology, corrosive nature, viscosity, Solid particle size, distribution phase, and density i.e. their factors effecting behavior in a fluid, Concentration of particles and the flow rates of both solids and liquid.

Unit-IV: Solid-Gas Flow (10 Hours): Horizontal flow, Suspension mechanism, determination of voids, energy requirements for conveying, pressure drop and solid velocities in dilute phase flow, dense phase conveying, vertical transport.

Unit-V: Bubble and Drop Formation (10 Hours): Phase holdups, Interfacial areas, mixing and pressure drops, multiphase (gas liquid solid) operations.

Text / References:

1. The flow of complex mixtures in pipe Govier, G.W. and Aziz, K
2. Chemical engineering, Vol I, Coulson JM and Richardson J.F
3. Multiphase Flow Handbook Crowe, C.T.
4. Fundamentals of Multiphase Flow Brennen, C.E

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

SSSUTMS School of Engineering SEHORE (M.P.)

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for
Undergraduate Degree Courses in Engineering & Technology
Department of Chemical Engineering

CMA-704 (A)	Food Technology	3L:0T:0P	4 credits	3Hrs/Week

Course Preambles:

- Knowledge and understanding of food properties, processing and preparation and their interrelationship to produce quality food
- Knowledge and understanding of nutrition and food consumption, and the consequences of food choices on health.

Course Outcomes:

- demonstrates hygienic and safe practices in the selection, handling and storage of food.
- Recognises the relationship between food properties, preparation and processing.
- Recognises the nutritional value of food items, recognises the impact of food habits and choices on health.

Unit-I: Introduction (10 Hours): Current status of the Indian a) agriculture b) Food Industry c) Food processing industry.

Unit-II: Basic Food Biochemistry and Microbiology (10 Hours): Food Constituents, Water activity enzymes, Ambient Temperature Processing: Raw material preparation, Size reduction of solid fibrous foods and in liquid foods, Emulsification and Homogenization, Theory and equipment, Mixing and Forming, Extraction and expression,

Unit-III: Membrane Concentration Fermentation (10 Hours): Membrane concentration Fermentation: Theory, Types, Equipment Effect on foods.

Unit-IV: Heat Processing using Heat or Water (10 Hours): Theory, Equipment, Effect on foods, blanching, extrusion, pasteurization, Heat Sterilization, In-container Ultra high temperature (UHT)/aseptic processes. Heat processing using Hot air: Theory, Equipment, Effect on foods, Dehydration, Baking and Roasting; Heat Processing using hot oils: Theory, Equipment, Effect on foods Frying.

Unit-V

Unit-V: Heat Processing by Direct & Radiated Energy: (10 Hours): Heat Processing by direct & radiated energy: Theory, Equipment, Effect on foods Dielectric heating microwave. Processing by removal of heat, Food Preservation & Storage Food contamination Modified Atmosphere Storage (MAS) Hurdle Technology, Post Processing, Applications, and Packaging.

Text / References:

1. Vijaya khader, Preservation of Fruits and Vegetables.
2. Viyaya khader, Food Processing and Preservation.
3. Srilakshmi. B, Food science, (2nd edition) & Food science & Nutrition.
4. Swaminathan. M, Essentials of Food and Nutrition , Vol. I & II.

Registrar
Sri Satya Sai University of Technology & Medical Sciences, Sehore (M.P.)

SSSUTMS * Faculty of Engineering * SEHORE (M.P.)

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for
Undergraduate Degree Courses in Engineering & Technology
Department of Chemical Engineering

CMA-704 (B)	Optimization Methods	3L:0T:0P	4 credits	3Hrs/Week

Course Preambles:

- To understand the basics of optimization techniques, and problem formulation for optimization
- To understand the single variable and multivariable optimization techniques and their application
- To understand the linear programming application for optimization
- To understand the advance optimization technique like the genetic algorithm

Course Outcomes:

- The students will understand the necessary and sufficient condition for optimization and will be able to formulate the optimization problem.
- The students will be able to solve different optimization problem and their application to the case studies like heat exchanger, evaporator etc.

Unit-I: Nature and Organization of Optimization Problems (10 Hours): What optimization is all about, Why optimize, scope and hierarchy of optimization, examples of applications of optimization, the essential features of optimization problems, the general procedure for solving optimization problems, obstacles to optimization.

Unit-II: Basic Concepts of Optimization (10 Hours): Continuity of functions, unimodal versus Multimodel functions. Convex and Concave functions, Convex region, Necessary and sufficient conditions for an extremum of an unconstrained function, interpretation of the objective function in terms of its quadratic approximation.

Unit-III: Optimization of Unconstrained Functions (10 Hours): One-dimensional search: Numerical methods for optimizing a function of one variable, scanning and bracketing procedures, Newton's, Quasi-Newton's and Secant methods of uni-dimensional search, region elimination methods, polynomial approximation methods, how the one- dimensional search is applied in a multi-dimensional problem, evaluation of uni-dimensional search methods.

Unit-IV: Unconstrained Multivariable Optimization (10 Hours): Direct methods, random search, grid search, uni-variate search, simplex method, conjugate search directions, Powell's method, indirect methods- first order, gradient method, conjugate method, indirect method-second order: Newton's method forcing the Hessian matrix to be positive definite, movement in the search direction, termination, summary of Newton's method, relation between conjugate gradient methods and Quasi-Newton method.

Unit-V: Modern methods of Optimization (10 Hours): Modern methods of Optimization: Genetic Algorithms – Simulated Annealing – Ant colony optimization – Tabu search – Neural-Network based Optimization – Fuzzy optimization techniques – Applications. Use of Matlab to solve optimization problems.

Registrar
Sri Satya Sai University of Technology & Medical Sciences, Sehore (M.P.)

SSSUTMS * Sehore (M.P.)

Text / References:

1. Edgar, T.F., D.M. Himmelblau, and L.S. Lasdon, Optimization of Chemical Processes, 2nd Edition, McGraw-Hill International Edition, Singapore, 2001.
2. Rao, S.S., Engineering Optimization Theory and Practice, 4th Edition, A Wiley Interscience Publication, Canada, 2009.
3. Reklaitis, G.V., A. Ravindran, and K.M. Ragsdell, Engineering Optimization: Methods and Applications, 2 nd Edition, John Wiley, New York, 2006.
4. Fletcher R., Practical method of optimization, 2 nd Edition, John Wiley, New York, 2000.
5. Chong E.K.P. and Zal S. H., An Introduction to optimization, 2 nd Edition, John Wiley, New York, 2001.
6. Nocedal J. and Wright S.J. Numerical Optimization, 2 nd Edition, Springer,2000.
7. G. Mitsuo and C. Runwei, Genetic Algorithms and Engineering Optimization, John Wiley, New York, 2000.

Registrar
Sri Satya Sai University of Technology & Medical Sciences (S.S.S.U.T.M.S.)

S S S U T M S
School of Engineering

CMA-801 Chemical Process Modeling and Simulation

CMA-801	Chemical Process Modeling and Simulation	3L:0T:0P	3 credits	3Hrs/Week

Course Preambles:

- To understand knowledge of fundamental principles and basic laws of modeling
- To understand the approach for mass/heat transfer & CRE
- To apply the knowledge of differential equations
- To understand the approach to modeling
- Formulation of a mathematical model for various chemical Engg. System.

Course Outcomes:

Students are able to model every Chemical Engineering system assigned to them. Moreover, they could make the program of the model equation to get output results and analyzed the performance of the system.

Unit-I: Introduction (07 Hours): Introduction, Uses of mathematical models, Scope of coverage, Principles of formulations, Introduction of Matlab and use of the language to solve modeling problems.

Unit-II: Mathematical Modeling in Chemical Reaction Engineering (15 Hours): Mathematical Modeling in Chemical Reaction Engineering: CSTR, PFR, Batch reactor, semibatch reactor, Series of isothermal CSTR, constant hold-up CSTR's, CSTR's with variable hold ups, gas phase pressurized CSTR, non isothermal CSTR, Bioreactor, trikle bed reactor. Simulation, program development and numerical solutions of above processes.

Unit-III Mathematical Modeling in Mass Transfer (15 Hours): Mathematical Modeling in Mass Transfer: Ideal binary distillation column, multicomponent non ideal distillation column, batch distillation with hold up, steam distillation, Multisolute batch liquid- liquid extraction, continuous extraction, multistage countercurrent extraction, plug flow type liquid- liquid extraction, reactor with mass transfer, Absorption, Adsorption. Simulation, program development and numerical solutions of above processes.

Unit-IV: Mathematical Modeling in Heat transfer (10 Hours): Mathematical Modeling in Heat transfer: Two heated tanks, single component vaporizer, double pipe heat exchanger, shell and tube heat exchanger, multicomponent flash drum, cooling towers. Simulation, program development and numerical solutions of above processes.

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

SSSUT MS Scholar Engineering SEHORE (M.P.)

Unit-III: Mathematical Modeling in other chemical processes (12 Hours): Mathematical Modeling in other chemical processes: Interacting and non-interacting systems with and without heaters, isothermal hydraulic system, forward and backward feed triple effect evaporator, melting, batch reverse osmosis Unit, Real CSTR modeled with an exchange volume, Real CSTR modeled using by passing and dead space, Two CSTR's with interchange. Simulation, program development and numerical solutions of above processes.

Text / References:

1. Process Optimization in Chemical Engineering by Edger Himmelblau.
2. Lubyen W. L., Process Modeling, Simulation and Control for Chemical Engineers, McGraw- Hill, New York, 1989.
3. Elements of Chemical Reaction Engineering by Fogler, Prentice Hall of India.
4. Mickley H. S., Sherwood T. S., Reed C. E., Application of Mathematical Modeling in Chemical Engineering, Tata-McGraw-Hill, New Delhi, 2002.
5. A. Kayode Coker, Modelling of Chemical Kinetics and Reactor Design, Gulf professional publication

CMA-801	**Chemical Process Modeling and Simulation**	**0L:0T:1P**	**1 credits**	**2Hrs/Week**

List of Experiment:

1. Modeling and simulation of Chemical reaction processes
2. Modeling and simulation of mass transfer processes
3. Modeling and simulation of heat transfer processes
4. Modeling and simulation of fluidized process
5. Modeling and simulation of flash evaporator
6. Modeling and simulation of linear and non linear systems

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Undergraduate Degree Courses in Engineering & Technology

Department of Chemical Engineering

CMA-802 (A) Chemical Process Equipment Design

CMA-802 (A)	Chemical Process Equipment Design	3L:0T:0P	3 credits	3Hrs/Week

Course Preambles:

- Provide students with a basic understanding equipment design.
- To teach students the design of pressure vessel.
- To teach students the design of the storage vessel.
- To teach students to apply the design concepts in practical industrial design problem.

Course Outcomes:

After completion of this course, the students will be able to do the design of industrial pressure vessel and storage vessel.

Unit-I: Importance of Chemical Process Equipment Design (10 Hours): Importance of chemical process equipment design, the design procedure for pressure vessels subjected to internal pressure, and combined loading, closures for pressure vessels, Code and standards for pressure vessels (IS:2825:1969), materials of construction, selection of corrosion allowance and weld joint efficiency.

Unit-II: Design of Pressure Vessels (08 Hours): Design of pressure vessels subjected to high pressure, monoblock construction, shrink fit construction, external pressure, optimum proportions of pressure vessels, optimum sizing of vessels.

Unit-III: Design of Supports (07 Hours): Design of supports, flanges, nozzles for vessels, Design of jackets, coils for pressure vessels.

Unit-IV: Mechanical Design of Storage Tanks (10 Hours): Mechanical design of storage tanks for volatile and non-volatile liquids, roof and bottom design, optimum proportions of the storage tank, storage tanks for solids and its design procedure, Design of cylindrical storage vessel.

Unit-V: Heat Exchangers Design (12Hours): Codes and standards for heat exchangers; Baffles; Tie-rods; Tube joining methods; Design of shell and tube heat exchangers, design of single effect evaporator, Design of distillation column, absorption column, and reactors.

Text / References:

1. Process equipment dsign-vessel design by Lloyd E. Brownell and Edwin Young, John Wiley, NewYork 1963.
2. Chemical Engineering Volume 6 – Design by J.M. Coulson, J.F. Richardson and R. K. Sinnott, Pergamon press International Edition 1989.
3. Introduction to chemical equipment design – Mechanical Aspects by B.C. Bhattacharyya, CBS Publications.
4. Process Equipment Design by M.V. Joshi and V.V. Mahajani Macmillan India
5. Pressure Vessel Hand book by Eugene F. Megyesy, Pressure vessel company, USA.
6. Design of machine elements by V.B. Bhandari, McGraw Hill.

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

SSSUTMS School of Engineering SEHORE (M.P.)

CMA-802 (B) Novel Separation Technology

CMA-802 (B)	Novel Separation Technology	3L:0T:0P	3 credits	3Hrs/Week

Course Preambles:

- The objective of this subject is to expose students to understand advance separation technique for separation and its application to chemical engineering.
- To train students on advanced separation processes, thermodynamics of separation operations and equilibrium-based design methods.

Course Outcomes:

- To built advanced concepts of separation techniques used in chemical industries.
- To understand the principles and functioning advanced separation techniques.
- To understand the applications of advanced separation techniques as per industrial requirement..
- To recognize the selection criteria between advanced separation techniques and conventional separation techniques.

Unit-I: Separation Techniques (10 Hours): Limitations of common separation techniques – sedimentation, screening, filtration, evaporation, distillation, absorption, liquid-liquid and solid-liquid extraction. Principles of membrane separation process classification, characterization and preparation of membrane.

Unit-II: Analysis and Modeling of Membrane Separation (12 Hours): Analysis and modeling of membrane separation, Membrane modules and application. Reverse Osmosis and ultra-filtration, membrane characteristics and applications, Ion- selective membranes and their application in electrolysis.

Unit-III: Vaporization and Gas Separation (12 Hours): Vaporization and gas separation using membranes, Liquid membrane, Industrial applications. Liquid membrane separation, critical extraction, pressure swing adsorption and freeze drying, pervaporation and permeation, nano-separation. Foam and bubble separation, principle, classification, foam and surfactants, Separation techniques, Column Separations.

Registrar
Sri Satya Sai University of Technology & Medical Sciences, Sehore (M.P.)

SSSUTMS

Unit-IV: Multi-Component Separation (10 Hours): Multi-component separation, Zone melting and Zone refining, electrophoresis, desalting by freezing, centrifugation.

Unit-V: Parametric Pumping (07 Hours): Parametric pumping, thermal parametric pumping, batch, continuous pumping, pH-parametric pumping, heatless parametric pumping.

Text / References:

1. Seader J. D. and Henley E. J., Separation Process Principles.
2. Suresh S, Keshav, A Textbook of Separation Processes.
3. King C. J, Separation Processes.
4. Arden T. V., Water Purification By Ion-exchange.

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Undergraduate Degree Courses in Engineering & Technology

Department of Chemical Engineering

CMA-803 (A) Safety and Risk Analysis

CMA-803 (A)	Safety and Risk Analysis	3L:0T:0P	3 credits	3Hrs/Week

Course Preambles:

- To give knowledge of process plant safety, hazardous chemicals, fire and explosion hazards and different methods of hazard identification and its analysis in qualitative and quantitative scales.
- The students will introduce to personnel safety and case study problems.
- To develop the social, ethical and environmental responsibility among the students.
- To develop the safety concepts among the students with a detailed understanding of technical knowledge.
- To develop the responsibility and ability for precautions and remedial actions for any untoward event.

Course Outcomes:

At the end of the course, the student Students will gain knowledge of safety standards to be maintained at process industries and handling of problems related to safety, different methods of hazard identification and their analysis.

Unit-I: Introduction (12Hours): Introduction to process plant safety, handling of hazardous chemicals, Lower flammability limit (LFL), UFL, LEL, UEL, TLV, electrostatic hazards, Hazard code and explosive limit, TWA, Ceiling level, Safety in handling of gases, liquids and solids, Flammable liquid hazards, fire and explosion index, fireball hazards, oil spillage hazards, Bleveuvce, pool fires, jet fires, radiation hazards.

Unit-II: Fires and Explosions (18 Hours): The Fire Triangle, Distinction between Fires and Explosions, Definitions, Flammability Characteristics of Liquids and Vapors, Liquids, Gases and Vapors , Vapor Mixtures, Flammability Limit Dependence on Temperature and pressure, Estimating Flammability Limits, Limiting Oxygen Concentration and Inerting, Flammability Diagram, Ignition Energy, Autoignition, Auto-Oxidation, Adiabatic Compression, Ignition Sources, Method Energy of Chemical Explosions, Energy of Mechanical Explosions, Missile Damage Blast Damage to People, Vapor Cloud Explosions, Boiling-Liquid Expanding-Vapor Explosions.

Unit-III: Toxicology (12Hours): Toxic materials and their properties, effect of dose and exposure time, relationship and predictive models for response, Threshold value and its definitions, material safety data sheets, industrial hygiene evaluation.

Registrar
Sri Satya Sai University of Technology & Medical Sciences (A.P.)

SSSUTMS School of Engineering

Unit-IV: Risk Assessment (10 Hours): Review of Probability Theory, Interactions between Process Units, Revealed and Unrevealed Failures, Probability of Coincidence , Redundancy, Common Mode Failures, Event Trees, Fault Trees, Advantages and Disadvantages of Fault Trees, Relationship between Fault Trees and Event Trees.

Unit-V: Resources for Combating Fires (10 Hours): Resources for combating fires, dry chemical powders, firefighting foam, fixed and portable fire extinguishers, OSHA standards, the importance of plant layout in safety, the importance of site selection, personal safety, the role of human error in losses. Case studies of fires, explosions, disasters in chemical process plants.

Text / References:

1. Crawl D.A. and Louvar J.A, Chemical process safety fundamentals with applications.
2. Chemical Process Safety: Fundamentals with Applications, Daniel A. Crowl and Joseph F. Louvar, Prentice Hall International Series, 2 nd Edition
3. Safe and Efficient Plant Operation and Maintenance, Greene R., McGraw Hill Book Co., New York.
4. Safety Management and Practices for Hazardous Units, Dekkar Marcel, McGraw Hill Book Co., New York, 1995
5. Safety and Good House Keeping, Saxena, National Productivity Council, New Delhi (1976), 3rd Edition.
6. Safety in Process Plant Design, Wells G.L., George Godwin Ltd., (1980).

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Undergraduate Degree Courses in Engineering & Technology

Department of Chemical Engineering

CMA-803 (B) Petrochemical Technology

CMA-803 (B)	Petrochemical Technology	3L:0T:0P	3 credits	3Hrs/Week

Course Preambles:

To learn properties, application and production techniques of various Petrochemicals and to understand scientific and technological principles of organic synthesis and related unit processes.

Course Outcomes:

- An ability to apply acquired knowledge in the area of Petroleum Processing and Petrochemical Engineering
- Familiarize and understand various unit processes in synthesis of various Petrochemicals, with the present and emerging feed stock scenario and resource constraints
- Understand and remember various properties and applications of second and third generation petrochemicals.
-

Unit-I: Introduction (10 Hours): Chemicals from methane and synthetic gas: Ammonia, Methanol and Hydrogen Cyanide.

Unit-II: Chemicals from Olefins (08 Hours): Ethylene derivatives, Propylene derivatives and Butylenes derivatives, Chemical from Aromatics, synthetic fibres, Plastics and rubber.

Unit-III: Conversion (08 Hours): Conversion of - Ethylene to ethylene oxide, ethylene glycol, ethanol amine Propylene to acrylic acid ,methyl ethyl ketone acrylonitrile.

Unit-IV: Conversion of Butane (08 Hours): Conversions of – Butanes to isobutene and n butanols, MIBK, MTBE Aromatics to maleic and phathalicanhydride, DMT, phenols and acetones Cyclohexane to caprolactum, adipic acid.

Unit-V: Hydration (10 Hours): Technologies for production of alcohols such as ethanol, isobutyl alcohol and higher alcohols, Esterification: Process for production of few esters such as acrylates, terephthalates, ester for flavoring industries.

Text / References:

1. Mall, I D, Petrochemical Process Technology.
2. Bhaskar Rao, Modern Petroleum Refining Processes.
3. Speight J, Chemistry & Technology of Petroleum.
4. Robert Mayer, Handbook of Petroleum Refining Processing.
5. N.N. Lebdev, Chemistry and technology of basic organic and petrochemical synthesis.
6. B.K. Bhaskarrao, A text on Petrochemicals, 2nd Ed, Khanna publishers, New Delhi.
7. G.N. Sarkar, Advanced Petrochemicals, 1st Ed, Khanna Publishers, New Delhi.

CMA-804 Project Stage-II

CMA-804	Project Stage-II (Major)	0L:0T:16P	8 credits	32Hrs/Week

Preambles:

The focus of the Industrial Training Project-II is on preparing a working system or some design or Understanding of a complex system using system analysis tools and submit it the same in the form of a write up i.e. detail project report. The student should select some real life problems for their project and maintain proper documentation of different stages of project such as need analysis market analysis, concept evaluation, requirement specification, objectives, work plan, analysis, design, implementation and test plan. Each student is required to prepare a project report and present the same at the final examination with a demonstration of the working system (if any).

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for
Undergraduate Degree Courses in Engineering & Technology
Department of Chemical Engineering

MANDATORY COURSES

Sr. No.	Course Code	Course Title	Credits	Preferred Semesters
1	MC	[Environmental Sciences, Induction Program, NSS/NCC] Constitution of India	Nil	I, III, IV,
		Total		0

Induction Program

MC	Induction Program	0L:0T:0P	Nil	2Hrs/Week

Induction program (mandatory)	3 weeks duration (Please refer Appendix-A for guidelines & also details available in the curriculum of Mandatory courses)
Induction program for students to be offered right at the start of the first year.	• Physical activity • Creative Arts • Universal Human Values • Literary • Proficiency Modules • Lectures by Eminent People • Visits to local Areas • Familiarization to Dept./Branch & Innovations

A student has to undergo this induction program after joining the institute and before the commencement of classes. Normal classes of the engineering program shall begin after the students have undergone a three-weeks induction program. The Induction program for students comprises of Physical activities; Learning an art form; Literature & Cinema; Social Awareness; Lectures &Visits; Universal Human Values; Familiarization to Department/ Branch, College& Innovations.

Registrar
Sri Satya Sai University of Technology & Medical Sciences, Sehore (M.P.)

SCHOOL OF ENGINEERING

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for
Undergraduate Degree Courses in Engineering & Technology
Department of Chemical Engineering

Constitution of India

MC	**Constitution of India**	**0L:0T:0P**	**Nil**	**2Hrs/Week**

Unit 1 Introduction

Concept of liberty; Concept of positive and negative obligations

Unit 2 The Premises of Social Revolution: Intellectual and historical origins of the concept of Social Economic Justice in India.

Unit 3 Sixty years of civil rights movement in India:

Moderate nationalism and the emergence of the politics of socio-economic justice; Annie Besant, the Theosophical Society and the Home Rule League Movement,

Unit 4 Impact of Socialism on the Writing of the Indian Constitution [I], [1914-31]:

From the First World War to the Karachi Resolution: [a] Jawaharlal Nehru's arrival in national politics and his initiation in municipal politics; [b] The Bolshevik Revolution [1917] and its impact on growth of Indian socialism; [c] Growth and influence of Fabian socialists on Indian nationalism; [d] Commonwealth of India Bill [1925]; [e] National Demand or the Motilal Nehru Report [1927-8] and the Calcutta Congress [1928]; [f] Karachi Resolution of the Indian National Congress [1931]

Unit 5 Impact of Socialism on the Writing of the Indian Constitution [II], [1932-52]:

From the Demand for Adult Suffrage to Passing of the Constitution of India: [a] Growth of the Congress Socialist Party and the demand for the adoption of adult suffrage; [b] Panchayati Raj and empowerment in the Indian Constitution; [c] The National Plan [1938], the Bombay Plan [1944] and proposals for large-scale industrialisation in India; [d] The August Offer [1940], Cripps Mission [1942] and the Cabinet Mission proposals [1946]; [e] The establishment of Indian Constituent Assembly [1946], the Indian Independence Act [1947], the working of the

Constituent Assembly and the Assembly debates and the role of the Oligarchy comprising of Jawahaharlal Nehru, Vallabhbhai Patel, Maulana Abul Kalam Azad and Rajendra Prasad in it; [f] Social reforms and State Security v. 'Due Process of Law'; [g] The introduction, passage and development of the Hindu Code Bill, 1956

References:

1. Bagehot, Walter, An Introduction to English Legal History, [London, 1990]
2. Berlin, Isaiah, Henry Hardy and Ian Harris, Liberty: Incorporating Four Essays on Liberty, [Oxford, 2002]
3. Austin, Granville, The Indian Constitution: Cornerstone of a Nation, [Oxford, 1966] –, Working of a Democratic Constitution: A History of the Indian Experience, [New Delhi, 2003]
4. Bagchi, Amiya Kumar, Private Investment in India, 1900-1939, [London, 1972]
5. Bakshi, P.M., The Constitution of India: With Comments and Subject Index, [Delhi, 1991]
6. Basu, Durgadas, Introduction to the Constitution of India, [New Delhi, 1995] –, Shorter Constitution of India, [Calcutta, 1959]
7. Chandra, Bipan, [et al.], India's Struggle for Independence, [New Delhi, 1991]
8. Coupland, Reginald, The Indian Problem, Three Volumes, [London, 1944]
9. Dutta, Nilanjan, 'From Subject to Citizen: Towards a History of Indian Civil Rights Movement', in Michael Anderson and Sumit Guha, Changing Concepts of Rights and Justice in South Asia, [New Delhi, 2000]
10. Dhavan, Rajeev and Thomas Paul, Nehru and the Constitution, [Bombay, 1992]
11. Forbes, Geraldine, Women in India, [Cambridge, 1996] Gauba, O.P., Constitutionalism in a Changing Perspective, [New Delhi, 1996]
12. Mohanty, Manoranjan, 'Does India Need a New Constitution? [A Democratic Right Perspective on Constitutional Discourse]', in Surya Narayan Misra, Subhas Chandra Hazary and Amareshwar Misra, [ed.], Constitution and Constitutionalism in India, [New Delhi, 1999]

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

S S S U T M S School of Engineering

(11) Assessment

PO/Course Assesment Tools Types	PO/Course Assesment Tools	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO 8	PO9	PO10	PO11	PO12
		Engineering Knowledge	Problem Analysis	Design/Development of Solution	Investigation	Modern Tool Usage	The Engineer and Society	Environment and Sustainability	Ethics	Individual and Team Work	Communication	Project Management	Life-Long Learning
Direct Tools	Test	*	*	*	*				*		*	*	
	Assignments	*	*			*				*			
	lab /seminar/industrial training/projects(Rubrics)	*	*	*		*		*	*	*	*	*	*
Indirect Tools	Course end survey	*				*		*					
	Exit survey	*	*										*
	Faculty Survey		*	*	*			*					
	Alumni Survey	*			*		*		*	*	*		*
	Program Statistics	*			*				*			*	

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

S S U T M S
School of Engineering
SEHORE (M.P.)

Sri Satya Sai
University of Technology and Medical Sciences
(Established under Govt. of M.P. Registered under UGC 2(F) 1956)

(Minutes of the Board of Studies Committee Meeting)
School Of Engineering

Department of Chemical Engineering

Board of Studies Meeting of Chemical Engineering Department was conducted on 30.06.2021 at 2:00 PM Venue: HOD Room, Department of Chemical Engineering following members was present.

1. Dr. Anuradha Devi, Assoc. Prof. (Chemical Engineering), - Chairman
2. Dr. Satyendra Singh Tomar, Prof. (Chemical Engineering)
3. Dr. S. Suresh Assoc. Prof. (Chemical Engineering, MANIT Bhopal),-External Member
4. Dr. Neelu Jain, Prof. (Chemistry), Member
5. Mr. Manoj Kumar Gandwane, Asst. Prof. (Chemical Engineering), Member
6. Mr. Pradeep Semil, Asst. Prof. (Chemical Engineering), Member
7. Mr. Nilesh Ahirwar Asst. Prof. (Chemical Engineering), Member
8. Mrs. Arpita Bhattacharya, Senior Manager, Bharat Refineries, Industry Expert

Minutes of Meeting:

Dr. Anuradha Devi, Chairman of BOS opened the meeting by welcoming and introducing the external members, to the internal and co-opted members and thanked them for accepting to become the member of the Board of Studies

Dr. Anuradha Devi expressed their concern about motivating students towards domain specific courses in 5th semester and discuss about 6th semester courses.

Dr. S Suresh gathered the information and suggested that final year students can be free from the core subject. So that students will able to concentrate on their project.

Mrs Arpita Bhattacharya suggested enhancing the software skill of students. So that industry will easily absorb them.

A new value added course "**Environmental Management System**" is implemented after taking the feedback from all stakeholders for increasing the employability and skills of the students.

BOS members have suggested some modifications in syllabus keeping demand of present scenario in mind. The following changes are incorporated in the syllabus based on suggestion:

CMA-504 (B) Oil & Paint Technology	Unit 5: Utilization of refinery by-products (gums, soap stocks, deodorizer distillates, fatty acid, distillates, waxes, spent bleaching earth, etc.)
CMA-505 (A) Petroleum Processing Technology	Unit 5: Introduction to major petrochemicals like Synthesis gas, Acetaldehyde, Ethylene oxide, styrene, Acrylonitrile, Butadiene
CMA-603 (A) Transport Phenomena	UNIT 5: Turbulence phenomena; phenomenological relations for transfer fluxes; time smoothed equations of change and their applications for turbulent flow in pipes; boundary layer theory; laminar and turbulent hydrodynamics thermal and concentration boundary layer and their thicknesses; analysis of flow over flat surface. Introduction to macroscopic balances for isothermal flow systems, non- isothermal systems and multicomponent systems.
CMA-604 (B) Fertilizer Technology	Unit 5: Manufacturing of organic fertilizer, fertilizer produce by Vermi- compost.
CMA-605 (A) Nano Technology in Catalysis	Unit 1: Generic methodologies for nanotechnology: Introduction, classification and fabrication, Summary of the electronic properties of atoms and solids, Effects and importance of the nanometer length scale, Fabrication methods, Preparation, safety and storage issues, some key examples of nanotechnology
CMA-605 (B) Fluidization Engineering	Unit 4: Single rising bubbles; Davidson model for gas flow at bubbles; Evaluation of models for gas flow at bubbles.
CMA-704 (B) Optimization Methods	Unit 5: Modern methods of Optimization: Genetic Algorithms – Simulated Annealing – Ant colony optimization – Tabu search – Neural-Network based Optimization – Fuzzy optimization techniques – Applications. Use of Matlab to solve optimization problems

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P)

SSSUTMS School of Engineering SEHORE (M.P.)

The Chairman thanks the member for cooperation, their suggestions and peaceful conduction of meeting.

Signature of All members (Including Chairman)

S. No.	BOS Members	Signature
1	Dr. Anuradha Devi, Assoc. Prof. (Chemical Engineering), - Chairman	
2	Dr. Satyendra Singh Tomar, Prof. (Chemical Engineering) , Member	
3	Dr. S. Suresh Assoc. Prof. (Chemical Engineering, MANIT Bhopal),- External Member	
4	Dr. Neelu Jain, Prof. (Chemistry), Member	
5	Mr. Manoj Kumar Gandwane, Asst. Prof. (Chemical Engineering), Member	
6	Mr. Pradeep Semil, Asst. Prof. (Chemical Engineering), Member	
7	Mr. Nilesh Ahirwar Asst. Prof. (Chemical Engineering), Member	
8	Mrs. Arpita Bhattacharya, Senior Manager, Bharat Refineries, Industry Expert	

Registrar
Sri Satya Sai University of Technology & Medical Sciences Sehore (M.P.)

SSUTMS

Chairman