



Solapur University, Solapur

Faculty of Science

B.Sc. Part-I Entrepreneurship Syllabus (ENTIRE)

**Choice Based Credit System (CBCS)
(w.e.f. June, 2016)**

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- **Choice Based Credit System:** With the view to ensure worldwide recognition, acceptability, horizontal as well as vertical mobility for students completing undergraduate degree, Solapur University has implemented Choice Based Credit System (CBCS) at Undergraduate level.

The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective/minor or skill based courses. The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. Therefore, it is necessary to introduce uniform grading system in the entire higher education in India. This will benefit the students to move across institutions within India to begin with and across countries. The uniform grading system will also enable potential employers in assessing the performance of the candidates. In order to bring uniformity in evaluation system and computation of the Cumulative Grade Point Average (CGPA) based on student's performance in examinations.

- **Outline of Choice Based Credit System:**
 1. **Core Course:** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.
 2. **Elective Course:** Generally a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.

Discipline Specific Elective (DSE) Course: Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective.
 3. **Ability Enhancement Courses (AEC):** The Ability Enhancement (AE) Courses may be of two kinds: Ability Enhancement Compulsory Courses (AECC) and Skill Enhancement Courses (SEC). "AECC" courses are the courses based upon the content that leads to Knowledge enhancement; (i) Environmental Science and (ii) English/MIL Communication. These are mandatory for all disciplines. SEC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc.

- **Credit:** Credit is a numerical value that indicates students work load (Lectures, Lab work, Seminar, Tutorials, Field work etc.) to complete a course unit. In most of the universities 15 contact hours constitute one credit. The contact hours are transformed into credits.

Moreover, the grading system of evaluation is introduced for B.Sc. course wherein process of Continuous Internal Evaluation is ensured. The candidate has to appear for Internal Evaluation of 30 marks and University Evaluation for 70 marks. It is 70+30 pattern of evaluation. It is applicable for theory and practical as well. The details regarding this evaluation system are as under.

- **Conversion of marks into Grades:**

A table for the conversion of the marks obtained by a student in each paper (out of 100) to grade and grade point is as given below:

Sr. No.	Range of Marks	Grade	Grade Point
1	80 – 100	O	10
2	70 – 80	A+	9
3	60 – 69	A	8
4	55 – 59	B+	7
5	50 – 54	B	6
6	45 – 49	C+	5
7	40 – 44	C	4
8	<39	FC	0 (Failed in Term Exam)
9	<39	FR	0 (Failed in Internal Assessment)

1. Grade Point Average at the end of the Semester (SGPA)

$$SGPA = \frac{(G_1 \times C_1) + (G_2 \times C_2) + \dots \dots \dots}{\sum C_i}$$

($\sum C_i$ = The total number of credits offered by the student during a semester)

2. Cumulative Grade Point Average (CGPA)

$$CGPA = \frac{(G_1 \times C_1) + (G_2 \times C_2) + \dots \dots \dots}{\sum C_i}$$

($\sum C_i$ = The total number of credits offered by the student upto and including the semester for which CGPA is calculated.)

3. Final Grade Point Average (FGPA)

It will be calculated in the similar manner for the total number of credits offered for the completion of the said course.

Where: C_i = Credits allocated for the i^{th} course.

G_i = Grade point scored in the i^{th} paper (subject)

SOLAPUR UNIVERSITY, SOLAPUR

Faculty of Science Choice Based Credit System (CBCS) (w.e.f. June 2016)

- **Title of the Course:** B.Sc. Part-I
- **Subject:** Entrepreneurship
- **Introduction:** This course provides a broad overview of entrepreneurship and to produces expert hands that would have sufficient knowledge and expertise to solve the urgent problems of the region by using entrepreneurship. The course structure is technology-centric where students basically learn technology and are taught necessary basic subjects for that purpose.
- **Objectives of the course:** The objectives of B. Sc. Entrepreneurship (Entire) course are
 - To provide an intensive and in-depth learning to the students in field of entrepreneurship.
 - Beyond simulating, learning, understanding the techniques, the course also addresses the underlying recurring problems of disciplines in today scientific and changing business world.
 - To develop awareness & knowledge of different organization requirement and subject knowledge through varied subjects and training methodology in students.
 - To train the students to take up wide variety of roles like researchers, scientists, consultants, entrepreneurs, academicians, industry leaders and policy.
- **Advantages of the Course:** Entrepreneurship has tremendous job potential. The successful students will be able to establish trading, industrial, managerial skills and consultancy organizations in pharmaceuticals, paper, fermentation, food processing & preservation, agriculture, environment protection and also their own industry for micropropagation of commercially important plants in vitro, transgenic plants, vaccine production, clinical pathology, genetic counseling, human karyotyping etc.
 - Multinational companies dealing with production of tissue cultured and genetically modified plants, food products, leather, dairy, beverages, pharmaceutical, chemical Industries, agribusiness, Environment protection.
 - Medical & Scientific Research Organizations.
 - Universities in India & aboard.

- **Eligibility and Admission:** A Candidate passing 10+2 with Biology or Math's as one of the subject and passed from state syllabus / CBSE / equivalent with minimum passing percentage of 45% aggregate for open category and 5 % relaxation in the aggregate for all reserved categories candidates as per the government rules and regulations. Admission is based on first come first serve basis.
- **Duration:** The duration for this program is of 3 years with semester pattern (06 Semesters)
- **Medium of Instruction:** English
- **Syllabus Structure:**
 - The University follows semester system.
 - An academic year shall consist of two semesters.
 - Each B.Sc. course shall consist of three years i.e. six semesters.
 - B.Sc. Part-I Entrepreneurship shall consist of two semesters: Semester I and Semester II.

In semester I, there will be four core subjects. Each subject is having two papers of 100 marks for each. Similarly in Semester II there will be four core subjects. Each subject is having two papers of 100 marks for each. English will be as Ability Enhancement Course (AECC) in both semesters I and II. English paper carries 100 marks in each semester.

The scheme of evaluation of performance of candidates shall be based on University assessment as well as College internal assessment as given below. For B.Sc. Part-I Entrepreneurship sem I & II the internal assessment will be based on Internal tests, Home assignment, Viva, Seminar, Group discussion etc. as given below. Practical course examination of 100 marks for each course shall be conducted at the end of IInd semester. The practical examination of 100 marks shall also consist of 70 marks for University practical assessment and 30 marks for college internal assessment.

For University practical examination out of two examiners, one examiner will be internal and another examiner will be External. Both examiners will be appointed by the University. The internal practical assessment shall be done as per scheme given below.

- **Scheme of Evaluation**

As per the norms of the grading system of evaluation, out of 100 marks, the candidate has to appear for college internal assessment of 30 marks and external evaluation (University assessment) of 70 marks. The respective B.O.S. may decide the nature of college internal assessment after referring to scheme given below or may be used as it is.

Semester – I

Theory: (100 marks)

University Examination (70 marks): No. of theory papers: 9

Internal Continuous Assessment: (30 marks)

Scheme of marking: 15 marks – Internal test
15 marks – Home assignment / seminars / viva/ industry visit/
group discussion.

Semester – II

Theory: (100 marks)

University Examination (70 marks): No. of theory papers: 9

Internal Continuous Assessment: (30 marks)

Scheme of marking: 15 marks – Internal test
15 marks – Home assignment / seminars / viva/ industry visit/
group discussion.

Practical Examination: (100 marks)

University Examination (70 marks): No. of practical course: 4

Internal Continuous Assessment: (30 marks)

Scheme of marking: 20 marks – Internal test on any two practical's
10 marks – Lab Journal/Viva, attendance, attitude etc.

- **Passing Standard**

The student has to secure a minimum of 4.0 grade points (Grade C) in each paper. A student who secure less than 4.0 grade point (39% or less marks, Grade FC/FR) will be declared fail in that paper and shall be required to reappear for respective paper. A student who failed in University Examination (theory) and passed in internal assessment of a same paper shall be given FC Grade. Such student will have to reappear for University Examination only. A student who fails in Internal assessment and passed in University examination (theory) shall be given FR Grade. Such student will have to reappear for both University examination as well as internal assessment. In case of Annual pattern/old semester pattern students/candidates from the mark scheme the candidates shall appear for the same 70 marks of external examination and his performance shall be scaled to 100 marks.

- **ATKT**

Candidate passed in all papers except 5 (five) papers combined together of semester I and II of B.Sc. Part-I Entrepreneurship examination shall be permitted to enter upon the course of Semester III of B.Sc. Part-II Entrepreneurship.

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Structure for B. Sc. Part-I Entrepreneurship (Entire)

Subject/ core course	Name and Type of Paper		No. of papers/ Practical	Hrs/Week			Total Marks Per Paper	UA	CA	Credits
	Type	Name		L	P	T				
Class: →	B.Sc.-I Semester-I Theory									
	Ability Enhancement Course (AECC)	English paper I (communication skill)		4.0	--	--	100	70	30	4.0
	Entrepreneurship science	ENT 101:	Paper I: Entrepreneurship and world of business	2.5	--	--	100	70	30	2.5
			Paper II: Economics for manager and managerial accounting	2.5	--	--	100	70	30	2.5
	Industrial chemistry	ENT 102:	Paper I: Fundamental of inorganic chemistry	2.5	--	--	100	70	30	2.5
			Paper II: Fundamental of organic chemistry	2.5	--	--	100	70	30	2.5
	Industrial microbiology	ENT 103:	Paper I: Fundamental of microbiology	2.5	--	--	100	70	30	2.5
			Paper II: Basic techniques in microbiology	2.5	--	--	100	70	30	2.5
	Industrial Biotechnology	ENT 104:	Paper I: Cell Biology	2.5	--	--	100	70	30	2.5
			Paper II: Animal and plant physiology	2.5	--	--	100	70	30	2.5
Total (Theory)				24	--	--	900	630	270	24

Subject/ core course	Name and Type of Paper		No. of papers/ Practical	Hrs/Week			Total Marks Per Paper	UA	CA	Credits
	Type	Name		L	P	T				
Class: →	B.Sc.-I Semester-II Theory									
	Ability Enhancement Course (AECC)	English paper II (communication skill)	Paper II	4.0	--	--	100	70	30	4.0
	Entrepreneurship science	ENT 105:	Paper I: Principles of marketing and management accounting	2.5	--	--	100	70	30	2.5
			Paper II: Cost accounting and project management	2.5	--	--	100	70	30	2.5
	Industrial chemistry	ENT 106:	Paper I: Fundamental of physical chemistry	2.5	--	--	100	70	30	2.5
			Paper II: Fundamental of analytical chemistry	2.5	--	--	100	70	30	2.5
	Industrial microbiology	ENT 107:	Paper I: Fundamental of industrial microbiology	2.5	--	--	100	70	30	2.5
			Paper II: Basics techniques in industrial microbiology	2.5	--	--	100	70	30	2.5
	Industrial Biotechnology	ENT 108:	Paper I: Basics of Biomolecules	2.5	--	--	100	70	30	2.5
			Paper II: Basics of Metabolism	2.5	--	--	100	70	30	2.5
Total (Theory)				24	--	--	900	630	270	24
Practical Syllabus										
	Entrepreneurship science	Laboratory Course I	Based on ENT 101 and ENT 105	--	4	--	100	70	30	4
	Industrial chemistry	Laboratory Course II	Based on ENT 102 and ENT 106	--	4	--	100	70	30	4
	Industrial microbiology	Laboratory Course III	Based on ENT 103 and ENT 107	--	4	--	100	70	30	4
	Industrial Biotechnology	Laboratory Course IV	Based on ENT 104 and ENT 108	--	4	--	100	70	30	4
Total (Practical)					16	--	400	280	120	16
Grand Total (Semester I + Semester II)				48	16	--	2200	1540	660	64

Abbreviations:

L: Lectures; T: Tutorials; P: Practical's; UA: University Assessment; CA: College Assessmen

Entrepreneurship Science (ENT 101)
Paper-I
(Entrepreneurship & the World of Business)

Marks-100	Period-40L
Unit I i. Introduction to Entrepreneurship Meaning, concept, Definition of an entrepreneurship and Characteristics of an entrepreneur. Entrepreneurship as Process. Scope of Entrepreneurship in India. Entrepreneur v/s Entrepreneurship. Entrepreneur v/s Manager. ii. Motivation, Type & Barriers to Entrepreneurship Entrepreneur Motivation. Factors responsible For Emergence of Entrepreneurship. Type of Entrepreneur. Barriers to entrepreneurship.	12
Unit II.i Behavioral orientation of the entrepreneurs Location of Business, Choice of Business Line. Innovativeness of product & Profit Margin, Management of Business Growth. Influence of Background Factor on Behavioral Orientation. ii. Women Entrepreneurship Introduction & Scope of the Introduction & among Woman. Program Supporting Women Entrepreneurship. Problem Faced by Women Entrepreneurs.	08
Unit III: The World of Business. i. Introduction to business : Meaning & Definition, Characteristics or Features of Business. Objective & Scope of Business. Classification of Business Activity. ii Business Ethics: Meaning & definition of Business ethics, Nature & scope of business ethics, Importance of business ethics.	10
Unit IV Types of Business Organization Sole trader, HUF, Co-operative society, Partnership Private limited company and Public limited company Joint sector & Public sector Multinational & Transactional	06
Unit V Introduction to commerce & aid to Commerce.	04

Entrepreneurship Science (ENT 101)
Paper-II
Economics for Manager & Managerial Accounting

Marks-100	Period-40L
Unit I i.Introduction to Economics	10
Definition of economics	
Basic Concepts of economics	
Managerial economics – Meaning, Definition, Nature & Scope.	
ii. Economics of scale: Internal & External Returns of scale. Production function	
Unit II. i.Types of firms	09
Monopoly, Oligopoly and Perfect competition	
ii. Demand and demand analysis	
Demand analysis & its objective	
Elasticity of demand	
Demand schedule	
Unit III: Managerial Accounting	06
Basic Accounting concepts	
Meaning, Definition. Nature & scope of accounting.	
Different types of accounts. Passing of journal entries.	
Unit IVi: Business Finance	08
Meaning, Definition, Scope & function of business finance	
Sources of financial information	
ii Sources of finance: Internal & external source	
Unit V: Statement of financial information	07
Income statement, Profit & loss account	
Balance sheet, Preparation of final account	
Users of final statement.	

Industrial Chemistry (ENT 102)
Paper- I
Fundamentals of Inorganic Chemistry

Total Marks: 100

Periods:40L

Unit I. Nature of Chemical Bonding

08

1. Types of Chemical bonds.
Covalent, Ionic, Coordinate, Metallic, Hydrogen, Van der Waals forces.
2. Valence Bond Theory
Hybridisation, Need of Hybridisation, Types of Hybridisation.
Formation of molecules with sp sp^2 sp^3 hybrid orbitals such as $BeCl_2$, BF_3 , CH_4
3. Valence Shell Electron Pair Repulsion (VSEPR) Theory w.r.t. NH_3 , H_2O .

Unit II Molecular orbital Theory

08

- (a) Atomic and Molecular orbitals.
- (b) L.C.A.O. Principle
- (c) Bonding, Antibonding and Nonbonding Molecular orbitals.
- (d) Conditions for successful overlap
- (e) Different types of overlap.
 $s-s$, $s-p_x$, $p_x - p_x$ and $p_y - p_y$ or $p_z - p_z$
- (f) Energy level sequence of molecular orbitals for $n = 1$ and $n = 2$
- (g) M. O. Diagrams for -
 - i) Homonuclear diatomic molecule. H_2 , Be_2 , C_2 , N_2 and O_2
 - ii) Heteronuclear diatomic molecules CO and NO w. r. t. bond order stability and magnetic properties

Unit III Ionic Solids

10

1. Ionic Bonding
 - (a) Formation of ionic bond, Energetics of ionic bonding : Ionisation potential, Electron affinity and Lattice energy.
 - (b) Characteristics of ionic compounds.
 - (c) Born-Haber Cycle for Alkali metal halide ($NaCl$). (Numerical Problems are expected)
 - (d) Fajans Rule
2. Radius ratio and crystal structure.
 - (a) Definition : Radius ratio $\left(\frac{r_+}{r_-}\right)$, Coordination number, Stoichiometry and unit cell.
 - (b) Concept and calculation of radius ratio $\left(\frac{r_+}{r_-}\right)$ for ionic solid with octahedral geometry.
 - (c) Radius ratio effect on geometry.
 - (d) Crystal structure of $NaCl$ and $CsCl$ w.r.t. unit cell, radius ratio, coordination number and stoichiometry.

Unit IV Water Pollution**10**

- 1) Types of pollutant, causes of water pollution
- 2) Analysis of water pollution
- 3) Monitoring techniques and methodology
- 4) T.D.S. (Total dissolved solid)
- 5) D.O. (Dissolved oxygen)
- 6) B.O.D. (Biological Oxygen Demand)
- 7) C.O.D. (Chemical Oxygen Demand)
- 8) T.O.C. (Total organic carbon)
- 9) Hardness, chloride, alkalinity
- 10) Sulfide, nitrite, iron Mg.
- 11) Sodium potassium, pesticides, surfactants etc.

Unit V. Air Pollution**04**

- 1) Types of pollutant
- 2) Sources of pollution
- 3) Air quality standards
- 4) Sampling of Air
- 5) Toxic effect of carbon monoxide, nitrogen oxide, sox, nox
- 6) Acid rain

Reference Books :

- 1) Advanced Inorganic Chemistry - Cotton and Wilkinson
- 2) Inorganic Chemistry - J. E. Huheey
- 3) Concepts and models of Inorganic Chemistry - Douglas & Mc-Daniel
- 4) Principles of Inorganic Chemistry - Puri, Sharma
- 5) New Consise Inorganic Chemistry - (ELBS) - J. D. Lee
- 6) Text book of Inorganic Chemistry - P. L. Soni
- 7) Advanced Inorganic Chemistry - Satyaprakash, Tuli, Basu
- 8) Theoretical Principles of Inorganic Chemistry - G. S. Manku
- 9) Principles of Inorganic Chemistry - Puri, Sharma & Kalia
- 10) Environmental pollution analysis - S.M. Khopkar
- 11) Environmental Chemistry - A.K. De
- 12) Environmental Chemistry - Harry W. Vanloon, Stephin J.Duffy, OxfordUniversity Press
- 13) Environmental Chemistry - S.S. Dara

Industrial Chemistry ENT-102
Paper-II
Fundamentals of Organic Chemistry

Total Marks : 100

Periods:40L

Unit I Chemistry of Hydrocarbon

10

A) Alkanes : - 1. Methods of formation with special reference to Wurtz reaction, Kolbe reaction and decarboxylation of carboxylic acid.

2 Mechanism of free radical halogenation of alkanes.

3 Cycloalkanes - Nomenclature methods of formation (a) Internal Wurtz reaction (b) Distillation of calcium or barium salt of dicarboxylic acid.

4 Chemical properties of cyclopropane (i) Free radical substitution of chlorine in presence of light. (ii) Action of HBr and conc. H_2SO_4 (iii)

Catalytic reduction by H_2/Ni

B) Alkenes: 1 Nomenclature of alkenes.

2 Methods of formation of alkenes with mechanism

i) By dehydration of lower alcohols.

ii) By dehydrohalogenation of lower alkyl halides.

3 Chemical reactions of alkenes - Hydrogenation, Electrophilic and free radical additions,

Hydroboration, Oxidation, Epoxidation, Ozonolysis, Hydration,

Hydroxylation, Oxidation with $KMnO_4$, Polymerisation of alkenes - ethylene and propylene

Chemistry of Hydrocarbon

C) Dienes : 1. Nomenclature and classification of dienes.

2. Isolated, Conjugated and cumulated dienes.

3. Butadiene - Methods of formation, polymerisation, 1 : 2 & 1 : 4 additions and Diels-Alder reaction.

D) Alkynes : - Nomenclature, Acidity of alkynes.

2. Electrophilic and Nucleophilic addition reactions, Hydroboration,

Oxidation, 3. Oxidation and polymerisation.

Unit II Chemistry of Aromatic compounds

06

1 Meaning of the terms - Aromatic, non-aromatic, antiaromatic and pseudoaromatic compounds.

2 a) Kekule structure of benzene b) Resonance structures of benzene.

c) Molecular orbital picture of benzene. d) Representation of benzene ring.

3. Modern theory of aromaticity. Fundamental Concepts - delocalisation of electrons, coplanarity and Huckel's $(4n + 2)$ π rule. Applications of Huckel's rule to naphthalene, anthracene, pyrrole, furan, thiophene and pyridine.

8

4 Mechanism of electrophilic aromatic substitution in benzene w.r.t. nitration, sulphonation, halogenation and Friedel - Craft's reaction alkylation

and acylation.

Unit III. Qualitative and Quantitative elemental analysis **09**

- 1 Qualitative analysis of Carbon, Hydrogen, Nitrogen & Sulphur
- 2 Quantitative analysis of -
 - i) Carbon & hydrogen by Combustion method
 - ii) Nitrogen by Kjeldahl's method
 - iii) Halogen and sulphur by Carius method.
- 3 Determination of molecular weight of an acid by titration method & Base platinichloride method.
- 4 Empirical formula and molecular formula determination.
(Numerical Problems Expected)

Unit IV. Pharmaceuticals **05**

1. Introduction
2. Qualities of ideal drugs
3. Methods of classification of drugs
4. Classification based on therapeutical action

Unit V. Synthetic Dyes 05

1. Introduction, Chromophore, auxochrome
2. Qualities of good dye
3. Classification based on constitution & methods of applications.
4. Witt's theory, colour & constitution.

Reference books:

- 1) Organic Chemistry : Hendrickson, Cram, Hammond.
- 2) Organic Chemistry : Morrison & Boyd
- 3) Organic Chemistry : Volume I & II I.L. Finar
- 4) Organic Chemistry : Pine
- 5) Advanced Organic Chemistry : Sachinkumar Ghosh
- 6) Advanced Organic Chemistry : B.S. Bahl and Arun Bahl
- 7) A Guide book to Mechanism in organic Chemistry : Peter Sykes
- 8) Text book of Organic Chemistry : P. L. Sony
- 9) Practical Organic Chemistry : By A. I. Vogel
- 10) Advanced Organic Chemistry - Reactions, Mechanism & Structure : Jerry March
- 11) Organic Chemistry : M.R. Jain
- 12) Organic Chemistry : J. M. Shaigel

Industrial Microbiology (ENT -103)

Paper-I

Fundamental of microbiology

Total Marks – 100

Periods - 40L

Unit I.i.Milestones in Microbiology

08

Important Contribution of

- 1) Antony Van Leeuwenhoek
- 2) Louis Pasteur
- 3) Robert Koch
- 4) Alexander Fleming
- 5) John Tyndall
- 6) Winogradsky

ii. Applied areas of Microbiology

Industrial Microbiology, Agricultural Microbiology, Dairy Microbiology, Food Microbiology, Medical Microbiology, Environmental Microbiology.

Unit II. General Characteristics of Microorganisms:

14

- 1) Types of Microorganisms - Bacteria, Algae, Fungi, Protozoa, Actinomycetes & Viruses
- 2) Difference between Prokaryotic & Eukaryotic Cell
- 3) Structure, Chemical composition & function of
 - a. Cell wall
 - b. Cell membrane
 - c. Capsule & Slime layer
 - d. Flagella
 - e. Pili
 - f. Nuclear material
 - g. Mesosome
 - h. Ribosome
 - i. Reserve Food Material
 - j. Cytoplasmic inclusions.

Unit III. Bacterial Taxonomy

06

- 1) General Principles of Nomenclature
- 2) Bacterial Classification based on -
 - a. Morphological characters-Size, shape, arrangement etc.,
 - b. Cultural characters
 - c. Biochemical characters
 - d. Serological characters

Unit IV. Sterilization & Disinfection

07

Control of micro-organisms Definition of sterilization, disinfectant, antiseptic, germicide, antimicrobial agents.

Physical agent of sterilization– Temperature (Dry heat, moist heat, incineration & boiling), Dessication, Filtration, Radiation

Chemical agents of Sterilization – Alcohols, Phenols, Halogens, gaseous agents (ethylene oxide, formaldehyde, Nitrous oxide, Ozone.

Unit V. Microbial Nutrition and Growth**05**

- 1) Basic nutritional requirements of microorganisms.
- 2) Nutritional classification based on Carbon & Energy source.
- 3) Growth – definition, Growth phases, Growth measurement, Continuous growth, Synchronous growth, Chemostat, Turbidostat, Diauxic growth

Reference books

1. Brock ,Biology Of microorganisms
2. Text book of microbiology by C.H. Pelzar
3. Text book of microbiology by T.Bapat phadake publication
4. Text book of general microbiology by Powar and Daginawala
5. Principles of fermentation technology by Whitaker
6. Bergeys manual of systematic bacteriology Vol IV
7. Text book of microbiology by Anantnarayan

Industrial microbiology (ENT 103)
Paper-II
Basic Techniques in Microbiology

Total Marks – 100

Periods -40L

Unit I. Microscopic Techniques

10

Construction, Working, Principles & Application of

- a. Bright field
- b. Dark field
- c. Phase contrast
- d. Fluorescent
- e. Electron - SEM, TEM

Unit II. Cultivation and Isolation Techniques

10

Components of Culture Media- Peptone, Meat extract, Glucose, Lactose, Bile salt, NaCl etc.

Types of Culture Media

- a. Living
- b. Non-Living
- c. Natural
- d. Synthetic
- e. Semi-synthetic
- f. Enrichment
- g. Enriched
- h. Selective
- i. Differential

Unit III. Cultivation and Isolation Techniques Isolation Techniques

03

- a. Serial dilution
- b. Streak plate
- c. Pour plate
- d. Spread plate

Unit IV. Stains and staining procedures:

10

Defination of dye and stain. Classification of stains – acidic, basic and neutral.

Theories, Procedures and mechanisms of – Simple staining, Differential staining, Gram staining, Acid fast staining, Negative staining.

Unit V. Cell Enumeration Techniques

07

Direct Methods

- a. DMC
- b. Neubaurs chamber

Indirect Methods

- a. SPC/ TVC
- b. Membrane filter technique

Recommended Books

1. Brock, Biology of microorganisms
2. Text book of microbiology by C.H. Pelzar.
3. Text book of Microbiology By T.Bapat Phadake Publication.
4. Text book of General Microbiology By Powar & Dagainawala
5. Principles of Fermentation Technology by Whithakar.
6. Bergey's Manual of systematic bacteriology Vol-IV
7. Text book of Microbiology By Anantnarayan

Industrial biotechnology (ENT 104)

Paper-I Cell Biology

Marks-100

Lectures 40

Unit I. 1 Introduction

(08)

Cell theory, History, Significant event in Cell Biology
Types of Cell- Prokaryotic & Eukaryotic cell, Ultrastructure of Prokaryotic (Eg. Bacteria, BGA) & Eukaryotic cell-(Plant & Animal cell.)
Cell as a basic unit of living system, Biochemical composition of cell

Unit II. Cell Wall & Cell Membrane:

(12)

Cell wall- Structure, Chemical composition, & function
Cell Membrane- Types, Structure, Composition, The lipid Bilayer membrane.
A summary of membrane functions - simple diffusion, Facilitated transports,
Active transport, Endocytosis, Pinocytosis, Phagocytosis, Exocytosis.
Cell senescence and death, cell differentiation.

Unit III. Cell Organelles

(10)

Structure and Function of the Endoplasmic reticulum, Golgi complex, Lysosome,
Ribosome, Mitochondria and Chloroplast.

Unit IV. Chemical nature & Structure of Genetic material

(05)

Unit V. Cell Division and Growth

(05)

Introduction Mitosis & Meiosis- Definition, stages, function & Characteristic
Chromosomes- Definition, morphology, function & Types
Euchromatin & Heterochromatin

Recommended Books

1. De Robertis, E.D.P. & De. Robertes, E.M.F.2001 Biology, Cell and Molecular Biology Lea & Febiger.
2. Bruce Albert, A. Bray, D.Lewis, J.Raff, M.Robers, K. Watson, J.D. 2000, Molecular Biology of Cell, 4th Edition, Garland.
3. Lodish H.199, Molecular Cell Biology, W.H. Freeman & Co. 4th Edition.
4. Drnell, J.E. 2000, Molecular Cell Biology, W.H. Freeman & Co.
5. Physiology by Ghyton
6. Physiology by Berry Berry.
7. Cell biology by C.B. Pawar.
8. Gene VIII By Benjamin and Lewins

Industrial biotechnology (ENT 104)
Paper-II
Animal and Plant Physiology

Marks-100

Lectures 40 L

Unit I. Animal Physiology **08**

Basic element for Growth: Carbon, Nitrogen, Hydrogen, Oxygen, Sources, Vitamins, Enzymes, Water & CO₂

Unit II. Tissue :Origin, location, structure, & function 08

- Epithelium
- Connective
- Muscular
- Nervous

Unit III. Physiology of Human Being **08**

1. Skin (V.S.) 2. Tooth (V.S.)
3. Tongue 4. Salivary gland
5. Oesophagus 6. Stomach
7. Rectum 8. Liver
9. Pancreas 10. Testies
11. Ovary 12. Kidney

Unit IV. Plant Physiology

Photosynthesis –

10

Introduction and significance of photosynthesis apparatus, Photosynthetic Pigments, accessory pigments, light reaction, photo systems, reaction center Complex, photo chemical reaction, Emerson enhancement effect, Electron transfer Pathway, Photophosphorylation Dark reaction, Calvin cycle, C₄ plant, CAM.

Unit V. Introduction to Tissue culture 06

Plant & Animal tissue culture

Recommended Books

1. De Robertis, E.D.P. & De. Robertes, E.M.F. 2001 Biology, Cell and Molecular Biology Lea & Febiger.
2. Bruce Albert, A. Bray, D. Lewis, J. Raff, M. Roberts, K. Watson, J.D. 2000, Molecular Biology of Cell, 4th Edition, Garland.
3. Lodish H. 1999, Molecular Cell Biology, W.H. Freeman & Co. 4th Edition.
4. Drnell, J.E. 2000, Molecular Cell Biology, W.H. Freeman & Co.
5. Physiology by Ghyton
6. Physiology by Berry Berry.
7. Cell biology by C.B. Pawar.
8. Gene VIII By Benjamin and Lewins.

SEMESTER

II

Entrepreneurship Science (ENT 105)
Paper-I
Principles of Marketing & Management accounting

Marks-100

Period-40L

Unit I: Overview of marketing & Marketing environment **10**

Definition of market & types of marketing, Marketing, origin of marketing
Nature & scope of marketing. Selling Vs marketing .Nature of marketing
environment, Need & importance of environment analysis, External
uncontrollable forces, Internal forces

Unit II: Market segmentation & Marketing research **12**

Meaning & criteria for market segmentation, Selecting the market
segmentation, Advantages of segmentation., Benefits of market
segmentation.

Marketing research: Importance of marketing research, Scope &
limitations of marketing research, Advantages & limitations of marketing
research, Marketing research process.

Unit III Introduction to management account: **10**

Meaning, Concept, Nature & Scope
Accounting: concepts & conventions

Unit IV: Working capital (theory & problems) **04**

Unit V: Analysis & interpretatin of financial statements (Ratio analysis) **04**

Current ratio, Lituid ratio, Inventory turnover ratio, Debaters turnover
ratio, Creditors turnover ratio, Gross profit ratio, Net profit ratio

Entrepreneurship Science (ENT 105)
Paper-II
Cost accounting and Project management

Marks-100

Period-40L

Unit-I Basic Terms in Cost Accounting financial accounting and Management

Accounting:

08

Definition of Cost, Price Value, Types of Cost - by nature of elements by function, by controllability, by changes in Activity or volume definition and examples each. Definition, Characteristics and difference. Object of Cost Accounting.

Unit-II

12

Classification of Elements of cost as material, labour and expense
Direct and Indirect Examples of each. Preparation of cost sheet. Job Cost Sheet - Definition, Features, Advantages and limitations, cases on job cost sheet.
Classification of costing methods - Job costing, Contract costing, Batch costing, Pre costing, One Operation Costing, Service Costing
Form costing (Explanation and where to use only)

Unit-III: Smart up and Project Management

Small Enterprises as introductory frame work

08

Definition Characteristics, Relationship between small & large unit.
Objective & Scope of Small business, Problems of SSI Role of Small Entrepreneurship in Economic Development

Unit-IV Project Management & Project formulation:

06

Definition and meaning of project. Types of project. Project identification, selection, Meaning of project report, Significance of project report. Contents of project report.

Unit-V Process of project development

06

General information, Project description, Market potential, Capital cost and sources of finance, Assessment of working capital requirement, Other financial aspects, Economic and social variables, Project implementation

Industrial Chemistry (ENT 106)
Paper-I
Fundamentals of Physical Chemistry

Total Marks: 100

Periods:40L

Unit I :Dimensions and Units **08**

- 1) Atomic weight molecular weight, equivalent weight, mode
- 2) Composition of liquid mix and gaseous mixture, stoichiometry
- 3) Calculations of percentage (W/W), (W/V), (V/V)
- 4) Different methods of determination of concentration
- 5) Mole of fraction and atomic fraction.
(Simple numerical problems are expected)

Unit II: Reaction Kinetics **08**

1. Chemical Kinetics and its scope, Rate of reaction, Definition and units of rate constant.
2. Factors affecting rate of reaction. Concentration, pressure, temperature and catalyst.
3. Order and Molecularity of reaction, Zero order reaction and its example :Photochemical union of H₂ and Cl₂

Unit III: First order reaction: **08**

1. Derivation of Rate constant. Characteristics of first order reaction. Examples:
i) Decomposition of oxalic acid
2. Second order reaction: Derivation of rate constant for equal and unequal concentration of the reactants. Characteristics of Second order reaction. Examples : i) Reaction between K₂S₂O₈ and KI
3. Pseudounimolecular reactions such as Hydrolysis of methyl acetate in presence of Acid
4. Methods to determine the order of reaction: a) Integration method b) Graphical method c) Half change method, d) Ostwald's isolation method (Numerical Problems Expected)
5. Energy of Activation

Unit IV. Study of Gaseous State **08**

1. a) Ideal and Non ideal gases
b) Deviation from ideal behavior. (Only Boyle's law)
c) Causes of deviation, van der Waal's equation, explanation of real gas behavior by van der Waal's equation.
2. Critical Phenomena : PV-Isotherms of real gases (Andrew's isotherms), continuity of state, Relationship between critical constants and van der Waal's constants.
3. Liquefaction of gases, Joule-Thomson effect.
(Numerical Problems expected)

Unit.V Properties of Liquid **08**

1. Introduction, additive & constitutive properties.
2. Viscosity, coefficient of viscosity, determination of viscosity by Ostwald's Viscometer

3. Surface tension:- Determination of surface tension by Drop –Weight method
4. Parachor:-Macleod equation & its modification by Sugden, applications of parachor in the determination of molecular structures as benzene, quinone, NO₂ group & PC15 (Numerical problems not expected).

Reference Books:

- 1) Mathematical preparation of Physical Chemistry : F. Daniel Mc-Graw Hill Book Com.
- 2) Elements of Physical Chemistry : S. Glasstone and D.Lewis (D.Van Nostrand Co.Inc)
- 3) Physical Chemistry : W. J. Moore (Orient Longman)
- 4) Principles of Physical Chemistry : Maron Prutton
- 5) University Chemistry : B. H. Mahan (Addision - Weseley Publ. Co.)
- 6) Chemistry Principle & Applications : P.W. Atkins, M. J. Clugsto, M.J. Fiazer, R. A. Y. Jone (Longman)
- 7) Physical Chemistry : G. M. Barrow (Tata Mc-Graw Hill)
- 8) Essentials of Physical Chemistry : B. S. Bahl & G.D. Tuli (S. Chand)
- 9) Physical Chemistry : A. J. Mee.
- 10) Physical Chemistry : Daniels - Alberty.
- 11) Principles of Physical Chemistry : Puri - Sharma (S. Nagin)
- 12) Text Book of Physical Chemistry : Soni Dharmarha
- 13) University General Chemistry : CNR. Rao (McMillan)
- 14) Chemistry : Sienko - Plane (Recent Edn.,)
- 15) Physical Chemistry Through problems :Dogra and Dogra (Wiley Eastern Ltd.,)
- 16) Physical Chemistry : S. Glasstone.
- 17) Basic Chemical Thermodynamics : V. V. Rao

Industrial Chemistry (ENT 106)
Paper-II
Fundamentals of Analytical Chemistry

Total Marks: 100

Periods: 40L

I. Fuels **08**

- 1) Types of fuels, testing of fuels i.e. calorific value, heating value.
- 2) Octane number, flash point, fire point & applications.
- 3) Introduction of petroleum
- 4) Constituents and refining of petroleum i.e. fractionation of crude oil.
- 5) Natural gas, (C1 to C4) strain run, gasoline (C5 to C12), kerosene.
- 6) Diesel & Residual oil.
- 7) Cracking
- 8) Reforming, hydro forming, isomerisation.

II. Industrial Polymer **08**

- 1) General idea of polymers
- 2) Types of polymers, homogeneous & heterogeneous polymers, classification based on a) origin b) composition c) method of vulcanization d) physical properties e) elastomers f) thermoplastic g) thermo settings.
- 3) Linear, branched & cross linked polymers
- 4) Addition polymers, polyethylene, polypropylene, pvc, orlon, teflon, polystyrene
- 5) Condensation polymers, terylene, nylon-66, resin, bakelite & melamine
- 6) Synthetic elastomers - styrene, butadiene, nitrilerubber, Buna-s, Buna-N, rubbers vulcanization.

III. Thermodynamics **08**

- 1) Enthalpy, heat capacity
- 2) Spontaneous process, non spontaneous process
- 3) Second law of thermodynamics, Carnot theorem (Numerical problems are expected from heat engine, head of reaction cycle)

IV. Thermochemistry **08**

- 1) Heat of mixing Hess' Law, Heat of decomposition.
- 2) Carnot's cycle & its efficiency, Kirchhoff's equation, Joule Thompson effect. (Simple numerical problems are expected)

V. Chemistry in day to day life **08**

- 1 Types of water, desalination, Fresh water, Dissolved Oxygen and water quality.
- 2 Milk : Definition, Chemical composition of milk of different species such as cow, buffalo and goat. **Adulteration in milk** like Sugar, Urea, Starch.
- 4 Essential nutrients for plants, Classification, Major, minor & trace their sources and forms.
- 5 Importance of Inorganic Compounds as Medicine- Antacid products Na_2CO_3 , $\text{Al}(\text{OH})_3$, AlPO_4 , $\text{Mg}(\text{OH})_2$, Cis -plat

Reference Books

- 1) Chemistry - Central Science, Brown, Lemay, Bursten 8th Edition.
- 2) Outline of Dairy Technology - Sukumar De Oxford university Press.
- 3) Introduction to Agronomy & soil water management - V. G. Vaidya, N.R. Sahastrabudhye.
- 4) Principles of Soil Science - M. M. Raj, Millian Co. of India, Bombay 1977
- 5) Inorganic Medicinal & Pharmaceutical Chemistry- Block, Roche, Soine – Wilson, Varghese Publishing House.
6. Industrial Chemistry - B.K. Sharma
7. Engineering Chemistry - Paradkar
8. Physical Chemistry - G.M. Barrow, International Student Edition,
9. Polymer Chemistry - Govarikar
10. Polymer Chemistry - Bill Meyer
11. Text Book of Physical Chemistry - Puri & Sharma
12. Thermodynamics for Chemist - S.Glasstone
13. Thermodynamics - Rastogi & Mishra

Industrial Microbiology (ENT 107)
Paper-I
Fundamentals of Industrial Microbiology

Mark-50	40 L
Unit I. History & scope of Industrial microbiology	03L
Unit II. Screening Techniques- Primary screening & Secondary screening	05L
Unit III. Basic concepts of Fermenter- Introduction Factors involved in fermenter design Types, Design, Construction, Working & Application of fermenter Factors affecting on fermentation process	10L
Unit IV. Preservation & Maintenance: Industrially Important Microorganisms Serial subculture Preservation by overlaying cultures with mineral oil Lyophilization Other methods	07L
Unit V. 1.Fermentation Media a. Raw material b. C & N sources c. Alternative sources d. Buffers e. Antifoam agents f. Precursors	10L
2. Sterilization of fermentation media & Fermenter	05L

Industrial Microbiology (ENT 107)
Paper-II
Basic techniques in Industrial Microbiology

Marks-50	Period-40L
Unit I. Strain Improvement:	10
a. Mutagenesis (Chemical and UV)	
b. Site directed mutagenesis	
c. Gene Manipulation	
Unit II. Scale up of fermentation process & Development of inoculums	04
Unit III. Microbiological Assays	08
a. Metabolic response assay	
b. Turbidometric assay	
c. Enzymatic assay	
Unit IV. Fermentation Economics	08
Computer Applications in fermentation technology	
Unit V Downstream processing	10
a. Precipitation	
b. Crystallization	
c. Solvent Extraction	
d. Distillation	
e. Filtration	
f. Centrifugation.	

Recommended Books:

1. Brock, Biology of microorganism
2. Text book of microbiology by C.H. Pelzar.
3. Text book of Microbiology By T.Bapat Phadake Publication.
4. Text book of Industrial Microbiology By L.E. Casida.
5. Principles of Fermentation Technology by Whithakar.
6. Bergey's Manual of systematic bacteriology Vol-IV
7. Text book of Industrial microbiology By A.H. Patel

Industrial Biotechnology (ENT 108)
Paper-I

Basic Biomolecules

Marks-100

Period-40L

Unit I. Carbohydrates

10L

Monosaccharides: classification, configuration, conformation and derivatives,
Common disaccharides, structure and occurrence of storage and structural
Polysaccharides, glycosaminoglycans, Glycoprotein: structure & function.

Unit II . Lipids

08L

Fatty acids, Triacylglycerol, Glycerophospholipids, Sphingolipids:
Sphingomyelins, Cerebrosides & gangliosides, Cholesterol, Micelles,
Bilayers, Liposomes, Lipoprotein structure & function.

Unit III . Proteins

10L

Amino acids: structure, nomenclature and general properties, peptide bond,
Primary structure of proteins, amino acid composition, Specific peptide cleavage
And sequence determination, Secondary structure: peptide group,
Ramachandran diagram, helical structure: alpha-helix & other polypeptide
helices,
Beta-pleated sheets, Protein stability: Electrostatic interactions, hydrogen bond
& hydrophobic forces, disulphide bond, General idea of tertiary and quaternary
structure of proteins.

Unit IV. Vitamins & Hormones:

07L

Vitamins of B-group: their coenzyme forms, recommended dietary allowance
(RDA), source and biochemical function. Fat soluble vitamins: RDA sources
And function.
Hormones- Introduction Physiology of Hormone, Chemical classes, Functions

Unit V Enzymes:

05L

Classification, Nomenclature, Endoenzyme, Exoenzyme Induced enzyme and
constitutive enzyme Coenzymes, Isoenzymes specificity & stereospecificity,
Mechanism of enzyme action, Factors affecting on enzyme activity, Immobilization of enzyme

Industrial Biotechnology (ENT 108)
Paper-II
Basics of Metabolism

Marks-50

Period-40

Unit I. Introduction 03

Basics of the Energy source,
Concept of Autotrophs, Heterotrophs, Phototrophs, Chemotrophs

Unit II. Metabolism

07

Anabolism, Catabolism,
Glycolysis (EMP), TCA, HMP, Glyoxilate cycle and Energetics.
High energy phosphate compounds- introduction, phosphate group transfer.

Unit III. Modes of ATP Generation

12

ATP as the biochemical energy currency. Biological oxidation- reduction reactions introduction, redox potential, Structure of mitochondria,
Oxidative Phosphorylation: sequence of electron carriers, sites of ATP production, inhibitors of electron transport chain. Hypothesis of mitochondrial oxidative phosphorylation (basic concepts). Inhibitors of oxidative phosphorylation.
Photophosphorylation: Energy transfer between photosystems, cyclic & noncyclic electron transport.

Unit IV. Transport Mechanism

08

Structure of biological membrane,
Active transport, Passive transport,
Transporters & pumps,
Classification of transporters,
Ionic gradients across membrane,
Transmembrane channels –
Voltage gated & ligand gated channels with examples.

Unit V. Biotransformation

10L

Introduction
Role of enzymes in biotransformation,
Biotransformation of Xenobiotics,
Phase I & Phase II reactions, Cytochrome p-450 system,
Toxicity: acute, chronic, LC50, LD50, model organisms used in environmental monitoring.

Recommended Books

1. Voet & Voet, 2000 Biochemistry, John Wiley, New York

2. Zubay, 1995, Biochemistry, Brown Publishers.
3. Lehninger, 2000, Principles of Biochemistry, CBBS Publishers.
4. I.Stryer, 2002. Biochemistry, W.H.Freeman

Entrepreneurship Science
Based on ENT 101 and ENT 105

Entrepreneurship Practical (100 marks)

1. Understanding creative process.
2. Preparation of cost sheets.
3. Exercise of job cost sheets.
4. Exercise on job cost sheets.
5. To pass a journal entries.
6. To explain the given balance sheet of the proprietor.
7. Exercise on internal sources of finance.
8. Exercise on external sources of finance.
9. To study sources of fixed capital.
10. To study sources of working capital.
11. Exercise on cost volume profit analysis.
12. Exercise on demand forecasting.
13. Exercise on elasticity of demand.
14. To study problems of small scale industry.
15. To prepare project report on market analysis.
16. To prepare project report on technical analysis.
17. To prepare project report on financial analysis.
18. Exercise on market survey.

Industrial visits:

- 1 (one) visits in first term,
- 1 (one) visits in second term

Visit to Institutions:

- 1 (one) visit in semester-I
- 1 (one) visit in Semester-II

During visit following observations must be done.

1. To see plant or factory. Interaction with concerned officers, supervisor and workers.
2. Questioners should be supplied to students about manufacturing process, accounting section, administration section or any other department

Reference books

Entrepreneurship

1. Entrepreneurial Development - S.S. Khanka
2. Entrepreneurial Development - Satish Taneja & Dr.S.L. Gupta
3. Entrepreneurial Development - P.C. Shejwalkar
4. Dynamics of Entrepreneurial Development - Vasant Desai.

The world of business

1. General Commercial Knowledge - P.K. Ghosh & Y.K. Bhushan
2. Modern Business Organization & Management - S.A. Sherlekar

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Cost Accounting

1. Cost Accounting - Jain & Narang

2. Cost Accounting - Bhar
3. Cost Accounting – Jawahar

Financial Management

1. Marketing Management Analysis, Planning, Implementation And Control - Philip Kotlar
2. Marketing Management - Philip Kotlar
3. Fundamental Marketing - W.J. Stanton
4. Fundamental Marketing - M.J. Etzes.
5. Fundamental Marketing - B.J. Walker
6. Fundamental Marketing - S.A. Sherlekar

Management Accounting

1. Management Accounting - J. Made Gowda
2. Principles of Management Accounting - S.N. Maheshwari
3. Management Accounting - Guru Prasad Murthy
4. Practical Problems in Management Accounting - RS Kulshreshta, SC Gupta
5. Management Accounting Practical Problem - Dorai Raj S.N.

Managerial Economics

1. Managerial Economics in a Global Economy - Dominick Salvotole.
2. Introduction to Economics - Samulson & Nordhams
3. Managerial Economics – Mahajan

Small Scale Industries

1. Small Scale Industries - Vasant Desai
 2. Project Management - Nagarajan
 3. Project Management: A Development Perspective - B.B. Goel
 4. Dynamics of Entrepreneurship Development - Vasant Desai
- Entrepreneurship - Madhurima Lall
Entrepreneurship - Shikha Sahai
Entrepreneurship Development - S.S. Khanka
Srivastaba S.B.A. Practical Guide to Industrial Entrepreneurship Sultan Chand and Sons, New Delhi.
Prasanna Chandra: Project Preparation, Appraisal, Implementation, Tata McGraw Hill, New Delhi.
Holt : Entrepreneurship - New Venture Creation : Prentice hall of India

Laboratory course I
Entrepreneurship Science
Based on ENT 102 and ENT 106

Industrial Chemistry Practical

100 marks

1. Calibration of burette, pipette and beryl pipette
2. Preparation of 100 ml of 0.1 N KMnO_4 and its standardization.
3. Preparation of 0.1 N HCl by density calculation & its standardization.
4. Study of flash point & fire point of given solvent fuel.
5. Determining molecular weight polyvinyl alcohol by Viscometer.
6. Study of melt flow index.
7. Study of soaping point.
8. Preparation of M-dinitrobenzene
9. Preparation of nitro derivative of salicylic acid.
10. Separation of amino acids by thin layer chromatography
11. Determination of hardness of water.
12. Determination of D.O.
13. Determination of acidity, alkalinity of water
14. Determination of saponification value of oil
15. Determination of acid value in bleaching powder
16. Determination of available chlorine in bleaching powder
17. Determination of chloride in water by Mohr's method.
18. Determination of heat solution of CuSO_4
19. Estimation of iron from the cement (Volumetrically)
20. Separation of metal ions (Cu^{+2} , Co^{+2} , Ni^{+2}) by paper chromatography.
21. Kinetics of 1st and 2nd Order reaction.
23. Density of given liquid by Pyknometer.

Reference Books:

- 1) Practical book of Physical Chemistry : Nadkarni, Kothari & Lawande.
- 2) Experimental Physical Chemistry : A. Findlay.
- 3) Systematic Experimental Physical Chemistry : S.W. Rajbhoj, Chondhekar (Anjali Pub.)
- 4) Experiments in Physical Chemistry : R.C.Das and B. Behra. (Tata Mc. GrawHill)
- 5) Advanced Practical Physical Chemistry : J. B. Yadav (Goel Publishing House)
- 6) Practical Physical Chemistry : B. D. Khosala (R. Chand & Sons.)
- 7) Experiments in Chemistry : D. V. Jahagirdar
- 8) Vogel's Text Book of Quantitative Chemical Analysis, (Longman) ELBS. Edition
- 9) Vogel's Text Book of Qualitative Chemical Analysis, (Longman) ELBS. Edition
- 10) Comprehensive Practical Organic Chemistry - Quantitative Analysis by V.K. Ahluwalia, Sunita Dhingra, University Press. Distributor - Orient Longman Ltd.,
- 11) Comprehensive Practical Organic Chemistry preparation and Quantitative Analysis. V.K. Ahluwalia, Renu Agarwal, University Press. Distributor - Orient Longman Ltd.,
- 12) A laboratory Hand-Book of organic Qualitative Analysis and separation :V. S. Kulkarni, Dastane Ramchandra and Co. Pune

Laboratory course I
Industrial Microbiology
Based on ENT 103 and ENT 107

Lab Course based on Industrial Microbiology

- 1) Microscopy
- 2) Demonstration of Laboratory Equipments:
Incubator, Autoclave, Hot Air Oven, Centrifuge, Laminar Air flow, Colony counter.
- 3) Staining of Bacteria By-Monochrome Staining & Gram Staining, Motility by Hanging drop technique.
- 4) Mounting & Identification of Fungi
- 5) Preparation of Culture Media:
Peptone Water, Nutrient Broth, Nutrient Agar, MacConkey's Broth, MacConkey's Agar, Sabouraud's Agar
- 6) Isolation of microorganisms by:
 - Streak plate technique
 - Pour plate technique
 - Spread plate technique
- 7) Enumeration of microorganisms from Soil by SPC
- 8) Screening of Antibiotic & Enzyme producing microorganisms by suitable Technique.
- 9) Microbial Assay of Penicillin antibiotic by diffusion method
- 10) To study the Growth Curve

**Laboratory course I
Industrial Biotechnology
Based on ENT 104 and ENT 108**

Lab Course based on Industrial Biotechnology

1. Spot test for carbohydrates
2. Estimation of reducing sugars by Benedict's method
3. Spot test for Amino acids
4. Protein estimation by Biuret method
5. Quantitative determination of amino acid with Ninhydrin reagent.
6. Saponification of Fats
7. Estimation of Cholesterol
8. Study of acid Phosphatase from liver
9. Study of Alkaline Phosphatase from Liver
10. To study estimation of Titrable Acid Number (TAN)
11. Enzyme assays
12. To study Prokaryotic organisms
13. To study Eukaryotic organism
14. Study of Sub cellular organelles
15. Staining of mitochondria
16. Demonstration of digestive system of rat
17. Demonstration of reproductive system of rat
18. To study rate of photosynthesis or Oxygen evolved in Photosynthesis
19. To study comparative rate of stomatal and cuticular transpiration.
20. To extract and separate chloroplast pigment by ascending paper chromatography.
21. Study of different phases of Mitosis
22. Study of different phases of Meiosis
23. To study histology of mammalian organ