SHIVAJI UNIVERSITY, KOLHAPUR
SECOND YEAR B.TECH
Scheme of Teaching and Examination
Semester – III (Chemical Technology)

Subject Code	Subject	Teaching Scheme (Hours / Week)				Examination Scheme (Marks)					
						Theory			Practical		
		L	T	P	Credits	Scheme	Max. marks	Min. Passing $	Scheme	Max. marks	Min. Passing
CH211	Applied Chemistry- I	04	-	-	04	CIE	50	20	-	-	-
						SEE	50	20	-	-	-
MA211	Engineering Mathematics-III	03	-	-	03	CIE	50	20	-	-	-
						SEE	50	20	-	-	-
CH212	Material Science and Engineering	03	-	-	03	CIE	50	20	-	-	-
						SEE	50	20	-	-	-
CH213	Particulate Technology	04	-	-	04	CIE	50	20	-	-	-
						SEE	50	20	-	-	-
CH214	Process Fluid Mechanics	04	-	-	04	CIE	50	20	-	-	-
						SEE	50	20	-	-	-
CH215	Programming Practices for Chemical Engineers	02	-	-	02	-	-	-	-	-	-
CH211L	Applied Chemistry- I Laboratory	-	-	02	01	-	-	-	IPE	50	20
MA211T	Engineering Mathematics-III	-	01	-	01	-	-	-	IOE	50	20
CH213L	Particulate Technology Laboratory	-	-	02	01	-	-	-	EPE	50	20
CH214L	Process Fluid Mechanics Laboratory	-	-	02	01	-	-	-	IPE	50	20
						-	-	-	EPE	50	20
CH215L	Programming Practices for Chemical Engineers Laboratory	-	-	02	01	-	-	-	IPE	50	20
	Total	**20**	**01**	**08**	**25**	---	**500**	---	--	**300**	---

HS222	Environmental Studies	02	-	-	-	Project	30	40	---	---	---
						Theory	70				
Audit Course I											
	Introduction to Foreign Language	02	-	--	-	Institute Level	--	---	---	----	---

Total Credits: 25
Total Contact Hours/Week: 29 hrs

Note: $: Minimum 40% marks required in SEE as passing head.
• Tutorials and practical shall be conducted in batches with batch strength not exceeding 20 students.
• Environmental Studies Theory examination will be at the IV Semester. The grading in the subject will be as per the university rules.

CIE – Continuous Internal Evaluation, SEE – Semester End Examination,
IPE – Internal Practical Evaluation, EPE–External Practical Examination,
IOE– Internal Oral Evaluation, EOE–External Oral Examination

SHIVAJI UNIVERSITY, KOLHAPUR

SECOND YEAR B.TECH

Scheme of Teaching and Examination

Semester – IV (Chemical Technology)

Subject Code	Subject	Teaching Scheme (Hours / Week)				Examination Scheme (Marks)					
						Theory			Practical		
		L	T	P	Credits	Scheme	Max. marks	Min. Passing $	Scheme	Max. marks	Min. Passing
CH221	Applied Chemistry-II	04	-	-	04	CIE	50	20	-	-	-
						SEE	50	20	-	-	-
CH222	Chemical Engineering Thermodynamics	04	-	-	04	CIE	50	20	-	-	-
						SEE	50	20	-	-	-
CH223	Chemical Process Calculations	04	01	-	05	CIE	50	20	-	-	-
						SEE	50	20	-	-	-
CH224	Fundamentals and Applications of Heat Transfer	04	01	-	05	CIE	50	20	-	-	-
						SEE	50	20	-	-	-
CH225	Chromatography and Instrumental Methods of Analysis	04	-	-	04	CIE	50	20	-	-	-
						SEE	50	20	-	-	-
CH221L	Applied Chemistry-II Laboratory	-	-	02	01	-	-	-	IPE	50	20
						-	-	-	EPE	50	20
CH224L	Fundamentals and Applications of Heat Transfer Laboratory	-	-	02	01	-	-	-	IPE	50	20
						-	-	-	EPE	50	20
CH225L	Chromatography and Instrumental Methods of Analysis Laboratory	-	-	02	01	-	-	-	IPE	50	20
						-	-	-	EPE	50	20
	Total	**20**	**02**	**06**	**25**	--------	**500**	--------	--------	**300**	--------

HS222	Environmental Studies	02	-	-	-	Project	30	40	---	---	---
						Theory	70				
Audit Course II											
	Introduction to Performing Arts	01	-	02	-	Institute Level	--	---	---	----	---

Total Credits: 25

Total Contact Hours/Week: 28 hrs

Note:

$: Minimum 40% marks required in SEE as passing head.

• Tutorials and practical shall be conducted in batches with batch strength not exceeding 20 students.

CIE – Continuous Internal Evaluation, SEE – Semester End Examination,
IPE – Internal Practical Evaluation, EPE–External Practical Examination,
IOE– Internal Oral Evaluation, EOE–External Oral Examination

Detailed Examination Scheme

1. Out of total 100 theory marks, 50 marks are allotted for Continuous Internal Evaluation (CIE). In CIE minimum 20 marks are required to become eligible for Semester End Examination. (SEE).

2. CIE (50 marks) includes :

   - Internal Test – 1, of 25 marks in 5^{th} week on 1^{st} & 2^{nd} unit
   - Internal Test - 2, of 25 marks in 10^{th} week on 3^{rd} & 4^{th} unit

3. For the Semester End Examination (SEE), 100 marks (3 hours) paper will be set and finally it will be converted to 50 marks, in which student must secure minimum 40 % i.e. 20 marks as an university examination passing head.
4. Final theory marks (out of 100) will be the addition of CIE (out of 50 marks) and SEE (out of 50 marks).
5. Internal Practical Evaluation (IPE) will be assessed on the basis of Internal Oral/ Practical/Tutorials/seminar in which student must secure minimum 40% i.e. 20 marks.
6. Equivalence for the 'title changed' subjects and additional subjects:
   i. Applied Chemistry-I for Chemistry-I and Applied Chemistry-II for Chemistry-II
   ii. Particulate Technology for Mechanical Operations
   iii. Introduction to Foreign Language- Added as a need to impart other language skills

Academic Autonomy:

1. Flexibility in deciding Structure and Contents of Curriculum with reasonable frequency for changes in the same.
2. Continuous Assessment of Students performance with newly adopted - Credit System based on Award of Grade.
3. Credits are quite simply a means of attaching relative values to courses different components. They are a currency of learning, and in general regarded as a measure of the time typically required to achieve a given curricular outcome.
4. All subjects (year-wise) under each course/discipline are unitized.

Credit system:

Education at the Institute is organized around the semester-based credit system of study. The prominent features of the credit system are a process of continuous evaluation of a student's performance/progress and flexibility to allow a student to progress at an optimum pace suited to his/her ability or convenience, subject to fulfilling minimum requirements for continuation.

A student's performance/progress is measured by the number of credits that he/she has earned, i.e. completed satisfactorily. Based on the course credits and grades obtained by the student, grade point average is calculated. A minimum grade point average is required to be maintained for satisfactory progress and continuation in the programme. Also a minimum number of earned credits and a minimum grade point average should be acquired in order to qualify for the degree. All programmes are defined by the total credit requirement and a pattern of credit distribution over courses of different categories.

Course credits assignment:

Each course, except a few special courses, has a certain number of credits assigned to it depending upon its lecture, tutorial and laboratory contact hours in a week. This weightage is also indicative of the academic expectation that includes in-class contact and self-study outside of class hours.

Lectures and Tutorials: One lecture or tutorial hour per week per semester is assigned one credit.

Practical/Laboratory: One laboratory hour per week per semester is assigned half credit.

Example: Course Applied Chemistry - I: 5 Credits (04-00-02)

The credits indicated for this course are computed as follows:

Lectures: 4 hours/week = 4 credits

Tutorial: 0 hours/week = 0 credit

Practical: 2 hours/week = 2 *x* 0.5 = 1 credit

Also, (04-00-02) 5 credit course = (4 Lectures + **0** Tutorial hours + **2** Practical hours) per week = 06 contact hours per week

For each lecture or tutorial credit, the self study component is 1 hour/week. For total practical hours in a subject, the credit and therefore the self study component is half of the total hours. In the above example, the student is expected to devote 3 + 1 = 4 hours per week on self study for this course, in addition to class contact of 5 hours per week.

Earning credits:

At the end of every course, a letter grade is awarded in each course for which a student had registered. On obtaining a pass grade, the student accumulates the course credits as earned credits. A student's performance is measured by the number of credits that he/she has earned and by the weighted grade point average.

The credit system enables continuous evaluation of a student's performance, and allows the students to progress at an optimum pace suited to individual ability and convenience, subject to fulfilling minimum requirement for continuation.

Features of Credit System at Department of Technology, Shivaji University, Kolhapur:

Every subject is allotted credits based on its academic importance/weight age.

1. All subjects may not have same credits.
2. 25 Credits / Semester.
3. Absolute Grading System with 6 Passing Grades viz. AA, AB, BB, BC, CC, CD, DD and FF for failure.
4. Getting FF grades in 4 heads in the one academic year he/she considered as failed.
5. Continuous Evaluation: Internal Test T_1 [25 marks], and Internal Test T_2 [25 marks].
6. Standardization of courses; each course is of 6 units. T_1 for unit 1 and 2, T_2 for unit 3 and 4, SEE for all units.
7. Internal Test 1 & Internal Test 2 to be handled by internal examiner; SEE mostly by external examiner.
8. Under no circumstances will a request for re-test be entertained after internal test.
9. Re-examination after SEE; No examination for odd sem. courses in even sem. or vice-versa.

Attendance rule:

All students must attend every lecture, tutorial and practical class. However, to account for late registration, sickness or other such contingencies, the attendance requirement will be a minimum of 75 % of the classes actually held. A student with less than 75 % attendance in a course during the semester, in lectures, tutorials and practicals taken together (as applicable), will be awarded an 'XX' grade in that course irrespective of his/her performance in the tests.

The course coordinator will award 'XX' grade to the student who is deficient in attendance taking into account the consolidated attendance record for the whole semester. For the purpose of attendance calculation, every scheduled practical class will count as one unit irrespective of the number of contact hours.

Attendance record will be maintained based upon roll calls (or any equivalent operation) in every scheduled lecture, tutorial and practical class. The course coordinator will maintain and consolidate attendance record for the course (lectures, tutorials and practicals together, as applicable).

Evaluation system:

1. Semester Grade Point Average (SGPA) =

$$\frac{\sum (\text{course credits in passed courses X earned grade points})}{\sum (\text{Course credits in registered courses})}$$

2. Cumulative Grade Point Average (CGPA) =

$$\frac{\sum (\text{course credits in passed courses X earned grade points) of all Semesters}}{\sum (\text{Course credits in registered courses) of all Semesters}}$$

3. At the end of B. Tech Program, student will be placed in any one of the divisions as detailed below (According to AICTE Handbook):

   I^{st} Division with distinction: CGPA $\geq$ 8.25 and above

   I^{st} Division : CGPA $\geq$ 6.75 and < 8.25

   II^{nd} Division : CGPA $\geq$ 6.75 and < 6.25

An example of these calculations is given below:

Typical academic performance calculations - I semester

Course no.	**Course credits**	**Grade awarded**	**Earned credits**	**Grade points**	**Points secured**
Col 1	Col 2	Col 3	Col 4	Col 5	Col 6 (col4 *col5)
MALXXX	5	CC	5	6	30
CSLXXX	4	CD	4	5	20
PHLXXX	4	AA	4	10	40
PHPXXX	2	BB	2	8	16
MELXXX	4	FF	0	0	00
TTNXXX	2	AB	2	9	18
Total	21		17	38	124

1. Semester Grade Point Average (SGPA) =

$$\frac{(124)}{(21)} = 5.90$$

2. Cumulative Grade Point Average (CGPA) =

   Cumulative points earned in all passed courses = 124 (past semesters) + 124 (this sem.) = 248

   Cumulative earned credits = 23 (past semesters) + 21 (this sem.) = 44

$$\frac{\sum (124 + 124)}{\sum (23 + 21)} = 5.63$$

System of Evaluation

Grade	Grade Points	Range	Description of Performance
AA	10	91-100	Outstanding
AB	09	86-90	Excellent
BB	08	76-85	Very Good
BC	07	66-75	Good
CC	06	56-65	Fair
CD	05	46-55	Average
DD	04	40-45	Poor
FF	00	Below 40	Fail (Eligible for Re-exam)
XX	--	--	Insufficient attendance
AB	--	--	Absent
$	--	--	Passed in Ist attempt

Audit Courses:

Additional courses shall be included as audit courses from the third semester onwards. While the performance of the student in audited courses shall be included in the Grade Card. These grades are not a part of SGPA or CGPA of the concerned student.

Second Year U.G. Program
Semester III
(Department: Chemical Technology)

APPLIED CHEMISTRY- I (CH211)

Teaching Scheme: L: 4 hrs/week **Credits: 5**
P: 2 hours/week

Evaluation Scheme:	**CIE**	**SEE**	**IPE**
	(25 + 25)	**50**	**50**

Unit I 09Hrs

Chemical Equilibrium: Characteristics of chemical equilibrium, Law of mass action, Equilibrium constants & their relationship, Derivation of Law of mass action from Chemical potential, Van't-Hoff's reaction isotherm, isochore and isobar. Rate law, Absolute reaction rate of Transition State Theory, Numerical based on above mentioned topics.

Distribution law: Introduction, Nernst distribution law, solubility and distribution law, explanation & limitations of distribution law, Henry's law, determination of equilibrium constant from distribution coefficient, numerical based on the above topics.

Unit II 09 Hrs

Chemical kinetics: Introduction, order and molecularity of reaction, rates of reaction, first and second order reactions with derivation, pseudo unimolecular reactions, Theories of reaction rates, determination of rates of reaction, Kinetics of fast reactions (relaxation and flow technique), chain reactions, numerical based on the above topics.

Photochemistry: Introduction, laws of photochemistry, quantum efficiency, photochemical reactions, kinetics of photochemical reactions, photosensitized reactions, photosynthesis.

Unit III 08Hrs

Adsorption: Definition, characteristics, types of adsorption, adsorption Isotherms and applications.

Catalysis: Definition, characteristics, types of catalysis, homogeneous & heterogeneous catalysis, theory of catalysis, acid base catalysis, solid catalysts like oxides, metal & zeolites, phase transfer catalysts, enzyme catalysts (biocatalysts), mechanism of catalysis

Unit IV 10Hrs

Dyes and dye intermediates : chromophore- auxochrome theory, classification of dyes based upon structure & methods of application, synthesis and applications of malachite green, methyl orange, alizarine & phenolphthalein.

Soaps and detergents: Soaps and saponification, cleansing action of soaps, manufacture of soap by modern process, detergents, classification, cleansing action, manufacture of anionic detergents (D.B.B.S.)

Unit V 07Hrs

Drugs: Chemotherapy, synthesis and mode of action of sulpha drugs (sulphanilamide), antibiotics (chloramphenicol), analgesics (paracetamol).

Pesticides: Introduction, classification, synthesis, properties and uses of BHC, DDT, Malathion.

Unit VI 08Hrs

Unit processes: Nitration: Nitrating agents, mechanism of aromatic nitration and industrial nitration of benzene to nitrobenzene by continuous processes.
Oxidation: Oxidizing agents, mechanism of oxidation, manufacture of acetic acid by oxidation of acetaldehyde. Halogenation.

LABORATORY PRACTICALS:
(Minimum 10 experiments should be completed)

1. Determination of reaction rate constant of acid catalysed hydrolysis of methyl acetate
2. Determination of reaction rate constant of reaction between $K_2S_2O_8$ & KI
3. To determine partition coefficient of benzoic acid in benzene and water.
4. To investigate the adsorption of oxalic acid or Acetic acid from aqueous solution by activated charcoal and examine the validity of freundlich and Longmuir isotherms.
5. Estimation of aspirin (acetyl salicylic acid)
6. Determination of saponification value of the given oil sample
7. Laboratory preparation of soap
8. Preparation of methyl orange
9. Laboratory preparation of m-Dinitrobenzene from nitrobenzene
10. Oxidation – Preparation of benzoic acid from benzaldehyde/ benzyl Alcohol

11 to14. Identification of mono functional and bi functional organic compounds (minimum 3 compounds)

REFERENCE BOOKS:

1. Puri & Sharma, Physical chemistry, Shobanlal Nagin Chand - 2005
2. Bhal & Tuli, Essentials of Physical chemistry, S. Chand & Co. - 2005
3. Prutton & Maron, Principles of Physical chemistry, oxford & IBH Publishing Co. Pvt. Ltd 1972
4. Gladstone, Text book of physical chemistry, Macmillan India Ltd. - 1995
5. Finar & Finar, Organic chemistry – Volume I& II, English language book society-1989
6. Bhal & Bhal, Organic chemistry, S. Chand -2000
7. P.L. Soni, Organic chemistry, S. Chand -1994
8. Pitter Sykes, Organic reactions and mechanism, Orient Longman-1986

REFERENCE BOOKS FOR PRACTICALS:

1. A. I. Vogel, Practical organic chemistry, CBS-1987
2. Sunita Rattan, Experiments in applied chemistry, S. K. Kataria & Sons- 2002

ENGINEERING MATHEMATICS-III (MA211)

Teaching Scheme: L: 3 hrs/week **Credits: 4**
T: 1 hrs/week

Evaluation Scheme:	**CIE**	**SEE**	**IOE**
	(25 + 25)	**50**	**50**

Unit I Linear Differential Equations 06Hrs

Linear Differential Equations with constant coefficients, Homogeneous Linear differential equations.

Unit II Partial differential equations 06Hrs

Four standard forms of partial differential equations of first order.

Unit III Application of Partial differential Equations 06 Hrs

Wave Equation, One dimensional heat flow equation, two dimensional heat flow Laplace equation (Steady State).

Unit IV Laplace Transform 07Hrs

Definition, Transforms of elementary functions, Properties of Laplace transforms, transforms of derivatives, transforms of integral, transforms of periodic function.

Unit V Inverse Laplace Transforms 06Hrs

Inverse Laplace transforms by using partial fractions, Convolution theorem, Applications to solve linear differential equations with constant coefficients (Initial value problems) using transform method, evolution of definite integrals.

Unit VI Vector Calculus 07Hrs

Differentiation of vectors, Velocity and acceleration, Gradient of scalar point function, Directional derivative, Divergence of vector point function, Curl of a vector point function, Irrotational and Solenoid vector fields.

The line integral, surface integral, volume integral, Gauss Divergence theorem, Stoke's theorem, Green's theorem(with out proof)

REFERENCE BOOKS:

1. Dr. B. S. Grewal "Higher Engineering Mathematics".
2. Erwin Kreyszig, "Advanced Engineering Mathematics".
3. J. N. Wartikar & P. N. Wartikar , "A text book of Applied Mathematics: Vol. I, II and III", Vidyarthi Griha Prakashan, Pune.
4. N. P. Bali, Ashok Saxena and N. Ch. S. N. Iyengar, "A textbook of Engineering
5. Mathematics", Laxmi Publication, Delhi.
6. S. C. Gupta, "Fundamental of Statistics".

MATERIAL SCIENCE AND ENGINEERING (CH212)

Teaching Scheme: L: 3 hrs/week **Credits: 3**

Evaluation Scheme:	**CIE**	**SEE**
	(25 + 25)	**50**

Unit I **Introduction to Material Engineering** 06Hrs

Definition of engineering materials, classification of engineering materials and scope of the subject, structural studies of materials – Types of bonds, atomic and ionic radius, inter atomic distances, Vander Waals forces. Crystal structures, molecular structures, amorphous phases.

Unit II **Properties of Engineering Materials** 07Hrs

Mechanical - hardness, strength, compression, fatigue and creep.
Thermal - specific heat, thermal conductivity, thermal expansion and thermoelectric effect.
Chemical - ionization and electrolysis.

Unit III **Metallic Materials** 07Hrs

Cast iron, Wrought iron and steel, effect of addition of elements such as Si, C,P, Mn, N to Iron. Elastic and plastic deformation, heat treatments alloys such as stainless steel, brass, bronze, duralumin, alnico, Nichrome, solder material.

Unit IV **Ceramic Materials** 06Hrs

Introduction, types, polymorphism, deformation and fracture in glass. Properties of refractory material, refractory such as a) Chromates b) Zircon c) High alumina refractory d) Porcelain. Cement, types manufacturing process, setting & hardening, uses.

Unit V **Organic Materials** 08Hrs

Polymers , Polymerization, types, mechanisms, plastics, types, properties and applications, properties and applications of bakelite, Nylon 66, rubber - classification vulcanization, protective coatings such as paints, polishes and varnishes.

Unit VI **Electrical and Magnetic Materials** 07Hrs

Factors affecting the resistivity of conductors, properties of materials such as Ag, Cu, Al, Nichrome and Ca as dielectric characteristics, insulating materials such as mineral oil, PVC, Mica fibers, glass and asbestos, Magnetisation, soft and hard magnetic materials such as a silicon iron, Alnico types alloys and ferrites.

REFERENCE BOOKS:

1. R.B. Gupta, Material science
2. V.K. Manchanda, A text book of material science.
3. V. Raghavan, Material science and engineering

PARTICULAR TECHNOLOGY (CH213)

Teaching Scheme: L: 4 hrs/week **Credits: 5**
P: 2 hrs/week

Evaluation Scheme:	**CIE**	**SEE**	**EPE**
	(25 + 25)	**50**	**50**

Unit I Properties and handling of particulate solids 08Hrs

Particle characterization, Particle size measuring technologies, Particle size distribution, Mean particle size, mixed particle sizes and shape. Properties of solid masses, Storage of solids (Bulk and Bin), Flow through Hoppers, Angle of repose and angle of friction, Introduction to conveying of solids.

Unit II Size reduction and Screening 10Hrs

Mechanism of size reduction, Energy for size reduction, Crushing laws, Methods of operating crushers, Classification of size reduction equipments, Types of crushing equipment, Factors affecting communition, Heat control methods in size reduction.

Standard test screens, Standards of screen, Screen effectiveness, Comparison of ideal and actual screens, Industrial screening equipment.

Unit III Sedimentation and Mixing of solids and pastes 08 Hrs

Basic principles, Flocculation, Thickeners, Batch sedimentation test, Design procedure for gravity sedimentation tanks.

The degree of mixing, Rate of mixing, Criteria for mixer effectiveness, Solid-liquid mixing, Mixing for paste and plastic masses, Solid-Solid mixing.

Unit IV Filtration 10Hrs

Classification of filtration, Types of filtration, Pressure drop through filter cake, Filter medium resistance, cake resistance, Washing of cake, Filter media and selection, Compressible filter cakes, Preliminary treatment of slurries before filtration, Filtration equipment, Filter selection, Filter press, Vacuum filters, Centrifugal filtration and Filtration calculations.

Unit V Gas Cleaning 07Hrs

Introduction, Gas cleaning equipment, Gravity separators, Centrifugal separators, Momentum separators, Electrostatic precipitators, Liquid washing, Odour removal, Fabric filters, Impingement method and Miscellaneous methods, Agglomeration and Coal essence

Unit VI Benefaction Process in Chemical Engineering 05Hrs

Froth flotation, Magnetic separators, Scrubbers, Jig classification, Heavy medium separation, Wilfiley table, Gravity settling tank.

LABORATORY PRACTICALS:

Any 10 experiments should be conducted.
1. Sieve Analysis
2. Screen Effectiveness
3. Jaw Crusher
4. Pulverizer
5. Ball mill
6. Sedimentation (Batch)
7. Beaker Decantation
8. Filter Press
9. Leaf Filter
10. Cyclone Separator
11. Air Elutriation
12. Rotary Drum Filter

Demonstration of following equipment and include in journal
1. Riffled Table
2. Mineral Jig
3. Froth Flotation

Industrial Visit:

There will be a visit to a Sugar industry or to a Distillery industry or to any other nearby chemical industry.

Visit report should be submitted inclusive of topics of conveying, screening, filtration, cyclone separator, crusher etc.

TEXT BOOKS:

1. Mccabe W.L. & Smith J.C. and Peter Harriott, Unit Operations of Chemical Engineering, 5th edition, Mcgraw Hill International.
2. C.M.Narayanan, B.C.Bhattacharyya, Mechanical Operations for Chemical Engineers, Computer Aided Analysis, Khanna Publishers.
3. J.F.Richardson & J.H.Harker with J.R.Backhurst, coulson & Richardson's, Chemical Engineering, vol 2,1st edition, Pergamon Press.

REFERENCES:

1. Foust A.G. - Principles of Unit Operations, 3nd ed. John, Wiley & Sons, New York 1979.
2. G.C.Sekhar, unit Operations in Chemical Engineering, Pearson education (Singapore). Ltd.

PROCESS FLUID MECHANICS (CH214)

Teaching Scheme: L: 4 hrs/week **Credits: 5**
P: 2 hrs/week

Evaluation Scheme:	**CIE**	**SEE**	**IPE**	**EPE**
	(25 + 25)	**50**	**50**	**50**

Unit I Unit systems and Introduction to Fluid statics 08Hrs

Physical quantities, S.I., CGS, FPS engineering units, Conversion of Units, Units and Equations, dimensional analysis, Application of dimensional analysis, Problems. Nature of fluids, Hydrostatic equilibrium, Barometric equation, Hydrostatic equilibrium in centrifugal field, Manometers, Example, U tube, inclined tube manometers.

Unit II Fluid flow phenomena and Basic equations of fluids flow 12Hrs

Behaviour of flowing fluid, Types of flow, Newtonian and non-Newtonian Fluids, viscosity and momentum flux, viscosities of gases and liquids, Turbulence, Reynolds experiment, Eddy viscosity, Flow in boundary layers, Laminar and Turbulent flow in Boundary layers, Boundary layer formation in straight tubes, Boundary layer separation and wake formation.

Mass balance, mass velocity, momentum balance, and Bernoulli's equation without and with friction, kinetic energy correction factor, correction for fluid friction, Pump Bernoulli's equation, Euler's equation, Problems.

Unit III Flow of incompressible fluids in conduits and thin layers 10Hrs

Shear stress distribution in a cylindrical tube, relation between skin friction and wall shear, the friction factor. Relations between skin friction parameters .Laminar flow in pipes, Laminar flow of Newtonian fluids. Average velocity, kinetic energy correction factor (Derivation), Momentum correction factor (Derivation), Hagen-poiseuille equation. Turbulent flow in pipes and closed channels. Velocity distribution for turbulent flow, universal velocity distribution equations for laminar sub layer and buffer layer, Relations between maximum and average velocities, Effect of roughness, the friction factor chart (Moody's diagram), friction factor in flow through channels of non-circular section, friction from changes in velocity or direction, Effect of fittings and valves, couette flow, Layer flow with free surfaces , Flow through annulus, Problems.

Unit IV Transportation and metering of fluids 08Hrs

Pipe and tubing, joints and fittings. Prevention of leakage around moving parts. Valves like Gate valve, globe valve, checks valve butterfly valve, needle valve, ball valve etc. Measurement of flowing fluids. Venturimeter, orifice meter, pitot tube, Rota meters, target meters, vortex- shedding meters, turbine meters, positive displacement meters, magnetic meters: ultrasonic meters.

Unit V Flow past immersed bodies 06Hrs

Drag coefficients of typical shapes, form drag and stream lining, Friction in flow through beds of solids, Erguns equation, Kozeny- Carman equation, Burke Plummer equation, Fluidization, Mechanism of fluidization, particulate and aggregative fluidization, minimum fluidization velocity, expansion of -fluidized beds, application of fluidization.

Unit VI Flow of compressible fluids and Agitation of fluids 07Hrs

Mach number, continuity equation, Total energy Balance, velocity of sound, ideal gas equations, the asterisk condition, stagnation temperature.

Agitation of liquids, Agitation equipment, flow patterns in agitated vessels, circulation rates, Flow numbers, power consumption, power correlations, power correlations for specific impellers, effect of system geometry and calculations for power consumption.

LABORATORY PRACTICALS:

(Any 10 experiments should be performed)
1. Venturimeter
2. Orifice meter
3. Reynolds's experiment
4. Bernoulli's experiment
5. Flow through helical coils
6. Flow through annular pipe
7. Flow through pipe & pipe fittings.
8. Flow through spiral coils.
9. Flow through packed bed
10. Flow through fluidized bed.
11. To study the properties of Newtonian and Non- Newtonian fluids.
12. Demonstration of –
a) Rotameter b) Pitot tube
13. Two phase flow system

TEXT BOOK:

Mc Cabe W.L. and Smith J.C,'Unit operations of Chemical Engineering.' VII edition, Mcgraw Hill Book Co., International ed. 1993

REFERENCES:

1. Steeter U.L, 'Fluid Mechanics' V ed. Mc graw Hill Book Co., International Edn.1971.
2. Richardson J.E. and Coulson J.M. Chemical Engineering. 3rd ed. Vol. 1 Pergamon Press 1985.
3. Miohell B.I. Fluid and Particle Mechanics Pergamon Press 1970.
4. Gupta S.K., Momemtum Transfer Operations, Tata McGraw Hill, 1979.

PROGRAMMING PRACTICES FOR CHEMICAL ENGINEERS (CH215)

Teaching Scheme: L: 2 hrs/week **Credits: 3**
P: 2 hrs/week

Evaluation Scheme: **IPE**
50

Unit I Revision of C and C++ 03Hrs

Unit II Beginning Visual Basic 03Hrs

What is Visual Basic, Features of Visual Basic, The Visual Basic Philosophy, The integrated development environment, the anatomy of Form, Project Types

Unit III Dealing With Data 05Hrs

Operators, Variables, Declaring Variables, Types Of Variables, Data types, Constants, Arrays: - Declaring Arrays, Specifying Arrays, Multidimensional Arrays, Dynamic Arrays, Arrays of Arrays,

Unit IV Writing Code 07Hrs

Collections, Procedures, Subroutines, Functions, Calling Procedures, Object Browser, Creating Classes & Object, I/O Statements, Control Flow Statements, If—Then, If-then-else, Nested Control Statements, Select-Case, Loop Statements, Do—Loop, For—Next, While-Wend, Exit Statement

Unit V Creating an Application Using Controls 07Hrs

What is on the toolbar, Textbox Control, Picture Box, Image Box, and Label Box? Frame, List Box, Option Button, Combo Box, Command Button, Check Box, The Drive, Directory, File List Controls, the Line & Shape Control, Scroll Box, Data, Timer

Unit VI Review of the course 02Hrs

LABORATORY PRACTICALS:

1. To study VB environment
2. To design and develop form to perform mathematical operations.
3. To study date, string and math functions.
4. To design the form using image control and scroll bars.
5. To design menu editor as text editor.
6. To design stop watch.
7. To design form using file controls, OLE control.

TEXT BOOKS:

1. Leon Lapids, Digital Computation for Chemical Engineering McGraw Hill, 1962.
2. Gary J Bronson , C++ for Engineers & Scientists PWS
3.Wait Groups OOP in Turbo C++ Robert Lafore Galgotia
4.Schaums outline Programming with C++ MGH

REFERENCE BOOKS:

1. Byron S. Gottfried,Programming with C (Shaum Series) Tata McGraw Hill.
2. Kanetkar.Understanding Pointers in C
3. B. Ram, Computer Fundamentals Architecture and Organization, New Age Publication.
4. S. S. Khandare,Computer Science and Information Technology, S. Chand Publication.
5. Henry and Korth and Sudarshan, Database System Concepts.
6. S. S. Sastry, Introductory Methods of Numerical Analysis, PHI.
7. Programming with VB 6.0 –Mohammed Azam
8. Mastering VB 6.0
9. Beginning VB 6.0 –Peter Wrights

ENVIRONMENTAL STUDIES (HS 111)

Teaching Scheme: L: 4 hrs/week **No Credits, University grade**

Evaluation Scheme: Theory: 70* marks
Project work: 30* marks

(4 Lectures to be equally divided in semester III and IV.)

(*Theory examination will be at the IVth semester. Please refer the detailed syllabus for the year mentioned at the end of syllabus of IVth semester.)

Audit course I

INTRODUCTION TO FOREIGN LANGUAGE

Teaching Scheme: L: 2 hrs/week **No Credits, University grade**

General Information:

This is a special introductory course of Foreign Language meant for the regular Engineering students of **S.Y.B. Tech** of Department Of Technology, Shivaji University, Kolhapur.

This course builds the skill sets needed to understand the basics of both language and communication. It is also interested in exploring the relationship between the two categories (language and communication) in order to work out how they relate to each other, it will include introductory concepts in semantics, semiotics, syntax, lexicography, and discourse analysis. It will also include an analysis of philosophical problems of reference, representation, rhetoric, sense, speech acts, and taxtuality. Students will have to submit a term paper and make an oral presentation on any aspect of language and/or communication that they wish to explore at length. Workshops are also included to help students internalize the concepts of communication to which they have been introduced.

AIMS & OBJECTIVES:

1. Introduction of Foreign alphabet, basic Foreign Grammar & Phonetic rules.
2. The Course is aimed at developing the listening, reading and writing skills in the learners.
3. The learner must be able to translate simple texts from and into foreign language.
4. Exposing the learners to simple aspects of life and culture of the foreign people.

SYLLABUS :

Translation:

A passage (approx. 100 words) from Foreign into English/Marathi.
Separate sentences from English into Foreign Language

COMPOSITION:

Simple Grammatical Exercises:

Topics: Recognising ***gender*** of noun, Formation of ***Plural*** noun, Inserting ***pronouns*** in correct forms, ***Conjugation*** of Verbs, Correct use of foreign ***adjectives***, Use of correct **C*ase forms.***

Second Year U.G. Program

Semester IV

(Department: Chemical Technology)

APPLIED CHEMISTRY II (CH221)

Teaching Scheme: L: 4 hrs/week **Credits: 5**
P: 2 hrs/week

Evaluation Scheme:	**CIE**	**SEE**	**IPE**	**EPE**
	(25 + 25)	**50**	**50**	**50**

Unit I 08Hrs

Major organic reactions: Mechanism in brief and industrial applications of Friedal crafts reactions, Mannich reaction, Gatterman Koch reaction, Claisen rearrangement, Benzidine rearrangement, Diels Alder reaction, aldol condensation, Kolbe synthesis.

Unit II 08Hrs

Chemistry of petroleum : Origin of crude, composition, refining of crude, cracking – catalytic cracking- batch process and continuous process, major petrochemicals like ethylene, propylene butadiene, benzene toluene, (industrial applications only)

Unit III 07Hrs

Chemistry of heterocyclic compounds: Introduction, classification, preparation, properties and applications of pyrrole, pyridine, furan, thiophene, quinoline, isoquinoline.

Unit IV 10 Hrs

Structure and bonding: Molecular orbital & valence bond approaches for diatomic molecules, hybridization & structure of H_2O, NH_3, BF_3, SF_6, PCl_5.

Co-ordination chemistry: Introduction, difference between double salt and complex salt, classification, Werners coordination theory, effective atomic no. (EAN), valence bond theory and crystal field theory for octahedral complexes.

Unit V 07Hrs

Inorganic heavy industries: Manufacture of H_2SO_4 (contact process), NH_3 (Habers process) with respect to reactions, reactants, catalyst and physicochemical principles.

Unit VI 08Hrs

Non aqueous solvents: Introduction, classification of solvents, characteristic properties of solvents (melting and boiling points, heats of fusion and vaporization, dielectric constant), liquid ammonia and liquid HF, reactions of liquid ammonia-precipitation, acid – base, oxidation- reduction, ammonolysis, reactions of HF precipitation, acid- base, protonation of organic compounds.

LABORATORY PRACTICALS:

(Minimum 10 experiments should be completed)

1-2. To prepare standard solution of alkali, acid and to estimate the purity of commercial Heavy chemicals like H_2SO_4, HNO_3, and NH_3.

3. Preparation of Hexanitrocobaltate.
4. Preparation of Hexamine cobalt chloride.
5. To prepare standard solution of sodium thiosulphate & to estimate copper from brass solution.
6. To prepare standard solution of potassium dichromate & to estimate Iron from ammonium sulphate using external indicator.
7. To prepare standard solution of potassium dichromate & to estimate Iron from ammonium sulphate using internal indicator.
8. Estimation of nitrogen from given fertilizer solution.
9. To prepare standard solution of EDTA & to estimate magnesium from given dolomite ore solution.
10. Preparation of acetanilide from aniline.
11. Estimation of copper by colorimetric method.
12. Estimation of Nickel by colorimetric method.
13. Estimation of Phenol
14. Estimation of Aniline
15. Estimation of Acetone
16. Estimation of Acetamide
17. Estimation of Glucose

REFERENCE BOOKS:

1. Finar & Finar, Organic chemistry Volume I& II, English language book society-1989
2. Bhal & Bhal, Organic chemistry, S. Chand -2000
3. P.L. Soni, Organic chemistry, S. Chand -1994
4. Pitter Sykes, Organic reactions and mechanism, Orient Longman-1986
5. Cotton & Vilkinson, Inorganic chemistry, Wiley Estern Ltd-1985
6. Dey & Selbin, Inorganic chemistry
7. Puri & sharma, Advanced Inorganic Chemistry, Shobanlal Nagin Chand - 1996

REFERENCE BOOKS FOR PRACTICALS

1 A. I. Vogel, Inorganic chemistry
2. A. I. Vogel, Practical Organic Chemistry, CBS-1987
3. Sunita Rattan, Experiments in Applied Chemistry, S. K. Kataria & Sons- 2002

CHEMICAL ENGINEERING THERMODYNAMICS (CH222)

Teaching Scheme: L: 4 hrs/week **Credits: 4**

Evaluation Scheme:	**CIE**	**SEE**
	(25 + 25)	**50**

Unit I 08Hrs

Scope of thermodynamics and its importance to Chemical Engineers Basic concepts, extensive and intensive properties, state function and chemical systems. Definition, symbols and interrelation, concepts of Entropy, Enthalpy and internal energy. First law of thermodynamics, Equations of state, critical properties, Vander Wall's constants,Virial expansions, Redlich-Kwong equation, Beattie-Bridgeman equation.

Unit II 08Hrs

First law applied to thermodynamic processes and calculation of Workdone, free energy and heat changes. Maxwell relation equation, second law and third law of thermodynamics. Thermodynamics relations based on second law. Relation between Cp and Cv, compressibility factor and coefficient of thermal expansion, concept of residual entropy and entropy of equilibrium.

Unit III 08Hrs

Partial molar and apparent molar properties, Gibbs Duhem equation, Chemical potential, effect of temperature and pressure fugacity, excess thermodynamic properties and thermodynamic properties of mixing. Gibbs-Duhem-Morgules equation, Konovalov laws. Colligative properties. Ebulliometric constant. Determination of Molecular Weight of unknown chemical substances. Solubility law.

Unit IV 08Hrs

Vapour liquid equilibrium, T-X-Y diagrams and X-Y diagram for ideal and non ideal system. Raoult's law and Henry's law. Deviations from Raoult's law. Comparison of ideal and non-ideal systems. Phase equilibria in non reaching multi-components, Binary, ternary systems. Graphical representation of L/L, L/S and G/S systems. Right angled triangular diagrams. Equilateral triangular diagrams, Janecke diagram, Effect of temperature and pressure on ternary equilibrium, Phenol-Water systems. Aniline-water-chlorobenzene systems.

Unit V 08Hrs

Statistical thermodynamics, thermodynamics probability, its relation with Entropy, partition function and its relation with thermodynamics functions, the Boltzmann distribution law, Distribution law for chemically reactive system. Thermodynamics charts and their uses. Searching of thermodynamics data.

Unit VI 08Hrs

Chemical Equilibrium, feasibility of chemical reaction, free energy change, Reaction co-ordinate, equilibrium constant, Effect of temperature and pressure, Relation between Kp, Kc and Kv, Le-Chatelier's principle, Endo-Exothermic relations, Heterogeneous equilibria, various methods of calculating free energy charge. Equilibrium conversions, case study of feasibility report for manufacture of industrial chemicals.

REFERENCE BOOKS:

1) R.P.Rastogi, R.R.Misra , An Introduction to Chemical Thermodynamics
2) Houghen-Watson , Chemical Engineering Process, .
3) J.M. Smith**.** H.C. Van Ness**.** M.M**.** Abbott**.,** Introduction to Chemical Engineering Thermodynamics
4) H.C.Weber, J.P.Meissner, Thermodynamics for Chemical Engineering
5) P.K.Nag , Engineering Thermodynamics .

CHEMICAL PROCESS CALCULATIONS (CH223)

Teaching Scheme: L: 4 hrs/week **Credits: 5**
T: 1 hrs/week

Evaluation Scheme:	**CIE**	**SEE**
	(25 + 25)	**50**

Unit I Basic Chemical Calculations 08Hrs

Units and Conversions, Pressure, Temperature, Density, Specific Gravity; Mole Concept, Equivalent Weight, Composition of solids, Liquids and Gases, Mass fraction, Mass percent, Mass Ratios, Mole fraction, Mole percent, Volume fraction and Volume percent, Normality, Molarity , Molality.

Unit II Gaseous Systems 06Hrs

Gaseous mixtures, Daltons law, Amagats law, Average molecular weight, Density of gaseous mixture, Estimation of vapour pressure.

Unit III Material Balances without Chemical Reaction 09Hrs

Material balances; Guidelines for solving material balance problems; Material balance of important industrial operations (Distillation, Absorption and Striping, Extraction and Leaching, Evaporation, Dryer, Mixing, Crystallization etc.); Recycle and Bypass operations.

Unit IV Material Balances with Chemical Reaction 09Hrs

Definition of terms involved; Generalized approach for solving problems; Material balance problems involving chemical reaction; Electrochemical reactions; Metallurgical applications; Recycle, bypass and purge calculations.

Unit V Energy Balance on Non Reactive and Reactive Processes 10Hrs

Elements of energy balance calculations; Change in pressure at constant temperature; Change in temperature; Phase change operations; Mixing and solutions. Heat of reaction Measurement and calculation of standard heat of reaction, Hess law; Heat of formation; Heat of combustion; Effect of temperature on heat of reaction; adiabatic reactions.

Unit VI Combustion 08Hrs

Minimum air required, Excess air, Combustion calculations. Stoichiometry and Industrial problems and introduction to degree of freedom analysis.

REFERENCE BOOKS:

1. Bhatt B.I. and Vora S.M. “Stoichiometry”, Fourth Edition, Tata McGraw-Hill Pub. Co. Ltd., 2004.

2. Himmelblau D.M., “Basic Principles and Calculations in Chemical Engineering”, Sixth Edition,Prentice-Hall of India Pvt. Ltd., 2004.
3. Felder R.M. and Rousseau R.W., “Elementary Principles of Chemical Processes”, Third Edition,John Wiley and Sons, Inc., 2000.
4. V. Venkataramani and N.Anantharaman., Process Calculations., 2003.
5. P.L.Ballaney, “Thermal Engineering”.

FUNDAMENTALS AND APPLICATIONS OF HEAT TRANSFER (CH223)

Teaching Scheme: L: 4 hrs/week **Credits: 6**
P: 2 hrs/week
T: 1 hrs/week

Evaluation Scheme:	**CIE**	**SEE**	**IPE**	**EPE**
	(25 + 25)	**50**	**50**	**50**

Unit I Mechanism of heat flow 04Hrs

Introduction to basic modes of heat transfer namely Conduction, Convection and Radiation. Scope of the subject.

Unit II Heat transfer by conduction in solids 08Hrs

Fourier's law, steady state heat conduction through walls, single and multilayer. Heat flow through a cylinder, Sphere, unsteady state heat conduction, equation for one and three dimensional conduction, and introduction to semi-infinite solid and critical radius of lagging, numerical problems.

Unit III Principles of heat flow in fluids 08Hrs

Typical heat exchange equipment, co-current and counter current flow. Energy balances, rate of heat transfer, overall and individual heat transfer coefficient. Calculation of overall heat transfer coefficients from individual heat transfer coefficients, fouling factors. Transfer units in heat exchangers, numerical problems.

Unit IV Heat transfer to fluids with and without phase change 12Hrs

Regimes of heat transfer in fluids, thermal boundary layer, heat transfer by forced convection in laminar flow. Laminar flow heat transfer to flat plate, the Graetz and Peclet number. Average heat transfer coefficient in Laminar flow. Heat transfer by forced convection in turbulent flow, dimensional analysis method, effect of tube length, empirical equations, estimation of wall temperature, analogy equations. Heat transfer in transition region, heat transfer to liquid metals, heat transfer by forced convection outside tubes, natural convection and numerical problems. Heat transfer from condensing Vapors, drop wise and film wise condensation, coefficients for film type condensation, derivation and practical use of Nusselt equation, condensation of superheated vapors, effect of Non-condensable gases, numerical problems.

Unit V Heat transfer to boiling liquids, Heat exchange equipment 10Hrs

Types of boiling, boiling of saturated liquid maximum flux and critical temperature drop, minimum heat flux film boiling and sub cooled boiling, Problems. Types of heat exchangers, single and multipass exchangers, correction of LMTD for cross flow. Simple design calculations of heat exchangers, introduction to compact heat exchanger i.e. plate type heat exchanger, different types of condensers and boilers, air cooled heat exchangers,

introduction to heat transfer in agitated vessel, types, construction, definition of fin efficiency, problems.

Unit VI Radiation heat transfer 10Hrs

Fundamentals of radiation, wavelength of radiation, emissivity, Laws of black body radiation, reflectivity, absorptivity of an opaque solid, Kirchhoff's law, radiation between two surfaces. Calculation of radiation between black surfaces, combined heat transfer by conduction - convection and radiation, problems. General heat transfer Characteristics, Calculation for Heat transfer co-efficient.

LABORATORY PRACTICALS:
(Minimum 10 experiments should be performed)
1. Emissivity measurement apparatus.
2. Natural convection.
3. Forced convection.
4. Heat transfer through lagged pipe.
5. Thermal conductivity of metal rod.
6. Double pipe heat exchanger.
7. Packed bed heat exchanger.
8. Climbing film evaporator.
9. Heat transfer through agitated vessel.
10. Shell and tube heat exchanger.
11. Fin tube heat exchanger.
12. Compact heat exchanger.

TEXT BOOKS:
1. McCabe W.L., Smith J.C. and Harriott P., "Unit Operations in Chemical Engineering" , 7th edition McGraw Hill,2005.
2. Sukhatme S.P., "Heat Transfer", 5th edition, University Press India Ltd., 1996.

REFERENCES:
1. William H. Mcadams, "Heat transmission", 3rd ed. McGraw Hill Series
2. Alan J. Chapman. "Heat Transfer", 4th ed. Macmilan Publishing Company, New York
3. Frank Kreith & Mark S. Bohn. , "Principles of Heat Transfer", 4th ed. Harper and Row Publishers, New York,
4. Coulson J.M. & Richardson J.F.,"Chemical Engineering" , 3rd ed. Vol.1
5. J.P. Holman. , "Heat Transfer" , 8th ed. Mc-Graw Hill Inc.1997.

CHROMATOGRAPHY AND INSTRUMENTAL METHODS OF ANALYSIS (CH225)

Teaching Scheme: L: 4 hrs/week **Credits: 5**
P: 2 hrs/week

Evaluation Scheme:	**CIE**	**SEE**	**IPE**	**EPE**
	(25 + 25)	**50**	**50**	**50**

Unit I 07Hrs

Electron Microscopy: Basic theory of electron microscopy, imaging system, image-translating system of electron microscope. Principle, working procedure and applications of scanning Electron Microscope and Transmission electron microscope.

Unit II 08Hrs

Infrared spectroscopy: Introduction, experimental techniques of Infrared spectra, FTIR spectroscopy.

Raman Spectroscopy: Introduction, Theories of Raman effect (Quantum and classical), Rotational and vibrational Raman spectra, Laws of mutual exclusion, Instrumentation, Advantages and limitations of Raman spectroscopy.

Unit III 07Hrs

Mass Spectroscopy: Principle, working procedure and applications of Mass spectroscopy.

NMR Spectroscopy: Principle, working procedure and applications of NMR spectroscopy.

Unit IV 10Hrs

Chromatographic Methods: General principle, classification of chromatographic methods, nature of partition forces, chromatographic behaviour of solutes, column efficiency and resolution. Gas Chromatography, Ion exchanges chromatography, Thin layer chromatography and Column chromatography.

Unit V 05Hrs

High Pressure Liquid Chromatography: Principle, Instrumentation required for HPLC and applications of HPLC.

Unit VI 10Hrs

Basic principles, working and applications of some other instruments: A potentiometer, a conductometer, a pH meter, a colorimeter and a spectrophotometer.

LABORATORY PRACTICALS:

(Any 10 experiments from the list.)

1. Conductometric titration of Strong acid with Weak base
2. Coductometric titration of Strong acid with strong base
3. Conductometric titration of Mixture of acid with base
4. Potentiometric titration of an acid mixture
5. Potentiometric titration of halide mixture

6. Colorimetric estimation of ammonium chloride using Nessler's reagent.
7. Colorimetric estimation of copper ion by copper ammonia method.
8. pH metric determination of dissociation constant of weak acid.
9. Determination of molarity of HCl solution pH-metrically.
10. Simultaneous spectrophotometric determination of chromium and manganese.
11. Spectrophotometric determination of indicator constant of methyl orange.
12. Demonstration of Chromatography experiments (any 3)

REFERENCE BOOKS:

1. B. K. Sharma, Instrumental Methods of Chemical Analysis, Goel Publishing House, 26th Edition (2007).
2. C. N. Banwell and E. M. McCash, Fundamentals of Molecular Spectroscopy, Tata McGraw Hill, VIth Edition (1994)
3. D. Pavia, G. Lapman and G. Kriz, Thomson, Introduction to Spectroscopy.
4. G. Aruldhas, Molecular Structure and Spectroscopy, Prentice Hall (2006)
5. H. Kaur, Spectroscopy, Pragati Prakashan, IVth Edition (2008)

Audit course II

INTRODUCTION TO PERFORMING ARTS (HS 113)

Teaching Scheme: L: 1 hr/week **No Credits, University grade**
P: 2 hrs/week

This course will introduce students to problems of performing arts & theatrical representation. It will include readings from ancient & modern performing arts & engage with some of leading theatrics'. Students will be exposed to the generic difference between different forms of drama / music / dance.

Students will be encouraged to stage scenes from well-known plays / music's / dances as a part of assessments.

ENVIRONMENTAL STUDIES (HS 111)

Teaching Scheme: L: 4 hrs/week **No Credits, University grade**

Evaluation Scheme: Theory: 70* marks
Project work: 30* marks
(Lectures to be equally divided in semester III and IV.)

Unit I Nature of Environmental Studies 02Hrs

Definition, scope and importance. Multidisciplinary nature of environmental studies Need for public awareness.

Unit II Natural Resources and Associated Problems 08Hrs

a) Forest resources: Use and over-exploitation, deforestation, Timber extraction, mining, dams and their effects on forests and tribal people.
b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
c) Mineral resources: Usage and exploitation, environmental effects of extracting and using mineral resources.
d) Food resources: World food problem, changes caused by agriculture effects of modern agriculture, fertilizer-pesticide problems.
e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources.
f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.
g) Role of an individual in conservation of natural resources.
h) Equitable use of resources for sustainable lifestyle.

Unit III Ecosystems 08Hrs

Concept of an ecosystem
Structure and function of an ecosystem
Producers, consumers and decomposers
Energy flow in the ecosystem
Ecological succession.
Food chains, food webs and ecological pyramids.
Introduction, types, characteristics features, structure and function of the following Ecosystem
a) Forest ecosystem,
b) Grassland ecosystem,
c) Desert ecosystem,
d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit IV Biodiversity and its Conservation 08Hrs

1. Introduction – Definition: genetic, species and ecosystem diversity.
2. Biogeographical classification of India.
Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.
3.Biodiversity at global, National and local levels.

4.India as a mega-diversity nation.
5.Western Ghat as a bio-diversity region.
6.Hot-spots of biodiversity.
7.Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts.
8.Endangered and endemic species of India.
9.Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Unit V Environmental Pollution 08Hrs

Definition: Causes, effects and control measures of:
a) Air pollution,
b) Water pollution,
c) Soil pollution,
d) Marine pollution,
e) Noise pollution,
f) Thermal pollution,
g) Nuclear hazards
• Solid waste Management: Causes, effects and control measures of urban and industrial wastes.
• Role of an individual in prevention of pollution.
• Pollution case studies
• Disaster management: Floods, earthquake, cyclone and landslides. Tsunami

Unit VI Social Issues and the Environment 08Hrs

• From Unsustainable to Sustainable development
• Urban problems related to energy
• Water conservation, rain water harvesting, watershed management
• Resettlement and rehabilitation of people; its problems and concerns.
• Environmental ethics: Issue and possible solutions.
• Climate change, Global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust.
• Wasteland reclamation.
• Consumerism and waste products.

Unit VII Environmental Protection 08Hrs

• Environment Protection Act.
• Air (Prevention and Control of Pollution) Act.
• Water (Prevention and control of Pollution) Act
• Wildlife Protection Act
• Forest Conservation Act
• Population Growth and Human Health, Human Rights.

Unit VIII Field Work 10Hrs

• Visit to a local area to document environmental as set river/ forest/grassland/hill/mountain
• Visit to a local polluted site – Urban/rural/Industrial/Agricultural or
• Study of common plants, insects, birds. or
• Study of simple ecosystems-ponds, river, hill slopes, etc.

REFERENCES:

1. Agarwal, K. C. 2001, Environmental Biology, Nidi Publ. Ltd., Bikaner.
2. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad 380013, India, Email:mapin@icenet.net (R)
3. Brunner R. C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
4. Clark R. S., Marine Pollution, Clanderson Press Oxford (TB)
Page No. 6
5. Cunningham, W. P. Cooper, T. H. Gorhani, E. & Hepworth, M. T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p
6. De A. K., Environmental Chemistry, Wiley Eastern Ltd.
7. Down to Earth, Centre for Science and Environment (R)
8. Gleick, H., 1993, Water in crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute. Oxford Univ. Press 473p
9. Hawkins R. e., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R)
10. Heywood, V. H. & Watson, R. T. 1995, Global Biodiversity Assessment, Cambridge Univ. Press 1140p.
11. Jadhav, H. & Bhosale, V. M. 1995, Environmental Protection and Laws, Himalaya Pub. House, Delhi 284p.
12. Mckinney, M. L. & Schocl. R. M. 1996, Environmental Science Systems & Solutions, Web enhanced edition, 639p.
13. Mhskar A. K., Matter Hazardous, Techno-Science Publications (TB)
14. Miller T. G. Jr., Environmental Science, Wadsworth Publishing Co. (TB)
15. Odum, E. P. 1971, Fundamentals of Ecology, W. B. Saunders Co. USA, 574p.
16. Rao M. N. & Datta, A. K. 1987, Waste Water Treatment, Oxford & IBH Publ. Co. Pvt. Ltd., 345p.
17. Sharma B. K., 2001, Environmental Chemistry, Goel Publ. House, Meerut
18. Survey of the Environment, The Hindu (M)
19. Townsend C., Harper, J. and Michael Begon, Essentials of Ecology, Blackwell Science (TB)
20. Trivedi R. K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II, Enviro Media (R)
21. Trivedi R. K. and P. K. Goel, Introduction to air pollution, Techno-Science Publications (TB)
22. Wagner K. D., 1998, Environmental Management, W. B. Saunders Co. Philadelphia, USA 499p.
(M) Magazine
(R) Reference
(TB) Textbook
23. Gholap T. N.Paryavaram Swhastra
24. Gharapure , Paryavaram Shastra .
25. V. R. Ahirrao, Paryavaran Vighyan, Nirali Prakashan, Pune.
26. Jay Kumar Magar, Paryavaram Shastra Parichay ,Vidya Prakashan, Nagpur.
27. Anupam Misra, Desh Ka Paryavaran , Ganolai santi Pratisthan. New Delhi.

Equivalence of S.Y B.Tech(Chemical Technology) Semester III and IV

The above detailed syllabus is a revised version of the S.Y.BTech (Chemical Technology) course being conducted by the Shivaji University at the Technology Department of the University. This syllabus is to be implemented from June 2012.(2012-13 onwards)

The Equivalence for the subjects of Chemical Technology at S.Y B Tech Semester III and IV pre-revised course under the faculty of Engineering and Technology is as follows.

S.Y.B Tech Semester III (Chemical Technology)

	Semester III **Pre-revised syllabus**	**Semester III** **Revised syllabus**	**Remark**
1.	Applied Mathematics III	Engineering Mathematics-III	Content is slightly modified and title is new
2.	Chemistry-I	Applied Chemistry-I	Content is slightly modified and title is new
3.	Material Science and Engineering	Material Science and Engineering	Content is slightly modified
4.	Mechanical Operations	Particulate Technology	Content is the same only title is new
5.	Process Fluid Mechanics	Process Fluid Mechanics	No change in the content
6.	Programming Practices for Chemical Engineers	Programming Practices for Chemical Engineers	Instead of C and C++ visual basic is included as a need of the field.

The examination pattern is changed from percent marks into credit system and the contents in all the subjects have been unitized into 6 units (chapters)

Audit course I is added which is not a parts of credits. It is evaluated by given grade. (Obtaining passing grade is essential)

S.Y.B Tech Semester IV (Chemical Technology)

	Semester IV **Pre-revised syllabus**	**Semester IV** **Revised syllabus**	**Remark**
1.	Chemistry-II	Applied Chemistry-II	Content is slightly modified and title is new
2.	Chemical Engineering Thermodynamics	Chemical Engineering Thermodynamics	Content is slightly modified
3.	Chemical Process Calculations	Chemical Process Calculations	Content is slightly modified
4.	Fundamentals and Applications of Heat Transfer	Fundamentals and Applications of Heat Transfer	Content is slightly modified
5.	Chromatography and Instrumental Methods of Analysis	Chromatography and Instrumental Methods of Analysis	Content is slightly modified

The examination pattern is changed from percent marks into credit system and the contents in all the subjects have been unitized into 6 units (chapters)

Audit course II is added which is not a parts of credits. It is evaluated by given grade. (Obtaining passing grade is essential)