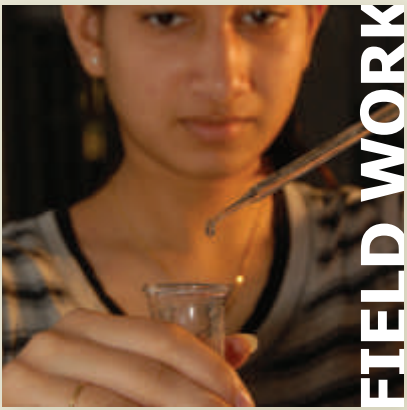
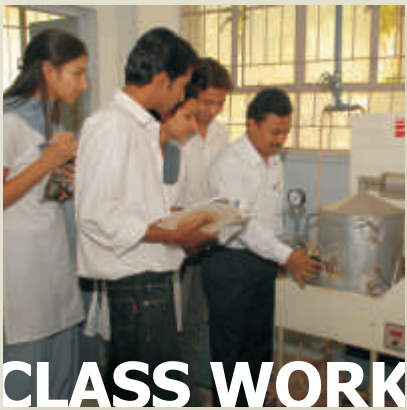
BHARATI VIDYAPEETH UNIVERSITY,
Pune.

(Established under Section 3 of UGC ACT 1956)

COURSE STRUCTURE AND SYLLABUS

B. Tech. (CHEMICAL)
(Sem. III & IV)





COURSE STRUCTURE & SYLLABUS

BHARATI VIDYAPEETH UNIVERSITY, PUNE

B. Tech. (CHEMICAL) (Sem. III & IV)

HIGHLIGHTS

Bharati Vidyapeeth University College of Engineering (BVUCOE) is the largest Engineering College in Maharashtra with an intake of 700 students in each academic year. Imparting quality technical education from Under Graduate to Doctorate Level, BVUCOE is probably the only Engineering College in India with an accreditation from both NAAC as well as NBA. The faculty at BVUCOE boasts of highly qualified academicians, a quality that is further emphasized by the fact that 15 of them are presently pursuing their Ph.D. degree.

BVUCOE has been ranked 29th amongst the Top 50 Technical Schools of India in survey conducted by DATAQUEST-IDC. We have enjoyed a ranking in this list for the last 4 years. Research is of utmost importance in all our programs. A total of 113 research papers were published in the academic year 2007-2008.

Currently we have 12 ongoing research projects. The infrastructure of BVUCOE is state-of-the-art with 62 classrooms, 59 laboratories and a well-stocked library that currently holds 27,130 titles. The college has an international presence with MoUs signed with the North Carolina A&T State University (Greensboro, USA), University of Venice (Italy), Actel Corporation (USA).Corporate interaction is also inculcated in our programs through our association with Oracle India Ltd., Infosys Ltd. and Tata Consultancy Services.

DEPARTMENT OF CHEMICAL ENGINEERING

Department of Chemical Engineering is one of the oldest department in Pune region and known for its very valuable contribution in providing high caliber, outstanding professionals to the industry and R & D establishments.

Being our own university, the department has got freedom to design and adopt the change in the structure and content of the syllabus in consultation with the industrial experts and researchers to suit their requirement. The department of chemical engineering desires its students to excel in the changing trends in the global economy. The salient features of the present course designed are:

- Computer Education with advanced simulation softwares
- Industrial training after VIIth semester for the period of six weeks
- Wide range of advanced elective subjects
- Expert interaction on each subject by the experts from the various fields

The department also conducts a post graduate course in Chemical Engineering. The P. G. students perform their dissertation work in collaboration with National Chemical Laboratories (NCL), Pune.

The Department of Chemical Engineering has following well equipped laboratories:

- Mechanical Operations
- Heat Transfer
- Mass Transfer
- Chemical Reaction Engineering
- Process Dynamics Instrumentation and Control
- Instrumental Analysis
- Software Laboratory – CHEMCAD, MATLAB, FEMLAB, gPROMS, T. K. Solver

The faculty has constantly endeavored to improve the academic standards and pursue the R & D work, publishing the academic research papers in the National and International journals. Some of the faculty members have presented their research papers at various conferences/seminars and workshops. As a result of continuous efforts by the faculty, the department has received the following funds/grants from the AICTE, New Delhi.

Young Career Award Research Project (10 Lakh)
Research Promotion Scheme (RPS) Grant (5.75 Lakh)
MODROB's for various chemical engineering laboratories (12 Lakh)

The department has the state of Art facilities of:

Gas Chromatography (G. C.)
High Pressure Liquid Chromatography (HPLC)
U.V.- Visible Spectrophotometer
Fluoride ion selective electrode meter

Department plans to provide low priced testing facility for Industry and research laboratories. Students' community actively involved in R & D experimentation can avail the same for affordable rates.

STRUCTURE & EXAMINATION PATTERN

B. Tech. - Chemical Engineering

Semester III

Total Duration : 32 Hrs/Week
Total Marks : 750

Subject Code	Subject	Teaching Scheme (Hrs.)			Examination Scheme (Marks)				Total (Marks)
		L	P	D	Theory	Unit Test	TW & Pr	TW & Or	
K70201	Applied Chemistry - I	04	02	-	80	20	50	-	150
K10202	Principles of Design & Material Technology	04	-	02	80	20	-	50	150
K20215	Solid Mechanics	04	02	-	80	20	-	50	150
K10204	Mechanical Operations	04	02	-	80	20	50	-	150
K10205	Stoichiometry	04	-	-	80	20	-	-	100
K10206	Computer Programming for Chemical Engineering - I	02	02	-	-	-	-	50	50
	Total	**22**	**08**	**02**	**400**	**100**	**100**	**150**	**750**

Teaching Scheme			Examination Scheme				Total
Lectures	Practical	Drawing	Theory	Test	T. W. & Pr	T. W. & Or.	
22	08	02	400	100	100	150	750

Semester IV

Total Duration : 32 Hrs/Week
Total Marks : 750

Subject Code	Subject	Teaching Scheme (Hrs)			Examination Scheme (Marks)				Total (Marks)
		L	T	P	Theory	Unit Test	TW & Pr	TW & Or	
K70208	Applied Chemistry -II	04	-	02	80	20	50	-	150
K70209	Engineering Mathematics - III	04	-	-	80	20	-	-	100
K10210	Fluid Mechanics	04	-	02	80	20	50	-	150
K10211	Heat Transfer-I	04	-	02	80	20	50	-	150
K10212	Chemical Engineering Thermodynamics - I	04	02	-	80	20	-	50	150
K40213	Electrical & Electronics Technology	02	-	02	-	-	-	50	50
	Total	**22**	**02**	**08**	**400**	**100**	**150**	**100**	**750**

Teaching Scheme			Examination Scheme				Total
Lectures	Practical	Drawing	Theory	Test	T. W. & Pr.	T. W. & Or.	
22	08	02	400	100	150	100	750

RULES FOR CONDUCTING TESTS

Mode of the test

In each semester for each subject three tests shall be conducted. The schedule for the same will be declared at the commencement of academic year in the academic calendar.

Each test shall carry 20 marks.

University examination pattern has given weightage of 20 marks for the tests.

To calculate these marks following procedure is followed:

i) Out of the three tests conducted during the semester, the marks of only two tests in which the candidate has shown his/her best performance shall be considered, to decide the provisional marks in each subject.

ii) Average marks obtained in two tests in which students have performed well, shall be considered as provisional marks obtained by the student in the tests.

iii) If the candidate appears only for two tests conducted during the semester, he/ she will not be given benefit of the best performance in the tests.

iv) If the candidate appears only for one test conducted during the semester, to calculate the marks obtained in the tests it will be considered that the candidate has got 0 (zero) marks in other tests.

v) The provisional marks obtained by the candidate in class tests should reflect as proportional to theory marks. In cases of disparity of more than 15% it will be scaled down accordingly; These marks will be final marks obtained by the student. No scaling up is permitted.

vi) If the candidate is absent for theory examination or fails in theory examination his final marks for tests of that subject will not be declared. After the candidate clears the theory, the provisional marks will be finalized as above.

Paper Pattern for Tests

i) All questions will be compulsory with weightage as following

Question 1	-	7 marks
Question 2	-	7 marks
Question 3	-	6 Marks

ii) There will not be any sub-questions.

For granting the term it is mandatory to appear for all the three tests conducted in each semester.

Roll numbers allotted to the students shall be the examination numbers for the tests.

SEMESTER - III

K70201: APPLIED CHEMISTRY – I

TEACHING SCHEME		EXAMINATION SCHEME	
Lectures	: 04 Hrs/week	Theory	: 80 Marks
Practical	: 02 Hrs/week	Duration	: 03 Hours
		Unit Test	: 20 Marks
		T. W. & Pr.	: 50 Marks

Unit-I (08 Hours)

Structural Effect and Reactivity :

Benzene and aromaticity, concept of aromaticity (4n+2), condition's necessary for demoralization, breaking and formation of bonds (Reaction intermediate). Factors affecting electron availability – Inductive effect, Resonance effect (resonance structures of naphthalene, anthracene, aniline, phenoxide ion, benzaldehyde, nitrobenzene, etc.), hyperconjugation, steric effect, tautomerism. Effects of resonance, inductive effect, steric effect on pKa and pKb, value of simple acids and bases. Types of reactions, types of reagents.

Unit-II (10 Hours)

Reaction Mechanism :

Mechanism of reaction involving carbonium ion intermediates:

Nucleophilic substitution – Hydrolysis of alkyl halide (SN^1 Mechanism). Also discuss SN^2 mechanism and factors affecting SN reactions.

Electrophillic substitution in benzene and mono-substituted benzene, nitration, sulphonation, halogenation, Friedal Craft alkylation and acylation.

Electrophillic addition to C=C, polar addition of hydrogen halides and water, alkylation, dimerisation.

Elimination's – E^1 reaction in acid catalyzed dehydration of alcohols, base catalyzed dehydro-halogenation of alkyl halides, comparison of elimination with substitution. Also cover E^2 mechanism.

Rearrangement- Beckman rearrangement.

Mechanism of reactions involving carbanion intermediates:

Addition of carbon nucleophile to C=O, Grignard reaction for preparation of primary, secondary, and tertiary alcohol's and carboxylic acids.

Nucleophilic substitution by carbon nucleophile-Wurtz reaction.

Carbanion involved in condensation-Aldol condensation and Claisen ester condensation.

Rearrangement involving carbanion-Favorskii rearrangement

Unit-III (06 Hours)

Spectroscopy:

Revision of UV. & I.R. spectroscopy. Application of UV & I.R. spectroscopy for identification of simple organic compounds (simple problems).

Unit-IV (08 Hours)

Gaseous State:

Gaseous state I - Behavior of ideal gases, kinetic molecular theory of gases. The kinetic gas equation. Derivation of gas laws from gas equation, kinetic energy and temperature. Types of molecular velocities and their calculations, mean free path and collision frequency, collision diameter and degrees of freedom. Law of equipartition of energies, specific heat and molar heats of gases.

Gaseous state II – Behavior of real gases-ideal and real gases, deviation from ideal behavior, Vander Wall's equation of state and it's limitations intermolecular forces. The critical phenomenon, experimental determination of critical constants of a gas, critical phenomenon and Andrews experiments, Vander Wall's equation and critical state, calculation of critical constants. Numericals based on above article.

Unit-V (08 Hours)

Solution:

Solution-Definition, why substances dissolve, temperature and solubility, solution of gas in gas, gases in liquid, Henry's law, the ideal solution, Raoult'1s law of ideal solution, solutions of liquids in liquids, theory of dilute solution. Colligative properties, osmosis, osmotic pressure, measurement of osmotic pressure. Colligative properties of dilute solution – lowering of vapor pressure, elevation of boiling point and thermodynamic derivation, depression in freezing point and thermodynamic derivation. Abnormal behavior of solutions of electrolytes. Numericals on all above. Numericals based on this article.

Unit-VI (08 Hours)

Instrumental Methods of Chemical Analysis:

Principles and working of flame photometer UV-Visible spectrophotometer, Gas Chromatograph, Conductivity meter, pH meter, Atomic Absorption Spectrophotometer, Polarimeter, Potentiometer, Karl Fischer Titrator.

List of Practicals - I Volumetric Analysis (Any Two)

Volumetric estimation of amide from the given solution of amide.
Volumetric estimation of acetone from the given solution.
Estimation of aniline / phenol from the given solution.

List of Practicals - II Preparations (Any Two)

Preparation of benzoic acid from benzamide.
Preparation of osazone derivative of glucose.
Preparation of aspirin from salicylic acid.

List of Practicals - III (Any Eight)

To determine the molecular weight of a given solute by freezing point of naphthalene.
To determine heat of solution of KNO_3 /NH_4Cl by studying their solubility in water.
To determine the equivalent weight of the given metal (Zn or Mg) Eudiometrically.
To determine distribution coefficient of iodine between water and CCl_4.
To standardize $Na_2S_2O_3$ solution by preparing $K_2Cr_2O_7$ & to estimate % of copper from given solution.
Heat of neutralization.
Thermodynamic parameters.
Purification of organic compound by recrystallization and sublimation and to find their physical constant (any four compounds)
Experiments on UV-Vis spectrophotometer.
Estimation of percentage of sugar by polarimeter.

Text Books/ References

Barrow G. M., Physical Chemistry, 5th ed, McGraw Hill, 1988.
Maron S. H. and Prutoon C. F., Principles of Physical Chemistry 4th ed, Oxford and

IBH, 1972.

Ewing G.M. Instrumental Methods of Chemical Analysis, 5th ed, McGraw Hill, 1985
Glasstone S.A. Text book of Physical Chemistry, 2nd ed. McMillan 1986
Moore W.J. Physical Chemistry, 5th ed., Orient Longman, 1972
Industrial Chemistry by B. K. Sharma
Principles of Physical Chemistry by Puri, Sharma, Pathana
Morrison and Boyd Organic Chemistry; Prentic Hall of India Ltd.
Jerry March, Advanced Organic Chemistry, McGraw Hill International Book Company
Peter Sykes, A Guide to Mechanism in Organic Chemistry, Orient Longman.

Syllabus for Unit Test

Unit Test 1	Unit I & IV
Unit Test 2	Unit II & V
Unit Test 3	Unit III & VI

K10202: PRINCIPLES OF DESIGN AND MATERIAL TECHNOLOGY

TEACHING SCHEME		EXAMINATION SCHEME	
Lectures	: 04 Hrs/week	Theory	: 80 Marks
Practical	: 02 Hrs/week	Duration	: 03 Hours
		Unit Test	: 20 Marks
		T. W. & Or.	: 50 Marks

Unit-I (07 Hours)

Introduction to Process Equipment Design:

General design procedure, Equipment classification, Design codes, Study of design parameters such as maximum working pressure, design pressure, design temperature, design stress & factor of safety, design of wall thickness & minimum actual thickness, Corrosion allowance, Design loading, Possions ratio. Design of various heads & closures such as flat head, torrispherial head, elliptical head, hemispherical head, conical head.

Unit-II (08 Hours)

Design of Machine Elements:

Design of machine elements such as agitators, shafts, keys and couplings

Valves: General construction working selection of globe valve, stop valve, three-way valve, steam trap, non rising stem, diaphragm. Pumps: General construction working application of different pumps, fan blowers.

Unit-III (09 Hours)

Introduction to Vessels and Vessel Elements:

Introduction to various vessels such as Pressure vessel, Storage vessel etc. Vessel Supports- Design of various such as skirt support, leg support, bracket support, saddle support, leg support, design of tall vertical column. Flanges & Nozzles- Detail design of Flanges, Gasket, Bolts & Nozzles.

Unit-IV (08 Hours)

Ferrous and non-ferrous materials and its alloys (Al ,Cu , Ni , Ti , and its alloys, babbites). Engineering properties, Metal- metal and metal –nonmetal composites, Heat treatment of steels. Surface treatments: Electroplating, anodizing, lining.

Unit-V (08 Hours)

Corrosion and its classification, Environmental study and method of elimination and prevention, Polymers: engineering plastics and rubbers, their typical properties and applications, Testing of polymers, Types of organic protective coatings, Factors determining choice of materials of constructions in chemical industry.

Unit-VI (08 Hours)

Various types of composite materials used in chemical industry and their applications, Crystalline and non-crystalline ceramic systems, Glass and porcelain enamels, Refractories.

List of Drawing Practical

Drawing Sheets (4 Nos. A-1) based on the following equipment :
Detail drawing of Various Heads.
Machine drawing conventions. Production drawing showing tolerances, various bolts, types of thread.
Types of valve – assembly and detailed drawing of globe, gate, needle, check, relief and safety valves, gear and vane pumps, reciprocating and centrifugal pumps.
Mechanical drive components : Shaft, Keys and Couplings.
Various types of vessels and accessories.
AUTOCAD assignment on A-4 sheets.
AUTOCAD Exercises (2 Nos.)
Sectional drawing of assemblies of components with the use of important commands of AUTOCAD. Components : knuckle joint, flanges coupling, stuffing box, cottor joint, valve, etc.

Text Books/References

Bhattacharya B. C., "Introduction to Chemical Equipment Design", CBS Publishers and Distributors

Dawande S. D., "Process Design of Equipments", Central Techno Publications

Joshi M. V., "Process Equipment Design", McMillan India

Hajra Choudhry S. K., A. K. Hajra Choudhary, "Material Science & Processes", Indian Book Distributing Company

Khurmi R. S. and Gupta J. K., "A Text Book of Machine Design"

Bhandari V. B., "Design of Machine Elements"

Badger W. L. and Banchero J. T., "Introduction to Chemical Engineering", McGraw Hill

J. M. Coulson, J. F. Richadson and R. K. Sinott, "Chemical Engineering Vol. 6", Pergamon Press

Syllabus for Unit Test

Unit Test 1	Unit I & II
Unit Test 2	Unit III & IV
Unit Test 3	Unit V & VI

K20215: SOLID MECHANICS

TEACHING SCHEME		EXAMINATION SCHEME	
Lectures	: 04 Hrs/week	Theory	: 80 Marks
Practical	: 02 Hrs/week	Duration	: 03 Hours
		Unit Test	: 20 Marks
		T. W. & Or.	: 50 Marks

Unit -I (08 Hours)

Concept of Stress and Strain:

Concept of stress, strain; Normal, lateral, shear and volumetric stresses and strains; Stress-strain curve; Elastic constants and their relationship; Generalized Hooke's law.

Axial and Thermal Stresses

Axial force diagram; Stresses, strains and deformation of determinate and indeterminate, prismatic and tapered cross section, homogenous and composite bars; due to concentrated loading, self weight andtemperature effect; Axial rigidity.

Unit –II (08 Hours)

Axially Loaded Long Columns:

Concept of critical load and buckling; Differential equation of elastic curve; Euler's formula for hinged ends; Equivalent length for different end conditions; Limitation of Euler's formula; Rankine's formula; Johnson's formula.

Direct and Bending Stress:

Concept; Resultant stress due to the axial load and uniaxial or biaxial bending; Core of section; Effect of lateral force and self weight; Application to columns, retaining walls, dams, chimneys etc.

Unit-III (08 Hours)

Principal Stresses and Principal Planes:

Normal and shear stresses on any oblique plane; Concept of principal stresses and principal planes; Maximum shear stress; Analytical and graphical method. (Mohr's circle method); Combined effect of axial force, bending moment, shear force and torsion; Theories of failure.

Strain Energy:

Concept of strain energy; Modulus of Resilience and Toughness; Strain

energy for axially loaded members due to gradual, sudden and impact load; Strain energy due to self weight

Unit-IV (08 Hours)

Shear Force and Bending Moment in Beams:

Concept of Shear Force and Bending Moment; Relation between Shear Force, Bending Moment and intensity of loading; Shear Force Diagram and Bending Moment Diagram due to point load, uniformly distributed load, uniformly varying load and moments for the simple and compound beams; Elastic curve.

Flexure Stresses:

Theory and assumptions of pure bending; Moment of resistance; Flexure formula; Flexural rigidity; Modulus of rupture; Flexural stress distribution diagram for various sections; Force resisted by partial cross section.

Unit-V (08 Hours)

Shear Stresses:

Concept of direct and transverse shear; Shear stress formula; Concept of complementary shear stress; Shear stress distribution diagram for symmetrical and unsymmetrical section.

Torsion of Circular Shafts:

Theory, assumptions and derivation of torsional formula; Shear stress distribution across cross section; Twisting moment diagram; Shear stresses and strains in determinate and indeterminate shafts of hollow, solid, homogeneous and composite cross sections subjected to twisting moment; Torsional rigidity.

Unit-VI (08 Hours)

Slope and Deflection of Beams:

Concept of relation between deflection, slope, bending moment, shear force and intensity of loading; Double Integration method; Macaulay's method; Moment area Method; Conjugate beam method.

Pressure Vessels:

Stresses, strains and deformation in thin walled cylindrical and spherical vessels due to internal fluid pressure; Thick cylinders; Lame's equation of stresses.

Term-work:

The term-work shall consist of minimum TEN experiments from the following list:
Tension test – Mild Steel, Tor Steel, Aluminum
Compressive Strength test-Concrete
Compressive Strength test-Cement
Bending test – Timber
Bend Re-bend test- Mild Steel, Tor Steel
Direct Shear test- Mild Steel, Aluminum
Torsion test- Mild Steel, Aluminum
Izod & Charpy Impact test- Mild Steel, Aluminum, Brass, Copper
Rockwell Hardness test- Mild Steel, Aluminum, Brass, Copper
Fatigue test- Mild Steel, Aluminum
Block board test
Drawing up of SFD and BMD using computer software

Text Books/ References

Beer F. P. and Johnston E. R.,"Mechanics of Materials", McGraw Hill Publication
Gere J. M. & Timoshenko S. P., "Mechanics of Materials", CBS Publishers & Distributors
Singer F. L. & Pytel A., "Strength of Materials", Harper and Row Publication
Popov E. P., "Engineering Mechanics of Solids", Prentice Hall of India (P) Ltd.
Benham P. P.,Crawford R. J. & Armstrong C. G., "Mechanics of Engineering Materials", ELBS Longman Publication
Rajput R. K., "Strength of Materials", S. Chand Publication
Junnarkar & Adavi, "Mechanics of Materials", Charotar Publishing House
Ramamrutham S. & Narayan R., "Strength of Materials", Dhanpat Rai Publishing Company

Syllabus for Unit Test

Unit Test 1	Unit I & IV
Unit Test 2	Unit II & V
Unit Test 3	Unit III & VI

K10204: MECHANICAL OPERATIONS

TEACHING SCHEME		EXAMINATION SCHEME	
Lectures	: 04 Hrs/week	Theory	: 80 Marks
Practical	: 02 Hrs/week	Duration	: 03 Hours
		Unit Test	: 20 Marks
		T. W. & Pr.	: 50 Marks

Unit -I (08 Hours)

Properties and Handling of Particulate Solids:

Properties of solids: Particle size and shape. Screen analysis: Cumulative and differential. Specific surface of mixture. Standard screen series. Properties of particulate masses: Pressure in mass of particles. Angle of internal friction and angle of repose. Storage of solids.

Conveyors:

Basic types of conveyors. Basic principles of design and criteria for selection of conveyors.

Unit –II (08 Hours)

Size Reduction:

Principles of comminution: Criteria for comminution, Energy and power requirement in comminution, Laws of comminution. Size reduction equipment: Crushers , grinders and ultrafine grinders, cutting machines, Open and closed circuit grinding.

Unit-III (08 Hours)

Screening:

Types of screening equipment, Material balance and effectiveness of a screen, Comparison of ideal and actual screen.

Centrifugal settling process:

Working and theory of cyclone separator, Hydrocyclone and centrifugal sedimentation.

Gas filters. Fiber and fabric filters. Froth filtration. Magnetic separation. Electrostatic separations. Tabling and jigging.

Unit-IV (08 Hours)

Filtration :

Introduction .Equipment for filtration. Theory of filtration : filter media and filter aids, pressure drop through filter cake, compressible and incompressible filter cakes, cake and filter medium resistance, washing of cakes. Principles of cake filtration for constant rate and constant pressure filtration. Principles of continuous filtration. Principles of centrifugal filtration.

Unit-V (08 Hours)

Separation based on motion of particles through the liquids:

Gravity Settling Process: Gravity classifiers, Sorting classifiers, Terminal settling velocity, Free and hindered settling, Stokes law and Newton's law, Sink and float method, Differential method.

Sedimentation and Thickening: Batch sedimentation test. Types of thickeners. Design calculations: Kynch theory of sedimentation, Calculation of area of thickener.

Unit-VI (08 Hours)

Mixing of Solids and Pastes:

Mixers for pastes and plastic masses. Mixers for dry powders. Criteria for mixer effectiveness. Mixing index in blending granular solids. Rate of mixing.

Mixing and agitation of liquids:

Types of equipment, Mixing characteristics, Power consumption, Mixing index calculations.

Term work

Term will consist of the experiments. listed below of which at least eight should be performed in laboratory by the students .In addition, two more topics given in the list may be given as assignments.

List of Practicals

Determining the effectiveness of a screen
Determining the properties of particle beds
Determining the area of a thickener by conducting batch sedimentation test

Study of free settling of particles through fluids of different density and viscosity
Determining efficiency of a cyclone separator
Determining the resistance of a filter cloth and cake by using vacuum leaf filter or plate and frame press
Determining the energy consumption and crushing law constants for jaw crusher and ball mill or drop weight crusher
To study the behavior of a bed during the fluidization and determine the minimum fluidization velocity
Ore separation by froth floatation cell
Study of belt conveyor, bucket elevator and pneumatic conveyor

Text Books/References

W. L. McCabe, J. C. Smith and P. Hariott, "Unit operations in Chemical Engg.", McGraw Hill Publications

J. M. Coulson and F. Richardson, "Chemical Engineering Vol. II", Pergamon Press

W. L. Badger and J. T. Banchero, "Introduction to Chemical Engineering" McGraw Hill Publications

A. S. Foust, "Principles of Unit Operation", Wiley Publications

Syllabus for Unit Test

Unit Test 1	Unit I & II
Unit Test 2	Unit III & IV
Unit Test 3	Unit V & VI

K10205: STOICHIOMETRY

TEACHING SCHEME
Lectures : 04Hrs/week

EXAMINATION SCHEME
Theory : 80 Marks
Duration : 03 Hours
Unit Test : 20 Marks

Unit -I (06 Hours)

Overview of the needs of Process Engineer:

Importance of material and energy balance calculations in raw material and energy requirement .Calculations and performance analysis of a process plant. Material and energy balance equations as foundations of process design and process modeling and simulation.

Units and Dimensions:

Basic and derived units. Different unit systems. Relation between mole and mass, average molecular weight of a mixture. Different units of concentration: molarity, normality, molality, density, PPM, mol % and weight %.

Unit –II (09 Hours)

Material balances without Chemical Reactions:

Concept of material balance in respect of mass and moles. Material balance problems without chemical reactions. Material balance involved in unit operations: viz. absorption, stripping, distillation, extraction, crystallization, evaporation and drying. Chemical equation and stoichiometry.

Unit-III (09 Hours)

Material balances involving Chemical Reactions:

Concept, material balance calculations, Recycle, bypass and purge operations.

Unit-IV (06 Hours)

Gases, Vapours, Liquids and Solids:

Ideal gas law calculations. Compressibility factor . Vapor pressure of liquids. Steam table and vapor pressure of water .Saturation , partial saturation and humidity of gas-vapor mixture .Material balances

involving condensation and vaporization. Equilibrium composition determination for vapor-liquid, liquid-liquid and solid-liquid systems. (Binary Systems only) Solubility diagrams.

Unit-V (10 Hours)

Energy Balance:

General energy balance equation and its appropriate reduction for the purpose of process calculations. Calculation of enthalpy changes with and without Phase change and using heat capacity equations of the type $Cp = a + bT + cT^2 + .$ Standard heat of formation : Sources and prediction tools. Standard heat of combustion . Standard heat of reaction. Standard heat of Solution. Heat of reaction from heats of formation and heats of combustion. Use of Hess's law in enthalpy change calculations. Energy balance problems involving exothermic and endothermic reactions. Adiabatic reaction temperature. Problems based on heats of dissolution. Use of steam table for enthalpy of water and steam. Utility calculations involving steam and cooling water.

Unit-VI (08 Hours)

Fuels and Combustion:

Proximate and ultimate analysis. Gross and Net calorific values. Stoichiometric and excess air calculations. Adiabatic or theoretical flame temperature calculations.

Text Books/ References

B. I. Bhatt and Vora: "Stoichiometry" , Tata McGraw Hill Publishers

Himmelblau D. M.: "Basic Principles and Calculations in Chemical Engg.", Prentice Hall Publications

O. A. Hougen, K. M. Watson and R.A. Ragatz: "Chemical Processes Principles, Part-I, Material and Energy Balances", Asia Publishing House, Bombay

M. F. Felder and R. W. Pouseau: "Elementary Principles of Chemical Processes", John Wiley Publications

D. F. Rudd, G. J. Powers and J. F. Sirola: "Process Synthesis", Prentice Hall Publications

S. D. Shukla and G. N. Pandey: "Chemical Engineering Calculations", Lion Press, Kanpur

W. E. Ranz : "Describing Chemical Engineering Systems", McGraw Hill Publications

Syllabus for Unit Test

Unit Test 1	Unit I & II
Unit Test 2	Unit III & IV
Unit Test 3	Unit V & VI

K10206: COMPUTER PROGRAMMING FOR CHEMICAL ENGINEERING - I

TEACHING SCHEME
Lectures : 02 Hrs/week
Practical : 02 Hrs/week

EXAMINATION SCHEME
T. W. & Or : 50 Marks

Unit -I (04 Hours)

Introduction to C-Programming, Character sets, constant, variables and Data Types: int, float, double, char, string. Operators: arithmetic, relational, logical, increment and decrement, assignment, conditional. Standard input-output functions: printf ( ), scanf ( ), getch ( ) or getchar ( ).

Unit –II (05 Hours)

Control statements: programs using if statement, if-else statement, goto statement and switch-case statement.

Loop statements: programs using while loop, do-while loop and for loop.

Unit-III (04 Hours)

Arrays: single dimension, double dimension. String: programs using string. String functions: strlen ( )/strcpy( )/ strrev( )/ strcat ( )/strlwr ( )/ strupr ( )/ strcmp ( ).

Unit-IV (04 Hours)

Pointers: programs using pointers. Use of * and & operators. pointer arithmetic's. Use of pointers. Pointer and function: parameter passing to function by reference and by value. File handling, Linked list

Unit-V (04 Hours)

Application of C-programming for Chemical Engineering: various calculations and solutions in Chemical Engineering.

Unit-VI (03 Hours)

Number systems and conversion, Computers and communication: single user, multi-user, work station, client server systems. Programming languages: classification, machine code, assembly language, fourth generation languages.

List of Practicals

Minimum number of practicals: 7

Unsolved problems/assignments from the reference books should be given in the practical hours to do the programming. The problem(s) should be such that it will keep the students engaged for 2 hours

A report on the above should be submitted as term work

Text Books/ References

Yashwant Kanetkar, "Let Us C," 4th revised ed., BPB Publications

Cooper M. "The Spirit of 'C' – An introduction to modern programming", Jaico Publisher

Rajaraman V., "Fundamentals of Computers", Prentice Hall of India

E. Balagurusamy, "Programming in ANSY C", 2nd Ed. McGraw Hill Publication Co. 1989

Sanders D. H., "Computers Today," McGraw Hill Publications

Trainer T., et. al. "Computers," McGraw Hill Publications

SEMESTER - IV

K70208: APPLIED CHEMISTRY – II

TEACHING SCHEME
Lectures : 04Hrs/week
Practical : 02Hrs/week

EXAMINATION SCHEME
Theory : 80 Marks
Duration : 03 Hours
Unit Test : 20 Marks
T. W. & Pr. : 50 Marks

Unit -I (08 Hours)

Biomolecules:

Carbohydrates: Definition, classification, Reactions of carbohydrate oxidation, reduction, osazone formation, ester formation, isomerization, Davd L. configuration, cyclic structure of glucose, fructose, Fischer-Haworth projection chair form. Brief account and cyclic structure of disaccharides-maltose, sucrose, cellobiose polysaccharide starch.

Aminoacids, proteins and enzymes: α –amino acids, Fischer projection and relative configuration. Classification of α-amino acids, properties and reactions. Proteins-Formation of peptide linkage, features of peptide linkage, α helical configuration, β-pleated structure, primary, secondary, tertiary and quaternary structure of proteins.

Unit –II (08 Hours)

Transition Elements and their Complexes:

Transition elements, study of I^{st} transition series with respect to oxidation states, magnetic behaviour, colour, ability to form complexes and catalytic behaviour.

Co-ordination compounds-different terms-C.N., ligands, EAN, etc. Nature of metal ligand bonding-VBT and CFT-Formation and above properties in tetrahedral, square planar and octahedral complexes of I^{st} transition series on the basis of VBT and CFT.

Unit-III (08 Hours)

Volumetric Analysis:

Standard solutions and various methods of expressing various methods of solutions, equivalent weights in different types of reactions. Primary and secondary standard solutions, their preparations. Classification of volumetric analysis- Acid-base, complexometric, oxidation-reduction,

precipitation-with specific examples, theories of indicators used in all above types of titrations, titration curve (acid-base, redox). Numericals on all above.

Unit-IV (06 Hours)

Colligative Properties and their Experimental Determination:

Boiling Point Elevation, Freezing Point depression, Osmotic Pressure. Numericals based on the topic.

Unit-V (08 Hours)

Surface Chemistry:

Interparticle forces, adsorption isotherms, determination of the surface area of fine powders using BET theory, surface films.

Catalyst Science:

Modern theories of catalysis physicochemical investigations of catalysts, kinetics of catalytic reactions, the Langmuir Hinshelwood approach.

Unit-VI (10 Hours)

Industrial chemistry: Oil, Soap & Detergent

Fats & Oils:

Analysis & composition, extraction of oils-pressing, rendering & solvent extraction, bleaching & refining.

Soaps:

Raw materials & manufacture, types of soaps

Detergents:

Classification & application, raw materials & manufacture, Enzyme & Zeolite based detergents, biodegradable detergents.

List of Practicals - I

Organic Qualitative Analysis (8 compounds):

Preliminary tests, type, elements, functional group & physical constants.

List of Practicals - II(Any Two)

To determine loss in weight & percentage composition of NaH CO_3 by gravimetric method.

To determine water of crystallization of $MgSO_4$. xH_2O by gravimetric method.

To determine water of crystallization of $BaCl_2$. xH_2O by gravimetric method.

List of Practicals - III(Any Two)

Determine λ-max for $KMnO_4$ & find concentration of unknown solution by using colorimetric measurements.

Determine surface tension of a given liquid by stalagmometer.

Identification of organic compounds by using IR & UV spectroscopy.

List of Practicals - IV(Any Two)

Preparation of tetra mine Cu (II) sulphate

Preparation of potassium tri-oxalato ferrate.

Preparation of crystal of potash alum.

Text Books/ References

Barrow G. M., Physical Chemistry, 5th ed, McGraw Hill, 1988

Maron S. H. and Prutoon C. F., Principles of Physical Chemistry 4th ed, Oxford and IBH, 1972

Ewing G. M., Instrumental Methods of Chemical Analysis, 5th ed, McGraw Hill, 1985

Glasstone S. A., Text book of Physical Chemistry, 2nd ed. McMillan 1986

Moore W. J., Physical Chemistry, 5th ed., Orient Longman, 1972

B. K. Sharma, Industrial Chemistry

Puri, Sharma, Pathana, Principles of Physical Chemistry

Conn E. E. and Stumps. P. Y., Outline of Biochemistry

Das-Gupta S. K., Biochemistry, Vol. I

Rao K. P., Text book of Biochemistry

Syllabus for Unit Test

Unit Test 1	Unit I & IV
Unit Test 2	Unit II & V
Unit Test 3	Unit III & VI

K70209: ENGINEERING MATHEMATICS – III

TEACHING SCHEME
Lectures : 04 Hrs/week

EXAMINATION SCHEME
Theory : 80 Marks
Duration : 03 Hours
Unit Test : 20 Marks

Unit -I (09 Hours)

Differential Equations:

Solution of Linear differential equation of n^{th} order with constant coefficients, Method of variation of parameters, Cauchy's and Legendre's linear equations. Simultaneous linear differential equations, Total differential equations, Symmetrical simultaneous differential equations.

Unit –II (09 Hours)

Applications of Differential Equations:

Applications to bending of beams, whirling of shafts and chemical engineering problems.

Applications of Partial Differential Equations:

Solution of wave equation, one and two dimensional heat flow equations by method of separating variables. Applications to problems in chemical and allied engineering.

Unit-III (08 Hours)

Fourier Transform:

Fourier integral theorem, Fourier sine and cosine integrals, Fourier transform, Fourier sine and cosine transforms, Inverse Fourier transforms, Solution of boundary value problems using Fourier transform (Diffusion equation only).

Unit-IV (09 Hours)

Laplace Transform:

Definition, Properties and Theorems, Inverse Laplace transform, Laplace transform of Unit-step function, Dirac-delta functions, Periodic functions, Ramp functions, Error function, First order Bessel's function, Si(t), Ci(t), Ei(t).

Applications to solution of linear differential equations, Liquid level

system consisting of single tank and two tanks in series (interacting and non interacting systems), Second order systems (damped vibrator).

Unit-V (09 Hours)

Vector Differentiation:

Radial, Transverse, Tangential, Normal components of linear velocity and acceleration. Gradient, Divergence and Curl, Directional derivative, Vector identities, Irrotational and Solenoidal Vector fields.

Unit-VI (08 Hours)

Vector Integration:

Line integral, Surface integral and Volume integral, Work done, Gauss Divergence theorem, Stoke's theorem and Green's lemma. Applications to fluid flow, Stream lines, Continuity equation, Motion equation and Bernoulli's equation.

Text Books/ References

Peter V. O'Neil, Advanced Engineering Mathematics, 5e, Thomson Learning

Erwin Kreys zing, Advanced Engineering, Wiley Eastern Ltd.

Wylie C. R. and Barrett L.C. , Advanced Engineering Mathematics, McGraw-Hill

M. D. Greenberg, Advanced Engineering Mathematics, 2e, Pearson Education

B.S. Grewal, Higher Engineering Mathematics, Khanna Publication, Delhi

P. N. Wartikar and J.N. Wartikar, Applied Mathematics (Volume I & II), Pune Vidyarthi Griha Prakashan

Murray R. Spiegel, Laplace Transforms, Schaum's Outline Series–International Edition

Syllabus for Unit Test

Unit Test 1	Unit I & IV
Unit Test 2	Unit II & V
Unit Test 3	Unit III & VI

K10210: FLUID MECHANICS

TEACHING SCHEME		EXAMINATION SCHEME	
Lectures	: 04 Hrs/week	Theory	: 80 Marks
Practical	: 02 Hrs/week	Duration	: 03 Hours
		Unit Test	: 20 Marks
		T. W. & Pr.	: 50 Marks

Unit -I (09 Hours)

Introduction:

Scope and applications

Fluid Statics :

Review and properties of fluids and related concepts. Concepts of pressure and hydrostatic equilibrium. Barometric equation. Manometer of different types.

Fluid Flow Phenomena:

Review of velocity fields, velocity gradients and the shear stress field in laminar flow. Dynamic and kinematic viscosity. Newtonian and Non-Newtonian fluid behavior, Reynolds No. Transition from laminar to turbulent flow for Newtonian and Non-Newtonian fluids. Nature of turbulence .Eddy viscosity.

Flow in Boundary Layer :

Basic concept . Boundary layer growth along a flat plate .Thickness of boundary layer. Boundary layer separation and wake formation. Qualitative discussion on importance of boundary layer in heat and mass transfer.

Unit –II (08 Hours)

Dimensional Analysis:

Fundamental dimensions. Units of various quantities used in fluid mechanics Dimensional analysis. Importance of dimensional analysis in experimental design. Applications of dimensional analysis.

Basic Equations of Fluid Flow:

Review of equations of continuity. Bernoulli's equation with and without friction, correction terms in Bernoulli's equations, applications to various cases.

Unit-III (07 Hours)

Flow of Incompressible Fluids:

Review of skin friction and wall shear in cylindrical tubes. Hagen Poisuille equation for Newtonian fluids . Laminar flow of Newtonian fluids. Turbulent flow in pipes and in closed conduits . Universal velocity distribution law and its limitations. Von Karman equation.

Smooth pipe flow in Newtonian fluids :

Friction factor .Friction factor as a function of a Reynolds No. Effect of roughness parameters . Use of friction factor versus Reynolds No. chart with allowance of pipe roughness and non-circular cross section for the solution of process flow problems (Moody's diagram)

Unit-IV (07 Hours)

Newtonian Flow past immersed bodies :

Flow past a sphere: Study of motion of spherical particle in an incompressible fluid. Particle Reynolds No. Settling velocity of a spherical particle in Stokes and in Newton's regimes .

Flow through a packed bed:Friction in flow through a packed bed. Packed bed Reynolds No. and Ergun equation.

Flow through a fluidized bed: Fluidization phenomena. Curve of pressure drop as a function of superficial velocity. Types of fluidization. Minimum fluidization velocity using Ergun equation .

Unit-V (09 Hours)

Transportation and Metering of Fluids:

Fluid moving machinery: Operation , selection and specification of pumps, fans, blowers. Calculation of power consumption and volumetric flow. Priming, Cavitation and NPSH calculations.

Flow Measurement Devices: Orificemeter, Venturimeter, Pitot tube and Rotameter.

Unit-VI (08 Hours)

Piping of Fluids:

Calculations of minor losses . Losses due to sudden contraction and expansion .Losses due to bends and fittings. Losses at the entrance and

exit. Concept of equivalent length. Pipes in series, pipes in parallel. Pipelines containing pumps. Optimum pipe diameter.

Gas/liquid and liquid/liquid Two phase flow :

Flow types and regimes in horizontal and vertical flow. Regime maps. Behavior of non-Newtonian fluids in two phase flow.

Flow through orifices, notches and weirs

Term work

Term work will consist of the experiments listed below , of which at least eight should be performed in laboratory by the students. In addition, two more subjects from the list may be given as assignments.

Determination of viscosity.

Flow through pipes. Analysis for laminar and turbulent regions

Flow through packed bed.

Flow through Venturimeter.

Flow through Orificemeter.

Flow through pipe fittings.

Verification of Darcy's law.

Characteristics of centrifugal pump.

Pump and blower specification writing in a format routinely used by process industry.

Trial and error solution to a given flow problem on a computer.

Flow through fluidized bed/packed bed.

Study of motion of particles in fluids of different viscosity.

Text Books/References

W. L. McCabe, J. C. Smith and P. Hariott: "Unit operations in chemical Engg. ", McGraw Hill Publications.

J. M. Coulson and F. Richardson: "Chemical Engineering Vol.1", Pergamon press.

S. K. Gupta: "Momentum transfer operations", Tata McGraw Hill Publishers.

M. M. Denn: "Process fluid mechanics", Prentice Hall Publications.

Syllabus for Unit Test

Unit Test 1	Unit I & II
Unit Test 2	Unit III & IV
Unit Test 3	Unit V & VI

K10211: HEAT TRANSFER – I

TEACHING SCHEME		EXAMINATION SCHEME	
Lectures	: 04 Hrs/week	Theory	: 80 Marks
Practical	: 02 Hrs/week	Duration	: 03 Hours
		Unit Test	: 20 Marks
		T. W. & Pr.	: 50 Marks

Unit -I (05 Hours)

Modes of Heat Transfer:

Conduction, convection and radiation. Fundamental laws employed: Conservation of mass, heat and momentum.

Dimensional Analysis:

Fundamental dimensions, units of various quantities used in heat transfer, importance of dimensional analysis in experimental design and data reduction, dimensional analysis applicable to three modes of heat transfer, dimensionless numbers with significance used in heat transfer.

Unit –II (10 Hours)

Conduction:

Fourier's law of heat conduction. Thermal conductivity of solids, liquids and gases. Differential equations from shell balances for steady (rectangular and cylindrical) and unsteady state conduction and their solutions for particular cases. Steady state conduction in infinite slab, infinitely long hollow cylinder, hollow sphere. Concepts of thermal resistance, contact coefficient, thermal conductance. Thermal resistance of infinite composite slab and cylinder. Heat loss through pipe insulation and optimum thickness of insulation. Critical radius of insulation. Unsteady state conduction. Heat transfer from extended surfaces. Efficiency of longitudinal fins. Heat transfer coefficient, pressure drop, wall temperature in heat exchangers with fins.

Unit-III (10 Hours)

Convection:

Newton's law of cooling. Shell balances for heat convection. Classification of convection.

Natural convection: empirical correlations laminar and turbulent flow, vertical plates, walls, cylinders, horizontal plates and cylinders.

Forced convection: empirical correlations laminar and turbulent flow, forced convection inside tubes and ducts.

Individual and overall heat transfer coefficient, Fouling factor.

The colburn analogy: colburn j factor.

Thermal boundary layer: Heat transfer in laminar and turbulent boundary layer. Boundary layer thickness in laminar and turbulent flow.

Reynolds analogy. Analogy between heat and momentum transfer in turbulent flow.

Unit-IV (09 Hours)

Radiation:

Stefan- Boltzman's law. Common terms in radiation: black body, gray body, opaque body, white body, emissive power, emissivity, Absorptivity, transmissivity and reflectivity.

Radiation laws: Kirchoff's law , Wein's displacement law, Planck's law. Solid angle. Intensity of radiation. Radient exchange between two finite and infinite black surfaces. Radient exchange between two infinite parallel gray planes. Radiation shield. Radiation shape factor, laws of shape factor. Radient heat exchange in an enclosure having black surfaces.

Unit-V (07 Hours)

Furnaces:

Types and classification of different furnaces. Characteristics of an efficient furnace. Heat transfer in furnace. Furnace efficiency calculations. Lobo and Evans method. Wohlenberg simplified method. Orrock-Hudson method.

Unit-VI (07 Hours)

Heat transfer in agitated vessels, packed bed, fluidized bed, gases at high Velocity. Heat transfer coefficient for liquid metals, forced cross flow heat exchanger, cross flow of air/gas across a tube.

Term work

Term work will consist of the experiments listed below , of which at least eight should be performed in laboratory by the students. In addition, four more assignments should be given to the students.

List of Practical

To determine thermal conductivity of a metal bar .
To determine Stefan-Boltzman constant .
To determine thermal conductivity of an insulating material.
To determine heat transfer coefficient in natural convection.
To determine heat transfer coefficient in forced convection.
To determine emmissivity of aluminium plate .
To determine heat transfer coefficient for pin fin .
Heat transfer in furnace.
Study of heat transfer in agitated vessels.

Text Books/ References

W. L. McCabe, J Smith, Harriot: "Unit Operations of Chemical Engineering", McGraw Hill Book Company.

D. Q. Kern : "Process Heat Transfer" , Tata McGraw Hill Publishers.

S. P. Sukhatme : "A text book on Heat Transfer" , Universities Press.

S. D. Dawande : "Principles of Heat and Mass Transfer",Central Technova Publications.

Syllabus for Unit Test

Unit Test 1	Unit I & II
Unit Test 2	Unit III & IV
Unit Test 3	Unit V & VI

K10212: CHEMICAL ENGINEERING THERMODYNAMICS-I

TEACHING SCHEME

Lectures : 04 Hrs/week
Tutorial : 02 Hrs/week

EXAMINATION SCHEME

Theory : 80 Marks
Duration : 03 Hours
Unit Test : 20 Marks
T. W. & Or : 50 Marks

Unit -I (07 Hours)

Introduction to Chemical Engineering Thermodynamics:

Introduction; Basic concepts of energy, work, heat, scope of thermodynamics, fundamental and derived quantities, state and path functions, thermodynamic systems, reversible & irreversible processes.

Unit –II (08 Hours)

First Law of Thermodynamics:

Statements, First law for cyclic process, Internal energy, Enthalpy, Heat capacity, Intensive & Extensive process, Equilibrium, Phase rule, Constant volume & constant pressure process.

Unit-III (09 Hours)

Volumetric Properties of Pure Fluids:

The P.V.T. behavior of pure substance, the viral equations & their application Types of process ideal & real gas, Compressibility factor, the constant volume, constant pressure, adiabatic, polytrophic processes, real gas, Vander Wall equation , Redlich Kwong equation, Peng-Robinson equation, Benedict-Webb Rubin equation, Cubic equation, Heat effect

Unit-IV (08 Hours)

Second Law of Thermodynamics:

Relevance of second law, Kelvin-Plank statement, Thermodynamic temp. scale Carnot cycle, entropy, Third law of thermodynamics, mathematical statement of 2^{nd} law, statement of 3^{rd} law.

Unit-V (09 Hours)

Thermodynamic properties of Fluids:

Maxwell relationships, residual properties, residual properties by equations of state, two-phase systems, Clausius - Clapeyron equation, type of thermodynamic diagram, availability.

Unit-VI (07 Hours)

System of Variable Composition-Ideal Behavior:

Fundamental property relation, Solution, properties of solution, Chemical potential Ideal gas mixture, ideal solution & Raoult's law, Henry's law

Text Books/ References

J. M. Smith & H. C. Vanness, "Introduction to Chemical Engineering Thermodynamics"

Narayanan," Chemical Engineering Thermodynamics"

Kenneth Denbigh, "Principles of Chemical Equilibrium"

Y. V. C. Rao, "Chemical Engineering thermodynamics"

B. F. Dodge, "Chemical Engineering Thermodynamics"

T. E. Daubert, " Chemical Engineering Thermodynamics"

Glasstone S., "Thermodynamics for Chemists"

Weber and Meissner, "Thermodynamics for Chemical Engineers"

B. G. Kyle, "Chemical and Process Thermodynamics"

Syllabus for Unit Test

Unit Test 1	Unit I & II
Unit Test 2	Unit III & IV
Unit Test 3	Unit V & VI

K40213: ELECTRICAL AND ELECTRONICS TECHNOLOGY

TEACHING SCHEME
Lectures : 02 Hrs/week
Practical : 02 Hrs/week

EXAMINATION SCHEME
T. W. & Or. : 50 Marks

Unit -I (04 Hours)

Three phase Circuits: Revision, Basic three phase voltage and current relations in Y & delta Measurements of power in three phase circuits using two-wattmeter method for balanced star and delta loads. Measurement of reactive power using single-wattmeter.

D. C. motors: Principal of working. Construction. Types. Characteristics. Starters. Method of speed control. Applications.

Unit –II (04 Hours)

Induction Motors:

a) Three phase : Rotating, Magnetic Field, Slip and Torque- slip. Characteristics, Starters, Applications, Simple calculations,

b) Single phase: Types, Starting methods, Applications. (No mathematical treatment)

Unit-III (04 Hours)

Introduction to Alternator:

Construction, Working principle, Regulation methods: (only by OC & SC Test using synchronized Impedance method only) Electrical heating: Introduction, Resistance and dielectric heating (Descriptive treatment only)

Unit-IV (05 Hours)

Transistors:

Transistors as an amplifier, Biasing circuits, different configurations of amplifiers, Audio Frequency Amplifiers, Frequency response, FET.

Unit-V (04 Hours)

Introduction to Operational Amplifiers:

Salient features. Inverting and Non-Inverting type amplifiers, Operational Amplifiers as adder, substractor, multiplier integrator etc. Introduction to Logic Gates: AND, NAND, OR, NOR with truth tables.

Unit-VI (04 Hours)

Special devices:

UJT, DIAC, TRIAC, SCR.

Study of power supplying function. Function generators. Digital multimeter. (Descriptive treatment only.)

Practical

The term work will consist of eight practicals out of the list given below. (4 experiments from electrical technology and 4 experiment from Electronics technology)

List of Practical

Electrical Technology:

Measurement of power and reactive power in three phase circuit using two-wattmeter and single -wattmeter.

Break test on D. C. shunt motor.

Speed variation of D. C. shunt motor using armature voltage and field current Method.

Load test of three phase Induction motor.

To find regulation of Alternator by OC and SC test.

Study of DC motor starter.

Study of starters for 3 phase Induction motors.

Electronics Technology:

Frequency response of single stage Audio Frequency Amplifier.

Study of Transistor characteristics.(C. C. only)

Study of Operational Amplifier circuits.

Study of SCR characteristics.

Study of Digital Multimeter and Function Generator.

Study of triac characteristics.

Text Books/ References

Malvino, " Electronic Principles" Tata McGraw Hill Publishers

Cotton H, " Electrical Technology" CBS publications.

Hughes Edward, " Electrical Technology", Longamann Publications.

RULES REGARDING ATKT, CONTINUOUS ASSESSMENT and AWARD of CLASS

A. T. K. T.

A candidate who is granted term for B.Tech. Semester-I will be allowed to keep term for his/her B.Tech. Semester-II examination even if he/she appears and fails or does not appear at B.Tech. Semester-I examination.

A candidate who is granted term for B. Tech. Semester - III will be allowed to keep term for his/her B.Tech. Semester-IV examination even if he/she appears and fails or does not appear at B.Tech. Semester-III examination.

A candidate who is granted term for B.Tech. Semester-V will be allowed to keep term for his/her B.Tech. Semester-VI examination if he/she appear and fails or does not appear at B.Tech. Semester-V examination.

A candidate who is granted term for B.Tech. Semester-VII will be allowed to keep term for his/her B.Tech. Semester-VIII examination if he/she appears and fails or does not appear at B.Tech. Semester-VII examination.

A student shall be allowed to keep term for the B.Tech. Semester-III course if he/she has a backlog of not more than 3 Heads of passing out of total number of Heads of passing in theory examination at B.Tch. Semester-I & II taken together.

A student shall be allowed to keep term for the B.Tech. Semester-V of respective course if he/she has no backlog of B.Tech Semester-I & II and he/she has a backlog of not more than 3 Heads of passing in theory examination and not more than 3 heads of passing in termwork and practical examination or termwork and oral examination.

A student shall be allowed to keep term for the B.Tech. Semester-VII course if he/she has no backlog of B.Tech. Semester-III & IV and he/she has a backlog of not more than 3 Heads of passing in theory examination and not more than 3 Heads of passing in termwork and practical examination or termwork and oral examination.

CONTINUOUS ASSESSMENT

In respect of Term work at B.Tech. Semester-I & II, B.Tech. Semester-III & IV and B.Tech. Semester-V & VI, target date shall be fixed for the completion of each job, project experiment or assignment as prescribed in the syllabus and the same shall be collected on the target date and assessed immediately at an affiliated college by at least one pair of the concerned teachers for the subject and the marks shall be submitted at the end of each term to the Principal of the college.

Termwork and performance of Practical/Oral examination shall be assessed on the basis of the depth of understanding of the principles involved, correctness of results and not on ornamental or colorful presentation.

For B.Tech. Semester-VII & VIII, termwork assessment will be done by external and internal examiners jointly during the examination schedule declared by the university. The record of continuous assessment shall be made available to the examiners during Term work and practical and Term work and oral examinations. Examiner shall use this record for overall assessment of the performance of the student. Every practical/termwork assignment shall be assessed on the scale of 20 marks and weightage of 20 marks shall be distributed as follows:

Sr. No.	Activity	Marks
1	Timely Submission	04
2	Presentation	06
3	Understanding	10

Marks obtained out of 20 for all assignments together will be converted on scale of marks assigned to term work of respective subject in the structure of the course.

CLASS

The class should be awarded to the student on the basis of aggregate marks obtained together in both the semesters of the respective year by him. The award of class shall be as follows.

A	Aggregate 66% or more marks	First Class with Distinction
B	Aggregate 60% or marks but less than 66%	First Class
C	Aggregate 55% or more marks but less than 60%	Higher Second Class
D	Aggregate 50% or more marks but less than 55%	Second Class
E	Aggregate 40% or more marks but less than 50%	Pass Class