VEER NARMAD SUTH GUJRAT UNIVERSITY, SURAT

SYLLABUS
OF
B.E. CHEMICAL

CHEMICAL ENGINEERING DEPARTMENT
Sarvajanik College of Engineering and Technology,
Dr. R.K. Desai Marg, Athwalines, SURAT
<table>
<thead>
<tr>
<th>Course No.</th>
<th>Course</th>
<th>Teaching Scheme</th>
<th>Examination Scheme</th>
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VEER NARMAD SUTH GUJRAT UNIVERSITY, SURAT  
SCHEME OF TEACHING AND EXAMINATION B.E. – III  
(CHEMICAL ENGG.) SEMESTER – 3

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VEER NARMAD SUTH GUJRAT UNIVERSITY, SURAT  
SCHEME OF TEACHING AND EXAMINATION B.E. – IV  
(CHEMICAL ENGG.) SEMESTER – 4

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### VEER NARMAD SUTH GUJRAT UNIVERSITY, SURAT

**SCHEME OF TEACHING AND EXAMINATION B.E. – V**

**(CHEMICAL ENGG.) SEMESTER – 5**

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### Scheme of Teaching and Examination BE – VI

**(Chemical Engg.) Semester – 6**

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### VEER NARMAD SUTH GUJRAT UNIVERSITY, SURAT
### SCHEME OF TEACHING AND EXAMINATION BE – VIII

(CHEMICAL ENGG) SEMESTER – 8

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## VEER NARMAD SUTH GUJRAT UNIVERSITY, SURAT
### B.E. Chemical Engineering 1\(^{st}\) Semester

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<td>Engineering Chemistry</td>
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<td>Computer Fundamental and Programming</td>
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VEER NARMAD SUTH GUJRAT UNIVERSITY, SURAT
MATHEMATICS – 1

SEMESTER -1

TEACHING SCHEME
L=3; P/D=0; TA=1

EXAMINATION SCHEME
Theory = 3hours; Marks= 100

(A) THEORY
1) complex variables:
Reorientation of complex numbers. De mowers theorem for rational index and its applications, functions of complex variables, special functions, exponential, logarithmic, trigonometric and hyperbolic functions

2) Calculus
reorientation of calculus, graphs and differentiation of hyperbolic and inverse hyperbolic functions, successive differentiation, standard forms, Leibniz’s theorem and application, techniques of partial differentiation.

Infinite series, convergency and divergency concepts, power series, expansion of functions: Taylor and Maclaurins series.
Indeterminate forms: 0/0, ∞/∞, ∞ → 0, 1/0, 0/0, 0∞, application of derivations, curvatures.


3) Ordinary differential equations (first order):
Reorientation, exact differential equations and integrating functions, Ode’s – first order and higher degree odes.
Modeling of real world problems, particularly engineering systems, first order differential equation, models in particular, RC and RL networks, spread of technical innovations, spread of epidemic.

(B) PRACTICAL/ DRAWINGS + TUTORIAL ASSIGNMENTS:
Based on the theory courses described above

(C) REFERENCES:
VEER NARMAD SUTH GUJRAT UNIVERSITY, SURAT

ENGINEERING MECHANICS

SEMESTER -I

TEACHING SCHEME  L=3; P/D=2; TA=1

EXAMINATION SCHEME  Theory = 3hours; Marks = 100

PRACTICAL / DRAWING  Internal evaluation Marks: 20
                      External evaluation Marks: 30

(A) THEORY

(1) Definition of mechanics, definition of force and its SI units, method of problem solution, concurrent coplanar forces, forces in plane and space, applications of triangle law, parallelogram law, equilibrium of forces
(2) Rigid bodies, non concurrent forces, moment about an axis, equilibrium of non concurrent forces.
(3) Analysis of perfect truss, method of joints and methods of section, graphical methods
(4) Analysis of cable subjected to point loads, UDL and self weight.
(5) Centrola, center of gravity, area moment of inertia, mass moment of inertia
(6) Application of friction to engineering problems, viz. wedge ladder, belt etc
(7) Graphical solution of rectilinear motion and its application, curvilinear motion, normal, tangential and transverse component of velocity and acceleration.
(8) Kinetics of particles, dynamic equilibrium, work, power and energy.
(9) Computer applications for few topics of engineering mechanics.

(B) PRACTICALS/DRAWING + TUTORIAL ASSIGNMENTS:
Based on theory courses prescribed above.

(C) REFERENCES:

VEER NARMAD SUTH GUJRAT UNIVERSITY, SURAT
BASIC MECHANICAL SYSTEMS

SEMESTER - I

TEACHING SCHEME
L=3; P/D=2; TA=1

EXAMINATION SCHEME
Theory = 3 hours; Marks = 100

PRACTICAL / DRAWING
Internal evaluation Marks: 20
External evaluation Marks: 30

(A) THEORY

(1) Conventional and non-conventional energy source – types of fuels, calorific value of fuels, and calculation of minimum air required for complete combustion of fuel.


(3) Internal combustion engines – definition, classification, components, working of the two stroke and four stroke cycle engines, SI and CI engines, different systems of IC engines like fuel system like fuel energy systems, ignition system, cooling system.

(4) Layout of different types of power plants – thermal power plant, nuclear power plant, hydro power plant, gas turbine power plant.

(5) Refrigeration and air conditioning: definition of refrigeration, air conditioning, vapor compression system, domestic refrigerator, Ice Plant, Wind Air conditioner

(6) Machines tools: Introduction to different types of machine tool such as lathe, drilling machines, shapers and milling machines, various operations, introduction to various manufacturing processes.

(B) PRACTICALS/DRAWING + TUTORIAL ASSIGNMENT:
Based on the theory course prescribed above.

REFERENCES:

VEER NARMAD SUTH GUJRAT UNIVERSITY, SURAT
ENGINEERING GRAPHICS

SEMESTER - I

TEACHING SCHEME
L=1; P/D=4; TA=0

EXAMINATION SCHEME
Theory = 3 hours; Marks= 100

PRACTICAL / DRAWING
Internal evaluation Marks: 20
External evaluation Marks: 30
Total Marks: 50

(A) THEORY:

1. Engineering Graphics:
   Introduction, importance and role of graphics in engineering graphics equipments and instruments, standard drawing papers, drafting techniques lettering, Dimensioning and architectural symbols as per I.S. Codes.

2. Graphic Presentations:
   Development of graphs, scales and nomograms for two and three variables, scale Conversions and engineering illustrations.

3. Setting of Curves:
   Different types of engineering curves, characteristics, construction and drawing of Curves: ellipse, parabola, hyperbola and spirals.

4. Technical sketching and detailing:
   Sketching of building plans, building components, electrical circuits and machines Foundations.

5. Engineering Projects:
   Types, uses and principles of isometric and orthographic projections, projections of Points and lines.

6. Computer Graphics:
   Use of computers in graphic display and autocad applications.

(B) PRACTICAL/DRAWINGS + TUTORIAL ASSIGNMENTS:
   Based on the theory course prescribed above.

(C) REFERENCES:
(A) THEORY:

1. **Thermodynamics:**
   First law of thermodynamics and its application, reversible and irreversible processes, second law of thermodynamics, entropy and its calculation in reversible and irreversible processes, Entropy and second law of thermodynamics, Entropy and disorder, Enthalpy and free energy.

2. **Electromagnetism:**
   Ampere’s theorem and its applications to determine magnetic induction in case
   
   (i) Conductor carrying current.
   (ii) Solenoid
   (iii) Toroid

   Lorentz force, wall effect in metals, High energy particles accelerators, Cyclotron and Betatron.

   Gauss’s law for magnetism, Types of matter magnetism, Diamagnetism, Paramagnetism, Ferromagnetism, Nuclear Magnetism, three magnetic vectors.

3. **Optics:**
   Spatial and temporal coherence, Interference by division of wave front and amplitude, interference by thin films, measurement of film thickness, Michelson’s Interferometer, and light propagation, Frensel and Fraunhofer diffraction, Fraunhofer diffraction at double slits, Multiple slits and circular Aperture, Raylength criterian, Resolving power of grating, telescope and prism.

   Polarization, polarizing sheets, Nalus law, Polarization by reflection and Browster’s law, Polarization by scattering of light, Huygen’s theory for uni-axial and bi-axial crystals.
### TEACHING SCHEME

L=3; P/D=2; TA=1

### EXAMINATION SCHEME

Theory = 3hours; marks= 100

### PRACTICAL / DRAWING

Internal evaluation marks: 20  
External evaluation marks: 30  
Total Marks: 50

### (A) THEORY:

1. **Electrostatics:**
   - Coulomb’s Law, Electric field, Guass theorem and its application: potential & potential gradient, point charge and charged spheres, capacitance concentric spheres, parallel plates, coaxial cylinders and parallel conductors, capacitors, Capacitors in series and parallel, capacitors with composite dielectrics, Electric Field energy.

2. **Electromagnetics:**
   - Ampere’s Law, Magnetic flux & flux density, Magnetic field strength due to straight conductor and circular coils, Field strength due to solenoid, Magnetomotive force, Magnetic circuit calculations, magnetic leakage, Magnetic hysteresis, Hysteresis and eddy current losses, magnetic field energy Lifting power of a magnet.


3. **Network Theorems:**
   - Kirchoff’s Law – Loop and mode methods of Analysis, Superposition, Thevenin And reciprocity theorems, Star-Delta transformations, Compensation and Norton’s Theorems, Maximum power transform theorem.

4. **R-L-C Circuits:**
   - Alternating voltages and currents and their graphical representations, Average and Effective values, form factor phase differences, power and power factor, purely Resistive, inductive and capacity circuits, R-L ,R-C, and R-L-C series circuits, Impedence and admittance, circuits in parallel, series and parallel resonance, Locus diagram for series circuits. Complex algebra and its application to Circuit analysis. Polyphase circuits: Balance two phase and three-phase systems,
star and Nesh Connections, calculation of balanced three-phae networks,
Polyphase vector Diagram, measurement of power in three phase circuits.

5. **Electrical wiring:**
Various types of residential wiring circuits as simple parallel circuits, staircase wiring, godown wiring etc., simple industrial wiring and testing of electricity.

(B) **PRACTICAL / DRAWINGS + TUTORIAL ASSIGNMENTS:**
Based on the theory course prescribed above.

(C) **REFERENCES:**

1. V.N. Mittal, Basic Electrical Engineering, Tata McGraw Hill Publications Ltd.
A) **THEORY:**

1. **Water:**
   Sources, impurities, hardness, estimation and units, Treatment for (i) boiler-feed water (ii) Potable water, Desalination of brackish water.

2. **Cement:**
   Manufacture, main constituents, setting and hardening of Portland cement, heat if hydration, RCC decays and protection.

3. **Pollution:**
   Types, sources, effects and control of air and water pollutants, sewage, BOD, COD, waste water treatments.

4. **Polymers:**
   Chain and step polymerizations, mechanisms if chain polymerizations, Resins & plastics, thermoplasts and thermostats, Moulding methods, structures and uses of PE, PP, PVC, PVA, VC-VA copolymer, PMMA, Phenoplasts, Amino resins, polyesters, nylon epoxies, silicon resins, and polyurethane, No. average molecular masses.

5. **Corrosion:**
   Dry and wet, their mechanisms causes and remedial measures of Galvanic, Crevice, Pitting and Stress corrosion, corrosion control, surface preparations, Zn and Sn coatings cathodic and anodic protection, inhibitors and paints.

6. **Only types and uses of:**
   Insulators, semi-conductors, lubricants, abrasives, adhesives, composite materials, glasses, refractories and non-ferrous alloys.

7. **Outlines of instrumental methods & Chemical analysis:**
   pH-metry, potentiometry, conductometry, polarography, visible spectrophotometry and flame photometry.
B) PRACTICAL / DRAWINGS , TUTORIAL ASSIGNMENTS:
Based on the theory course prescribed above.

C) REFERENCES:
(2) C.V. Agarwal, Chemistry of Engineering Materials, Tara Book Agency(1990)
(3) Chatwal & Anand , Instrumental Methods of Chemical Analysis (1990)
<table>
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<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tr>
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<tr>
<td>203</td>
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VEER NARMAD SUTH GUJRAT UNIVERSITY, SURAT  
MATHEMATICS –II  
SEMESTER -II  

TEACHING SCHEME  
L=3; P/D=0; TA=1  

EXAMINATION SCHEME  
Theory = 3hours; Marks= 100  

(A) THEORY:  

1) Calculus:  
Reorientations, Functions of several variables, Euler’s theorem, chain rule, applications: Maxima, Minima, Errors & approximations, series expansions, Tangent planes and normal Lines, Transformations and Jacobians.  

2) Ordinary differential equations (higher order):  
Re-orientations: Solution if linear mode of nth order with constant coeffs., complimentary functions, auxiliary equation having real or complex, distinct or repeated roots, particular integrals, General method, rules for finding P.I. for special forms viz. e^{ax}, \cos(x+b), x^m, v(x)e^{ax}, xv(x) including cases if failures, solution of nth order with variable coeffs. Of homogeneous type (Euler & Cauchy equation).  

Modeling of real world problems particularly engineering systems, second order differential Equations, Models in particular LCR networks, bending of beams, detection of diabetes. 
Method of variation of parameters, solution in series, regular points, regular singular points, Fibonacci method of solution, Bessel and Legendre different equations, Introduction to Pn(x) and Jn(x).  

3) Numerical Methods:  
Motivation solution of Algebraic and Trancendential equations, Bisection, false position, Newton Raphson methods.  

A) Systems of Linear equations :  
Guass-elimination, Gauss-seidel, Gauss-Jordon and Jacobi’s method.  

B) PRACTICAL / DRAWINGS + TUTORIAL ASSIGNMENTS:  
Based on the theory course prescribed above.  

C) REFERENCES:  
VEER NARMAD SUTH GUJRAT UNIVERSITY, SURAT  
ENGINEERING DRAWING

SEMESTER -II

TEACHING SCHEME     L=2; P/D=4; TA=0

EXAMINATION SCHEME   Theory = 3hours; Marks= 100

PRACTICAL / DRAWING  Internal evaluation Marks: - 20
                       External evaluation Marks - 30
                       Total Marks        - 50

(A) THEORY:

1. Orthographic Projections of Solids: Study of Indian standards for Engg. drawing,  
   Simple solids like prism, Cube, Cylinder, cone, pyramid, sphere etc. with varying  
   positions of axis with reference to principle plane, projections on auxiliary plane,  
   sections of solids mentioned above, Interpretation of orthographic views and  
   drawing of missing views, simple machine parts such as plumer blocks, brackets,  
   fixtures etc.

2. Isometric Projections: principles of Isometric projection, Isometric views of simple  
   solids and simple machine parts.

3. Development and Interpretation: Interpretation of simple solids such as cylinder,  
   prism, cone and pyramid, curves of intersection, Development of surfaces of simple  
   solids and interpenetrating solids, problems on industrial pipe lines, hoppers, funnel  
   and tanks.

(B) PRACTICAL/DRAWING + TUTORIAL ASSIGNMENTS:  
   Based on the theory course prescribed above.

(C) REFERENCES:

VEER NARMAD SUTH GUJRAT UNIVERSITY, SURAT
BASIC CIVIL ENGINEERING

SEMESTER -II

TEACHING SCHEME
L=3; P/D=2; TA=0

EXAMINATION SCHEME
Theory = 3hours; Marks= 100

PRACTICAL / DRAWING
Internal evaluation marks: 20
External evaluation marks: 30
Total Marks: 50

(A) THEORY:

1. Introduction to Civil Engineering, relation of Civil Engineering to other branches of Engineering.

2. Surveying and measuring techniques, need and type of surveys, conventional signs, linear distance measurement through chain and tapes, angle measurement with compass, notation of bearings, concept of contours and contour surveys and contour mapping.

3. Introduction to buildings, building components such as foundations, masonry work, different types of doors, windows and floorings. Basic building materials such as stones, bricks, mortar, concrete, wood and its important Properties. Reading of building and plant layout, basic types of roads adopted for different purposes.


(B) PRACTICAL/DRAWINGS + TUTORIAL ASSIGNEMENTS :
Based on the theory course prescribed above.

(C) REFERENCES:

(A) THEORY:

2. Spoken English:
   Following communication functions be discussed in mean natural dialogue forms:
   Greetings, introductions, making requests, suggestions, invitations, acceptance, refusal, seeking permission, giving a description, stating likes and dislikes, agreeing & disagreeing, stating performances, conversing on the telephone, inquiries & complaints, compliments, encouragement expressing thanks and apologies etc.

2. Written English:
   Business letters – Structures of business letter, essentials of a good business letters. Letters of inquiry, complaints, and requests etc.
   Report writing on general as well as scientific topics. Writing formal speeches for Occasions like inaugurations, introduction of guest speakers. Recording and Drafting of minutes of meetings.

(B) PRACTICALS/ DRAWINGS + TUTORIAL ASSIGNMENTS : NIL

(C) REFERENCES:

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VEER NARMAD SUTH GUJRAT UNIVERSITY, SURAT
MATHEMATICS III

SEMESTER- II

TEACHING SCHEME
L=3; P/D=0; TA=2

EXAMINATION SCHEME
Theory = 3hours; Marks= 100

PRACTICAL / DRAWING
Internal evaluation marks: 20
External evaluation marks: 30
Total Marks: 50

Multiple Integrals
Reorientation of concept of integrals, double and triple integrals, evaluation techniques, change of order of integration, integrals in polar and cylindrical coordinate, change of variables of multiple integrals. Application of double and triple integrals for evaluation of area, volume and mass.

Vector Calculus
Basic concepts of Vector Calculus, line integrals, scalar and vector point functions, differential operator, gradient, directional derivative, divergence, curl and Laplacian with their properties and physical interpretation.
Surface integrals, Green’s, Gauss and Stokes theorem (without proof), Applications.

Gamma, Beta and Error functions
Improper integrals and their convergence, Gamma and Beta functions and their properties. Error functions, Evaluation and application.

Fourier Series
Fourier expansion of functions with arbitrary period, in particular periodic functions with period $2\pi$, conditions of convergence. Fourier series of even and odd functions, Half range fourier series.

Partial Differential Equations (pde)
**Complex Variables:**

Basic mathematical concepts, Analytic functions, C-R equations, Harmonic functions, Related problems, Linear transformation, Conformal Mapping and applications, complex Integration including contour Integration (Simple cases).

**REFERENCES:**

VEER NARMAD SUTH GUJRAT UNIVERSITY, SURAT
CHEMISTRY – II (ORGANIC)

SEMESTER- III

TEACHING SCHEME
L=3; P/D=2; TA=0

EXAMINATION SCHEME
Theory = 3hours; Marks= 100

PRACTICAL / DRAWING
Internal evaluation marks: - 20
External evaluation marks - 30
Total Marks - 50

i) Purification of organic compounds by crystallisations, sublimation & different types of distillation.


iii) IUPAC Nomeclature of organic compounds including Hetero-and ali-cyclic compounds.

iv) Structural & Stero-isomerisms, optical isomers of lactic and tartaric acid, geometrical isomerism.

v) General nature of substitutions, addition, elimination, rearrangement, neucleophilic & electrophilic reactions/mechanisms.

vi) Preperations and chemical properties and uses of: chloroform, carbon tetra chloride, Iodoform, ethanol, ethylene glycol, glycerine, formaldehyde, acetaldehyde, Acetone, Lactic-, oxalic-, citric-, and succinic acids, diethyl ether, acetoacetic ester, malonic ester.

vii) Preperation and industrial uses of organometallic compounds: Lead, zinc, lithium and magnesium organometallic compounds.

viii) Aromatic halogenation, sulphonation, nitration, alkylation, acylation and addition reactions & their mechanisms.

ix) Study of chloro- and bromo- benzenes, benzyle chlorides, DDT & BHC.

x) Study of aniline, acetanilide, sulphanilic acid, sulphanilamide, diphenyleamine, Dimethylaniline. Tests to distinguish different amines.

xi) Preperations and chemical properties of phenol, catechol, Resorcinol, Quinol, And Phloroglucinol.

xii) Study of benzaldehyde, Salicaldehyde, Cinnamaldehyde, aceto-and benzo-phenones.

xiii) Study of benzoic-salysilic-, pthalic-and cinnamic acids.

xiv) Study of naphthalene, anthracene, furan, thiophene, pyrole, pyridene, quinoline and carbazole.
Qualitative analysis of Organic compounds, Preparations of important organic compounds, purifications and measurements of melting and boiling points of organic compounds etc.

REFERENCES:

BASIC ELECTRONICS

SEMESTER -III

TEACHING SCHEME L=3; P/D=2; TA=1

EXAMINATION SCHEME Theory = 3hours; Marks= 100

PRACTICAL / DRAWING Internal evaluation marks: - 20
 External evaluation marks – 30
 Tutorial marks: - 25
 Total Marks - 75

1. Electron emission, work function, thermionic, secondary, photo electric and field emission, Richardson’s equations, thermionic cathodes of different types.

2. Semi-conductor devices: Properties of intrinsic and doped semi-conductors, p-n junction diode, transistors, zener diode, uni-junction transistors, silicon controlled rectifiers, biasing circuits for transistors.

3. Rectifiers and filters: Analysis of single/half wave and full wave rectifiers using silicon diodes, 3-phase rectifiers circuits, introduction to bridge rectifiers and controlled rectifiers with resistive load, voltage doublers, simple filters.

4. Amplifiers: Load line, classification of amplifiers, graphical and analytical treatment of R-C coupled amplifiers, introduction to choke coupled, transformer coupled and push-pull amplifier circuits, basic principles of feedback amplifiers.


6. Photo-electricity: Photo conductive, photo voltaic and Photo-emissive effects, photo tubes, semi-conductor photo-diode and photo-transistor, photo-sensitive rely circuits, light emitting diode.

7. Industrial applications: C. R. T. and Cathode ray oscilloscope, deflection sensitivity of C. R. T. and Cathode Ray Oscilloscope, uses of C. R. O., electronic voltmeters,
typical applications of electronic devices for the measurements of non-electrical quantities like temperature, pressure, displacement, velocity, acceleration, vibration, strain etc., Strain Gauge bridge, electronic timers, introduction to radio frequency, induction heating, industrial applications of heating, digital computers, basics.

Practicals and Term Work will be based on above.

REFERENCES:

1. V. K. Mehta, Basic Electroncs Principles.
2. A. K. Sawhany, Electronic Instrumentation and Measurements.
1. Strength and Elasticity: Stress, strain, elasticity, stress-strain characteristics, Hook’s law, elastic constants and proportionality, yield limit, ultimate strength, proof stress, factor of safety, working stress and load factor.

2. Mechanical properties of materials: Metals- ductility, brittleness, toughness, malleability, behaviour of ferrous and non-ferrous metals in tension and compression, shear and bending stress, standard test pieces, influence of various parameters on test results, true and nominal stress, modes of fracture, characteristics stress-strain curves, strain hardening, Izod, Charpy and tension impact tests, fatigue strength, endurance limit, creeps of metals, co-relation between different mechanical properties, testing machines and special features, different types of extensometers and compressometers, measurement of strain by electrical resistance strain gauges.

3. Bending moment and shear force: Diagrams in statically determinate beams including cantilevers subjectd to concentrated uniformly distributed and varying loads and inplane moment loading, BM and SF diagrams by analytical and graphical methods, relation between bending moment, shear force and rate of loading, points of contraflexure.


5. Torsion: Circular, solid and hollo section shafts, shear stress and strain due to torsion, angle of twist, torsional moment of resistance, power transmitted by a shaft, keys and couplings, closed coiled helical springs.

6. Principal stresses and strains: Compound stresses, analysis of principal planes and principal stress, Mohr circle of stress, principal strains, angle of obliquity of resultant...
stress, principal stress in beams and shafts subjected to bending and torsion, with and without axial stress.

7. Columns: Different end conditions, effective length, least radius of gyration, theory of long columns, application and limitations, secant formula used by I. S. Code.

REFERENCES:

1. Timoshenko and Young, Elements of Strength of Materials, Affiliated East West Press.
2. Ryder G. H., Strength of Materials, ELBS, Hong Kong.
VEER NARMAD SUTH GUJRAT UNIVERSITY, SURAT
ELECTRICAL TECHNOLOGY

SEMESTER -III

TEACHING SCHEME

L=3; P/D=2; TA=0

EXAMINATION SCHEME

Theory = 3hours; Marks= 100

PRACTICAL / DRAWING

Internal evaluation marks:  20
External evaluation marks: 30
Total Marks: 50

THEORY:

D. C. Machines:
Construction, simple lap and wave windings, emf, torque and power equations, circuit model, characteristics, introduction to armature reaction and commutation, self excited generators, shunt series and compound motors, speed control, efficiency and losses.

Transformers:
Fundamentals and construction of single phase and three phase transformers, ideal transformer, emf equation, no load conditions, loading, accounting for finite permeability and core losses, equivalent circuit, no load and short circuit tests, per unit system, voltage regulation, efficiency, auto-transformer, three phase transformers, star and delta connections.

Synchronous Machines:
Construction and basic principles, three phase windings, rotating magnetic fields, distribution and pitch factors, emf equation, synchronous speed, armature reaction, synchronous reactance, voltage regulation, synchronizing to mains, damper winding, vector diagram for generating and motoring modes, synchronous motor starting, V curves.

Induction Machines:
Construction and simple theory of operation of three phase induction motor, equivalent circuit torque speed characteristics, no load and blocked rotor tests, load test, starting, speed control.

Fractional KW Motors:
Brief description of reluctance motor, hysteresis motor, two phase servo motor, stepper motors.

Practical work shall be based upon the theory course.

REFERENCES:
1. **Introduction:**
   Defination and importance of unit process in Chemical Eng., Outlines of unit processes and unit operations, Chemical process kinetics and factors affecting it, Symbols used in Chemical Eng., Process flow diagram.

2. **Nitration:**
   Defination and scope of nitration reactions, Nitrating agents, Aromatic nitration (Schmidt and Biauzzi nitrators) Mixed acid for nitration, D.V.S and nitric ratio, Comparision of batch Vs continuous nitration, Mfg. of Nitrobenzene, Dinitrobenzene, o- and p-Chlorobenzene.

3. **Amination by Reduction:**
   Defination and scope of Amination reactions, Various methods of amination and factors affecting it, Batch and continuous methods for manufacture of Aniline from Nitrobenzene, Cont. mfg. of Nitrobenzene using catalytic fluidized bed reactor, MOC in such processes.

4. **Halogenation:**
   Defination and scope of various halogenation reactions, Halogenatig agents, Industrial halogenation with types of equipments and its material MOC., Mfg. of Chlorobenzene, BHC and Vinyl chloride from Ethylene and Acetylene.

5. **Sulfation and Sulfonation:**
   Defination and scope of such reactions, Sufonating and sulfating agents and their applications, Chemical and physical factors affecting it, Industrial equipments and techniques for batch Vs cont. sulfonation, Mfg of benzenesulfonic acid and Dodecyle Benzene Sulfonates, Sulfation of Dimethyl Ether and Lauryl alcohol.

6. **Amination by Ammonolysis:**
   Defination and types of reactions, Aminating agents, Physical and chemical factors affecting it, Catalyst used in ammonolysis, Mfg. of Aniline from Chlorobenzene and Nitroaniline from Dichloronitroaniline.

7. **Oxidation:**
Definition of oxidation, Oxidizing agents, Liquid phase oxidation, Oxidation of Toluene with MnO2, Mfg. of Acetic acid from Acetaldehyde, Mfg. of Acetic acid from Ethanol, Vapour phase oxidation of Methanol, Benzene and Naphthalene, Apparatus and its MOC for oxidation reactions.

8. **Hydrogenation:**
   Definition and its scope, Properties of hydrogen and sources of hydrogen gas, Catalytic hydrogenation and hydrogenolysis, Factors affecting it, Apparatus and MOC, Industrial hydrogenation of fats and oil, Mfg. of Methanol from CO and H2.

9. **Hydrolysis:**
   Definition and types of hydrolysis, Hydrolysing agents, Equipments of hydrolysis, Industrial hydrolysis of fat, Hydrolysis of Carbohydrates, Starch to Dextrose, Mfg of Ethanol from Ethylene(Shell process), Mfg. of Phenol from Benzenesulfonic acid.

10. **Polymerization:**
    Introduction and chemistry of polymerization reactions, Classification of polymers, Methods of polymerization

**REFERENCES:**

2. Dryden’s, “Outlines of Chemical Technology”
### B.E. Chemical Engineering 4th Semester

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<td>406</td>
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</table>
THEORY:

1. General metallurgy
2. Chemistry of Beryllium, Lithium, Thorium, Tungsten, Uranium, Platinum and Molybdenum
3. Study of the Lanthanides La 57 to Lu 71
4. Theory of Electrolytic Dissociation, strong and weak electrolytes, Ostwald’s dilution law, Buffer capacity, ionic activity and activity coefficient, theory of strong electrolyte (Debye Onsager theory).
5. Electrical conductance, conductance of electrolyte, specific, equivalent, and molecular conductance, cell constant, transport numbers, Kohlrausch’s law and its applications, Electro analysis and Coulometry.
6. Equilibrium electrode potentials, classification of electrodes, types of electrochemical systems (Electrochemical cells).
7. Classification of polarization, voltametry and polarography, decomposition potential and over voltage, all types of electro-metric methods.
8. Introduction, classification, preparations, properties and chemical constitutions of Glucose and Fructose, Extraction of Sucrose from Cane Juice, Starch and cellulose.
10. Types of polymerizations, elastomers, natural and synthetic rubber, vulcanization and compounding.

12. Synthesis of drugs antiseptics, halogens, halogenated compounds, antimalarials, quinoline derivatives, antibacterials, sulpha drugs.

REFERENCES:

III L. Antropov, Theoretical Electrochemistry
VEER NARMAD SUTH GUJRAT UNIVERSITY, SURAT CHEMICAL ENGG. MATERIALS

SEMESTER – IV

TEACHING SCHEME

L=3; P/D=0; TA=0

EXAMINATION SCHEME

Theory = 3hours; Marks= 100

1. Concept from physical metallurgy: crystal structure, solid solutions, point defects, fick’s law, structure of high polymers phase transformation, mechanical properties, deformation of metals, failure of metals, creep, fracture, fatigue, radiation damage, equilibrium diagrams, Fe-C diagram.

2. Ferrous metals, cast iron, steel, alloy steel, effects of alloying elements.


4. Inorganic, organic and other materials

5. Corrosion and its control, protective coatings, chemical principles involved.

Note: Topics (1) and (2) should include the study of the effect of acids and alkalies on metals and alloys.

REFERENCES:


2. Van Vlack, “Elements of Material Science”.
VEER NARMAD SUTH GUJRAT UNIVERSITY, SURAT
PROCESS CALCULATIONS

SEMESTER - IV

TEACHING SCHEME L=3; P/D=0; TA=2

EXAMINATION SCHEME Theory = 3 hours; Marks = 100

Tutorial = 50

1. Mathematical techniques in Chemical Engg. 'Dimensions & Units'.
3. Material Balance with and without chemical reactions.
4. Material Balance involving recycle, bypass and purge systems.
5. Humidity, Saturation, Crystallization and Combustion calculations.
6. Thermophysics & heat capacity calculations.
7. Enthalpy changes of reactions, dissolution & laws of thermochemistry.
9. Combined material and energy balance for single stage processes like Distillation, Absorption & Stripping, Crystallization.

REFERENCE:

1. B. I. Bhatt & S. M. Vora , 'Stoichiometry'.
3. D. M. Himmelblau , 'Basic Calculations In Chemical Engg.'
4. Richardson & Coulson , 'Chemical Engineering', Volume VI.
i) Thermal Stresses: Thermoplastic stress-strain relations, thin circular disc, temperature symmetrical at centre, long thin circular cylinder, thin sphere.

ii) Vortex Induced Stresses, vortex wake of a stationary circular cylinder, Strohual number, effect of cylinder motion on wake, correlation model, thermocouple probe example, tow cable example.

iii) Energy Principles in solid continuum, Introduction to energy Work & internal energy, principles of virtual work, Bett’s & Maxwell’s laws, principles of minimum potential energy, Castigliano’s theorem, principles of complementary work, simple deflection, problems based on above theorems, theories of failure, their significance in design.

iv) Rotating cylinders and discs, rotating discs of uniform strength, stresses in rotating cylinders.

v) Strength of welded joints, types of weld, eccentric loading in welded joints.

vi) Bending of curved bars: Stresses in bars of small initial curvature-strength in bars of large curvature, extension of curved bars.

REFERENCES:

3. Ryder, ‘Strength Of Materials’, ELBS.
VEER NARMAD SUTH GUJRAT UNIVERSITY, SURAT
THEORY OF MACHINES AND MACHINE DESIGN

SEMESTER - IV

TEACHING SCHEME
L = 3; P/D = 4; TA = 1

EXAMINATION SCHEME
Theory = 3 hours; marks = 100

PRACTICAL / DRAWING
Internal evaluation Marks: 40
External evaluation Marks: 60
Total Marks: 100

A] THEORY OF MACHINES (40% Weightage):

   ii) Introduction to machines and mechanisms: four bar and slider crank mechanisms, Cams and cam followers, cam profiles.
   iii) Eriction: Screw, bearings, lubrication, clutches, brakes, Belt drives.
   iv) Gear drives: Types gears, gear nomenclature, applications.

B] MACHINE DESIGN [60% Weightage]:

   i) Design process, Material selection, factor of safety, types failures and their causes.
   ii) Design of joints: pin joints, threaded fasteners, welded joints
   iii) Design of power transmission elements.
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VEER NARMAD SUTH GUJRAT UNIVERSITY, SURAT
GENERAL CHEMICAL TECHNOLOGY – I

SEMESTER – V

TEACHING SCHEME
L=3; P/D=2; TA=0

EXAMINATION SCHEME
Theory = 3 hours; marks = 100

PRACTICAL / DRAWING
Internal evaluation marks: 20
External evaluation marks: 30
Total Marks: 50

1. Water conditioning & Environmental protection: demineralisation, deionisation, Desalination industrial waste treatment and pollution.
2. Fuels & Energy: Coal, coal chemicals, Fuel gases
5. Sulfuric acid manufacture.
6. Electrolytic manufacture of Al and Mg.
7. Pulp and paper industry.
8. Sugar and Starch industry
9. Oil, fats, soaps and detergents
11. Phosphatic fertilisers
12. Mixed fertilisers

REFERENCES:
1. Introduction: Conservation of energy and first law of thermodynamics, application to steady state flow process, enthalpy, internal energy, equilibrium state, phase rule, reversible and irreversible processes, heat capacity and specific heat.

2. Properties of pure substances: PVT behaviour, ideal and non ideal gases, different equations of state for real gases.


4. Second law of thermodynamics: Thermodynamic temperature scale, ideal gas temp., scale, concept of entropy, entropy change and irreversibility, third law of thermodynamics.

5. Thermodynamic properties of fluids: Mathematical relations among thermodynamic functions, Maxwells’ relations, interrelations between H,S,U,G,Cp,Cv, properties of single and two phase systems. Types of thermodynamic diagrams.


7. Refrigeration and liquifaction: Carnot refrigeration cycle, air refrigeration cycle, absorption refrigeration, heat pump, choice of refrigeration, liquifaction processes.

REFERENCE:

1. P. K. Nag, 'Chemical Engg. Thermodynamics'.
2. Smith & Vanness, 'Thermodynamics'.
1. Fluid properties and Dimensional Analysis
2. Fluid statics and its applications
3. Fluid flow phenomena: Types of flow-potential flow, one dimensional flow, laminar flow, turbulent flow, Reynolds number, Non-newtonian fluids, nature of turbulence, eddy viscosity, eddy diffusivity of momentum, flow in boundary layers, laminar and turbulent boundary layers, boundary layer thickness, boundary layer separation, wake formation
4. Basic equation of fluid flow
5. Friction in pipes and channels
6. Flow of compressible fluids and two phase flows.
7. Flow past immersed bodies
8. Fluid flow measurement
9. Pumping of fluids
10. Agitation and mixing of liquids

REFERENCE:

VEER NARMAD SUTH GUJRAT UNIVERSITY, SURAT  
MECHANICAL OPERATION  

SEMESTER –V  

TEACHING SCHEME  
L=3; P/D=2; TA=0  

EXAMINATION SCHEME  
Theory = 3hours; marks= 100  

PRACTICAL / DRAWING  
Internal evaluation Marks:  20  
External evaluation Marks: 30  
Total Marks: 50  

2. Size reduction & enlargement, crushers, grinders, disintegrators for coarse, intermediate and fine grinding, energy and power requirements, law of crushing, work index, etc.  
3. Screening and other separation methods: screen analysis, estimation of particle size, surface area and particle population based on screen analysis, ideal and actual screens, principle of elutriation, flotation, jigging, electrostatics and magnetic separation processes.  
4. Sedimentation, settling velocity, flocculation etc.  
5. Fluidization, Dense phase fluidization and boiling bed, min. fluidization velocity, min. porosity of bed and bed height, batch and continuous fluidization.  
6. Filtration, filter media, filter aids, batch and continuous filtration, filtration equipments, filter press, leaf, cartridge, vacuum nauch and rotary drum filters.  
7. Mixing and agitation: equipments, agitation of liquids, types of impellers, power consumption in agitated vessel etc.  
8. Conveying: mechanical and pneumatic conveying, elevators etc.  

REFERENCES:  

1. Modes of heat transfer: Fourier conduction equation, General conduction equation in cartesian, cylindrical and spherical co-ordinates.
2. Heat transfer by convection: Fluids with and without phase change, free and forced convection, laminar and turbulent flows heat transfer inside and outside tubes, concepts of thermal boundary layers, overall heat transfer coefficients, LMTD, Fouling factors, transfer units, flow over flat plates with heat transfer, empirical relations
3. Natural convection: Grashoff number, heat transfer to molten metals.
4. Boiling phenomena: Regimes of boiling etc.
5. Condensation: Film and drop condensation etc.
6. Evaporation: Single effect, multi effect evaporation, forward and backward feed system.
7. Heat exchangers
8. Radiation heat transfer
9. Extended surfaces

REFERENCES:

VEER NARMAD SUTH GUJRAT UNIVERSITY, SURAT
MASS TRANSFER-I

SEMESTER – V

TEACHING SCHEME

L=3; P/D=0; TA=1

EXAMINATION SCHEME

Theory = 3hours; Marks= 100
Tutorial = 25

1. Introduction to mass transfer operation: classification and methods.
2. Molecular diffusion in fluids: steady state diffusion in fluids at rest and in laminar flow (both gases and liquids), diffusivities of gases and liquids.
3. Mass transfer coefficient: in laminar, turbulent flows, theories of mass transfer, heat momentum and mass transfer analogies.
4. Introduction to diffusion in solids: Fick’s law
5. Interphase mass transfer
6. Equipments for gas liquid operation
7. Distillation: VLE data, flash and simple distillation, continuous, McCabe thiele and ponchon savarit method etc.

REFERENCES:
2. McCabe and Smith, Unit operation in chemical engineering, McGraw Hill Publication
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<td>604</td>
<td>Chem. SystemModel.</td>
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VEER NARMAD SUTH GUJRAT UNIVERSITY, SURAT
GENERAL CHEMICAL TECHNOLOGY – II

SEMESTER – VI

TEACHING SCHEME
L=3; P/D=2; TA=0

EXAMINATION SCHEME
Theory = 3 hours; marks= 100

PRACTICAL / DRAWING
Internal evaluation Marks: 20
External evaluation Marks: 30
Total Marks: 50

1. Petroleum Refining
2. Petrochemical industry.
3. Polymer industry: Manufacture of phenol and urea formaldehyde resins, PVC, Polyethylene, Synthetic rubber etc.
5. Fine Chemicals and drugs : Classification of dyes, Azo dyes, Reactive dyes, disperse dyes.
8. Environmental aspects of various industries.

REFERENCE:-

1. Thermodynamic properties of fluids: Partial molar properties, chemical potential, non-ideal solutions, fugacity, fugacity coefficient, for pure component and for mixture of gases. For liquids- Lewis randall rule, Henry’s law, excess property, activity and activity coefficient.

2. Phase equilibrium: Phase rule, Duhem theorem, miscible system, immiscible system, partially miscible systems, testing of vapor liquid equilibrium data, Gibbs Duhem equation, Van laar equation, Margules equation, Redlich kister equation, P-x-y , T-x-y and x-y diagrams, Vapour liquid equilibrium of ideal and nonideal solutions, Raoult’s and Henry’s law.

3. Chemical equilibrium: criteria, equilibrium conversion(x), constant(k), effect of temperature and pressure on k, evaluation of k, evaluation of equilibrium conversion for gas phase reaction.

4. Introduction to Statistical thermodynamics: Stefan Boltzmann, Bose Einstein and Fermi Dirac distributors, corrected Boltzmann statics, partition functions, etc.

REFERENCE:
2. Nag P.K “Engineering ”
3. B.F. Dodge, ‘Chemical Engineering Thermodynamics’, MGH.
VEER NARMAD SUTH GUJRAT UNIVERSITY, SURAT
CHEMICAL REACTION ENGINEERING – I

SEMESTER – VI

TEACHING SCHEME  
L=3; P/D=2; TA=1

EXAMINATION SCHEME  
Theory = 3hours; marks= 100

PRACTICAL / DRAWING  
Internal evaluation Marks: 20  
External evaluation Marks: 30  
Tutorial: 25  
Total Marks: 75

1. Introduction: Chemical Kinetics, Classification of reactions, variable affecting reaction.
2. Kinetics of homogenous reactions.
3. Instrumentation of Batch Reactor data.
6. Multiple reaction system: Plug flow reactors in series and/or parallel, equal sized mixed reactors, recycle factor.
7. Temperature & pressure effects: Single & Multiple reactions.
8. Industrial applications.

REFERENCES:

VEER NARMAD SUTH GUJRAT UNIVERSITY, SURAT
CHEMICAL SYSTEM MODELLING

SEMESTER – VI

TEACHING SCHEME  
L = 3; P/D = 0; TA = 0

EXAMINATION SCHEME  
Theory = 3 hours; marks = 100

1. Introduction; Physical and mathematical modelling, principle of similarity, definition of independent variables and dependent variables, boundary conditions.
2. Mathematical modelling of Chem. Engg. Systems: single, two and n-stage extraction steady state mass transfer processes, Un steady state formulations of a single stage extraction, steady state heat conduction through hollow cylindrical pipe using various boundary conditions, unsteady process of steam heating of a liquid, heat transfer through extended surface (triangle and rectangular), steady state counter current cooling of a tank, diffusion with chemical reaction in a tubular reactor etc.
3. Laplace Transforms: Thermometer systems, mixing tanks, fixed bed reactor formulations
4. Partial differential equations and finite differences; a review
5. Numerical methods: a review
6. Treatment of experimental results
7. Optimization

REFERENCES:

VEER NARMAD SUTH GUJRAT UNIVERSITY, SURAT
INSTRUMENTATION

SEMESTER – VI

TEACHING SCHEME
L=3; P/D=2; TA=0

EXAMINATION SCHEME
Theory = 3hours; marks = 100

PRACTICAL / DRAWING
Internal evaluation marks :- 20
External evaluation marks - 30
Total Marks - 50

INSTRUMENTATION:

1. Measuring instruments for temperature, pressure, level and flow.

MICRO-PROCESSOR APPLICATIONS:

2. Logic structure, combinational logics.
5. Interfacing, parallel & seriel, programmable peripheral interface, interrupts, data conversion.
6. Data conversion – ADC & DAC data logging, microcontrollers, program logic controllers, application to process control and drafting.

REFERENCES:

1. Donald Eckman, ‘Industrial Instrumentation‘.
VEER NARMAD SUTH GUJRAT UNIVERSITY, SURAT
MASS TRANSFER-II

SEMESTER –VI

TEACHING SCHEME

L=3; P/D=4; TA=0

EXAMINATION SCHEME

Theory = 3hours; marks= 100

PRACTICAL / DRAWING

Internal evaluation Marks: - 25
External evaluation Marks - 75
Total Marks - 100

1. Absorption: Equilibrium, material balances for single component transfer, multistage and packed tower operation.
2. Humidification: Vapor gas mixtures, gas liquid contact operations, adiabatic and nonadiabatic operation.
3. Liquid extraction: stage wise, stage type contactor etc.
4. Adsorption and ion exchange: stagewise operation etc.
5. Drying: Batch drying, mechanism, continuous drying.
8. Introduction to recent separation techniques using mass transfer.

REFERENCES:

2. McCabe and Smith, Unit operation in chemical engineering, McGraw Hill Publication
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>701</td>
<td>Transport Phenomena</td>
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<tr>
<td>702</td>
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<td>703</td>
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<tr>
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<td>Process Control</td>
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<td>705</td>
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<td>706</td>
<td>Project Preliminaries</td>
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<td>Training</td>
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</tbody>
</table>
1. **Transport by molecular motion**: review of momentum, energy and mass transport by molecular motion.

2. **Transport in laminar one dimensional flow**
   - shell and momentum balances - falling film flow through circular tube and annulus
   - Heat conduction with electrical heat source - Viscous heat source - Forced and Natural convection - Diffusion through stagnant gas film. - with homogenous chemical reaction - Forced convection mass transfer.

3. **Transport in arbitrary continum**
   - Equation of continuity - motion and mechanical energy - equation of change for Incompressible non-Newtonian flow - Dimensional analysis of the equilibrium change.

4. **Transport with two independent variables**
   - Unsteady viscous flow - steady viscous flow two dimensional potential flow - Boundary layer theory.

5. **Transport in turbulent flow**
   - Time smoothed quantities - for incompressible fluids - expression for the Reynold stresses - Time smoothed temperature - energy equation - Turbulent energy flux - Concentration fluctuations. - equation of continuity of Turbulent mass flux.

6. **Transport between two phases**
   - free convection - mass transfer coefficient in one phase - Binary mass transfer coefficient in two phases.

7. **Transport to layer flow systems.**

**REFERENCES:**
VEER NARMAD SUTH GUJRAT UNIVERSITY, SURAT
CHEMICAL REACTION ENGG. –II
SEMESTER –VII

TEACHING SCHEME

L=3; P/D=2; TA=0

EXAMINATION SCHEME

Theory = 3hours; Marks= 100

PRACTICAL / DRAWING

Internal evaluation Marks:   20
External evaluation Marks:  30
Total Marks: 50

1. Non-ideal fluids
2. Mixing of fluids
3. Kinetics & design for uncatalyzed heterogenous system
4. Fluid - Fluid reactions
5. Fluid particles rections
6. Catalysis
7. Porous catalysis
8. Deactivating catalysis
9. Solid catalyzed reactions
10. Fixed bed reactors,
11. Slurry reactors
12. Fluid bed reactors
13. Optimization
14. Industrial applications

REFERENCES:

VEER NARMAD SUTH GUJRAT UNIVERSITY, SURAT
PROCESS EQUIPMENT DESIGN & DRAWING

SEMESTER – VII

TEACHING SCHEME
L=3; P/D=4; TA=1

EXAMINATION SCHEME
Theory = 3hours; Marks= 100

PRACTICAL / DRAWING
Internal evaluation Marks: - 40
External evaluation Marks – 60
Tutorial = 25
Total Marks - 125

DESIGN:
1] Basic consideration of mechanical design of process equipments, selection of type of vessel
2] Criteria in vessel design.
3] Design of pressure vessels under internal pressure, constructional features, pressure vessel code, design of shell, types of heads for pressure vessel, design of thickness of heads.
4] Design of storage vessel, storage of nonvolatile and volatile liquids and gases. Codes for storage vessel design, bottom and shell designs.
5] Design of vessels under external pressure of vacuum stress analysis, use of stiffness, design of shell analytical and graphical methods, design of circumferential stiffners, design of covers, pipes and tubings under external pressure.
8] Design and construction of reaction vessels, evaporators, crystallizers, dryers, filters.
9] Supports for Vessels, types of brackets or leg support, skirt support, Saddle supports, design considerations.
10] Process hazards & Safety, measures in equipment design analysis of hazards, pressure relief devices.

DRAWING
1] Drawing based on actual design of selected process equipment, such as pressure vessels, storage vessels, heat exchangers, distillation columns, reaction vessels, crystallizers, absorbers, dryers etc.
2] Sketches of equipment accessories such as supports, roofs for storage vessel, jackets, cooling coils, tube sheet for heat exchangers, baffles in heat exchangers, trays for distillation column, packing for distillation towers, liquid distributor etc.
TUTORIAL:
Continuous internal evaluation based on above topics along with assignments.

REFERENCE:

1. Introduction: Steady and unsteady state design equation for an agitated heated tank. Introduction to P, PI, PID controls.
2. Dynamics of first order systems subjected to various disturbances like step, ramp, impulse & sinusoidal, eg. liquid level tanks, mixing process, thermometer etc., response of first order systems in series.
3. Dynamics of second order systems subjected to various disturbances like step, impulse, sinusoidal.
4. Linear closed loop systems, servo and regulator problem.
5. Closed loop transfer functions, block diagrams for various simple systems. Transient response of a control system. System compensation.
7. Advanced controls like feed forward, case and ratio controls.
8. Controller and control elements, control valves.

REFERENCE:

2. Kopell & Coughanowr, “Process system” published 1965, Mcgraw Hill co NY
Under the above subject each student will be assigned one topic related to Chemical Engg. field by the concerned staff member. The student will make an up-to-date literature survey / research oriented experimental work / design of (equipment / plant / system) / modeling and simulation of any system with reference to the topic assign to him/her under the supervision of the concerned staff member & submit two copies of the report. He/she will present material / literature / assigned work in the form of a paper by giving a talk to be followed by discussion. The copies of the report submitted by him/her will be evaluated as term work followed by Viva-Voce of each student.
- Each student is required to submit Project report on the designing of Chemical Plant/ exhaustive research oriented experimental work / exhaustive design work / modeling and simulation of any system / exhaustive work on industrial problem. The report will consist of important Chapters(with reference to the assigned topics) – for example on the designing of chemical plant - such as the follows.

1] Introduction
2] Literature Survey
3] Selection of the Process & process details with Justification
4] Thermodynamic & kinetics consideration
5] Physico-Chemical data & properties
6] Material Balance with flowsheet

The copies of the report submitted by him/her will be evaluated as term work followed by Vice – voce of each student.
Each student is required to undergo practical training in a Chemical Industry / R &
D organization for Four to Six weeks & has to prepare a report covering the
following aspects.
1] Introduction of the Industry. (Company Profile)
2] Process description & flow sheet. (Details about the process)
3] Details of equipment- Data sheet, types of the equipment, material of
   construction, internals.
4] Process utilities
5] Material Storage & handling
6] Instrumentation & Process control
7] Safety & environmental aspects.
8] Conclusion.

The copies of the report submitted by him/her will be evaluated as term work followed by
Vice – voce of each student.
### VEER NARMAD SUTH GUJRAT UNIVERSITY, SURAT
#### B.E. Chemical Engineering 8th Semester

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<td>802</td>
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<td>CAD in Chemical</td>
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<td>Elective – I</td>
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<td>805</td>
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<td>A – BIO CHEM.</td>
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<td>B – Energy Cons.</td>
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<td>C - PRPC</td>
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<td>Project</td>
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</table>
1. Introduction, basic consideration in chemical engg. Plant design, project identification, preliminary techno economic feasibility.
3. Selection of process equipments, standard versus special equipment, materials of construction, selection criteria etc.
4. Process auxiliaries, piping design, layout, support for piping insulation, type of valves, process control and instrumentation control system design.
5. Process utilities, process water, boiler feed water, water treatment and disposal, steam, oil heating system, chilling plant compressed air and vacuum.
6. Plant location and layout, principles, factors affecting plant location, use of scale models.
7. Cost estimation, factors involved in project cost estimation, total fixed & working capital, types & methods of estimation of total capital investment.
8. Estimation of total product cost, factors involved.
11. Economic considerations in process and equipment design, inventory control.
12. Optimum design, general products rates in plant operation, optimum conditions etc.

REFERENCE:
VEER NARMAD SUTH GUJRAT UNIVERSITY, SURAT
SAFETY AND WASTE MANAGEMENT

SEMESTER –VIII

TEACHING SCHEME

L=3; P/D=2; TA=0

EXAMINATION SCHEME

Theory = 3hours; marks= 100

PRACTICAL / DRAWING

Internal evaluation Marks - 20
External evaluation Marks - 30
Total Marks - 50

1. Types of hazards in chemical industries, Hazards due to high pressure and explosions, dust and vapour cloud explosions, inflammable materials, toxic materials, electrostatics, ionising radiations etc.
3. Fire and explosion indices and hazard analysis.
5. Disaster management, insurance, worker’s safety act etc.
6. Sources and effects of environmental pollution.
   - Air Pollution: Sources and effects materialiological aspects of air pollutant dispersion, air pollution sampling and measurement, air pollution control methods and equipment, control of specific gaseous pollutants.
   - Land Pollution (Solid waste): Sources and classification, methods of collection and disposal.
7. Management of industrial waste reuse, recycling, impact of pollution on environment and it’s assessment.

PRACTICALS:

3. To study BOD, AAS, Heavy metals analysis.
4. To study stack analysis.
REFERENCES:

1. C. S. Rao, Environmental and pollution control engineering, Wiley eastern limited
VEER NARMAD SUTH GUJRAT UNIVERSITY, SURAT
CAD IN CHEMICAL ENGINEERING

SEMESTER – VIII

TEACHING SCHEME
L=3; P/D=2; TA=2

EXAMINATION SCHEME
Theory = 3hours; marks= 100

PRACTICAL / DRAWING
Internal evaluation Marks:   20
External evaluation marks:  30
Tutorial:  50
Total Marks: 100

1. Introduction to CAD.
2. Elementary ideas of numerical techniques such as finite difference & finite element methods applied to chem. Engg. Problems.
3. Computer aided design of chemical process equipments, concept of modular design, optimum design, parameter optimization etc., development of simple algorithms for problems related to above topics.

PRACTICALS:
Development of Simple Programmes based on above topics.

TUTORIAL:
Continuous internal evaluation based on above topics along with assignments.

REFERENCE:
1. Fundamental Concepts Involved in Multi-Component Distillation
2. Calculations for Bubble Point and Dew Point Temperatures
3. Equilibrium Data
4. Thermodynamics of Vapor Liquid Equilibrium
   - The first and Second Laws of Thermodynamics
   - Ideal and Non Ideal solutions
   - Lewis and Randall Rule for Vapor and Liquid
   - Physical Equilibrium
   - Relation between Enthalpy to Fugacity and Acitivity
   - Excess Free Energy
5. Correlation of Vapor Liquid Equilibrium
   - Method of Lewis and Kay
   - Method of Souders, Selheimer and Brown
   - Method of Gamson and Watson
   - The Kellog Charts
6. Material Balance
7. Enthalpy Balance
8. Case Studies

Reference:
VEER NARMAD SUTH GUJRAT UNIVERSITY, SURAT
CH 804 B : ELECTIVE I: ENVIRONMENTAL ENGINEERING

TEACHING SCHEME
L=3; P/D=0; TA=1

EXAMINATION SCHEME
Theory = 3 hours; Marks= 100
Tutorial = 25

SYLLABUS

1. Environmental Engineering aspects of air, water and solid pollution
2. Waste Treatment Plant Design
3. Ecology and diversity
4. Environmental Impact Assessment
5. ISO 14000 Certification & Environmental Laws
6. Environment Audit and Case studies

RECOMMENDED BOOKS

6. Internet resources and Journals
VEER NARMAD SUTH GUJRAT UNIVERSITY, SURAT
Elective – I 804 C- (FERTILIZER TECHNOLOGY)

SEMESTER – VIII

TEACHING SCHEME          L=3; P/D=0; TA=1
EXAMINATION SCHEME        Theory = 3hours; Marks= 100
                           Tutorial = 25

Following aspects to be addressed to for various fertilizers and their intermediates such as Ammonia, Urea, Ammonium Sulfate, etc.
1] Present technologies available for the production, their technical along with energy consumption.
2] Operating conditions and unit operations involved.
3] Catalysis of process.
4] Instrumentation and process control.
6] Simulation and Optimization of the process.
7] Considerations for plant lay-out.
8] Economics of production.
9] Storage, handling, and transportation.
10] Hazop and Risk analysis study of the process.
11] Environmental aspects

TUTORIAL:
Continuous internal evoluation based on above topics alongwith assignments.

REFERENCES:
VEER NARMAD SUTH GUJRAT UNIVERSITY, SURAT

4. CH 805 A : ELECTIVE II : BIOCHEMICAL ENGINEERING

TEACHING SCHEME

L = 3; P/D = 0; TA = 1

EXAMINATION SCHEME

Theory = 3 hours; Marks = 100
Tutorial = 25

Syllabus

1. Cell Structure and Cell types, Chemicals of life (RNA, DNA, enzymes etc.)
2. Principles of biochemical reaction kinetics
3. Mass and energy balance in biological system, Transport phenomena, Enzymatic reaction kinetics
4. Free and immobilised enzyme cell systems
5. Microbial growth and product formation kinetics
6. Classification, design and analysis of bioreactors
7. Upstream processing - media and air sterilisation, Downstream bioprocessing
8. Interaction of Mixed Microbial Populations
9. Physical separation processes, Chromatography; Membrane processes
10. Biological Wastewater Treatment
11. Modern Biotechnological applications

References:

3. Blanch, Harvey W.; Clark, Douglas S. “Biochemical engineering” Marcel Dekker, N.Y.
1. Introduction- energy, types, resources, demand and supply
2. Need and opportunities to conserve energy
3. General strategies for energy savings
4. Equipments for energy conservation
5. Materials for saving energy
6. Non-conventional energy sources
7. Alternative fuel development
8. Energy audit and case studies

References:

5. Internet resources and Journals
VEER NARMAD SUTH GUJRAT UNIVERSITY, SURAT
ELECTIVE- II 805 C (PETROLEUM REFINING AND PETROCHEMICALS)

SEMESTER –VIII

TEACHING SCHEME
L=3; P/D=0; TA=1

EXAMINATION SCHEME
Theory = 3hours; marks= 100
Tutorial = 25

1. Oil fields and Refineries in India- Indian petroleum Industry, crude and gas reserves, refining picture.
2. Types of Crudes- composition, classification of petroleum.
4. Properties of crudes and products- Thermal properties, Test for various refinery products.
5. Processing of petroleum- Atmospheric distillation, Vacuum Distillation, various ways of operating distillation columns.
6. Treatment techniques-impurities, treatment of LPG, Gasoline, Kerosene and Lubes, Wax and purification.
7. Petrochemical Industry-Classification, Chemicals form C1, C2, C3, C4 compounds, chemicals from aromatics, Petrochemicals from various unit processes like oxidation, chlorination, alkylation etc., recent developments in the manufacturing processes.

TUTORIAL:
Continuous internal evaluation based on above topics along with assignments.

REFERENCE:
- Each student is required to submit Project report on the designing of Chemical Plant/
  exhaustive research oriented experimental work / exhaustive design work / modeling
  and simulation of any system / exhaustive work on industrial problem. The report
  will consist of important Chapters(with reference to the assigned topics) – for example on
  the designing of chemical plant - such as the follows.

1] Introduction
2] Literature Survey
3] Selection of the Process & process details with Justification
4] Thermodynamic & kinetics consideration
5] Physico-Chemical data & properties
6] Material Balance with flowsheet
7] Energy Balance with flowsheet
8] Process design & various equipments & optimum operation condition.
9] Fabrication drawing of one of the major equipment with all relevant necessary details.
10] Other important consideration such as instrument & process control, plant layout,
    safety precaution etc.
12] Cost estimation
13] Conclusion.
14] Bibliography & references.

The copies of the report submitted by him/her will be evaluated as term work followed by

Vice – voce of each student.