

 <p>Estd. 1962 "A" Accredited by NAAC(2021) With CGPA 3.52</p>	<p align="center">SHIVAJI UNIVERSITY, KOLHAPUR - 416004, MAHARASHTRA PHONE : EPABX – 2609000, www.unishivaji.ac.in, bos@unishivaji.ac.in शिवाजी विद्यापीठ, लिहापूर - ४१६००४, महाराष्ट्र दूरध्वनी - ईपीएबीएक्स - २६०९०००, अभ्यासमंडळे विभाग दूरध्वनी विभाग २३१-२६०९०९३/९४</p>	
---	---	---

SU/BOS/Science/ 71

Date: 15 / 11 / 2022

To,
The Principal,
All Affiliated Concerned Science Colleges/Institutions
Shivaji University, Kolhapur.

Subject :- Regarding syllabi of M.Sc. & B. Sc. Part- I (NEP-2020) degree programme under the Faculty of Science and Technology as per National Education Policy 2020 .

Sir/Madam,

With reference to the subject mentioned above, I am directed to inform you that the university authorities have accepted and granted approval to the syllabi and Nature of question paper of **M.Sc. & B. Sc. Part -I** under the Faculty of Science and Technology as per **National Education Policy 2020** .

Sr.No.	Faculty of Science and Technology	Programme/ Course
1	Chemistry and Chemical Engineering	M.Sc. Part-I Alcohol Technology (Entire)
		M.Sc. Part-I Sugar Technology (Entire)
		M.Sc. Part-I, AGPM,
		B.Sc. Part-I Sugar Technology (Entire)

This syllabi and nature of question paper shall be implemented from the Academic Year **2022-2023** onwards. A soft copy containing the syllabus is attached herewith and it is also available on university website www.unishivaji.ac.in (students Online Syllabus)

You are, therefore, requested to bring this to the notice of all students and teachers concerned.

Thanking you,

Yours faithfully,



Dy Registrar

Copy to:

1	The Dean, Faculty of Science & Technology	7	Appointment Section
2	Director, Board of Examinations and Evaluation	8	P.G.Seminar Section
3	The Chairman, Respective Board of Studies	9	Computer Centre (I.T.)
4	B.Sc. Exam	10	Affiliation Section (U.G.)
5	Eligibility Section	11	Affiliation Section (P.G.)
6	O.E. I Section	12	P.G.Admission Section

SHIVAJIUNIVERSITYKOLHAPUR



CHOICE BASED CREDIT SYSTEM

Syllabus

for

M.Sc.Part-I

AlcoholTechnology(Entire)

(UnderFacultyofScience&Technology)

AS PER NEP - 2020

(TobeimplementedfromAcademicYear2022 - 23)

M.Sc. Programme Structure (CBCS Pattern) (2022-23) M.Sc. Part – I

SEMESTER-I (Duration-Six Month)											
	Sr. No.	Course Code	Teaching Scheme			Examination Scheme					
			Theory and Practical			University Assessment (UA)			Internal Assessment (IA) and Practical		
			Lectures (Per week)	Hours (Per week)	Credit	Maximum Marks	Minimum Marks	Exam. Hours	Maximum Marks	Minimum Marks	Exam. Hours
CGPA	1	CC-101	4	4	4	80	32	3	20	8	1
	2	CC-102	4	4	4	80	32	3	20	8	1
	3	CC-103	4	4	4	80	32	3	20	8	1
	4	CC-104	4	4	4	80	32	3	20	8	1
	5	CCPR-105	16	16	8	--	--	--	200	80	*
Total(A)			--	--	24	320	--	--	280	--	--
Non-CGPA	1	AEC	2	2	2	--	--	--	20	8	1
SEMESTER-II (Duration-Six Month)											
CGPA	1	CC-201	4	4	4	80	32	3	20	8	1
	2	CC-202	4	4	4	80	32	3	20	8	1
	3	CC-203	4	4	4	80	32	3	20	8	1
	4	CC-204	4	4	4	80	32	3	20	8	1
	5	CCPR-205	16	16	8	--	--	--	200	80	*
Total(B)			--	--	24	320	--	--	280	--	--
Non-CGPA	1	SEC	2	2	2	--	--	--	20	8	1
Total(A+B)					48	640	--	--	560	--	--

<ul style="list-style-type: none"> • Student contact hours per week: 32 Hours (Min.) • Theory and Practical: 60 Minutes Each Lectures • CC-Core Course • CCPR-Core Course Practical • AEC-Mandatory Non-CGPA compulsory Ability Enhancement Course • SEC-Mandatory Non-CGPA compulsory Skill Enhancement Course 	<ul style="list-style-type: none"> • Total Marks for M.Sc.-I : 1200 • Total Credits for M.Sc.-I (Semester I & II): 48 • Practical Examination is annual. • Examination for CCPR-105 shall be based on Semester I Practicals. • Examination for CCPR-205 shall be based on Semester II Practicals. • *Duration of Practical Examination as per respective BOS guidelines • Separate passing is mandatory for Theory, Internal and Practical Examination
---	--

TotalCreditsforM.Sc.Program:96
TotalMarksforM.Sc.Program: 2400

I. CGPAcourse:

1. Thereshallbe14CoreCourses(CC)perprogram.
2. Thereshallbe 02DisciplineSpecificElective(DSE)coursesof08creditsperprogram.
3. Thereshallbe04CoreCourseSpecialization(CCS)coursesof16creditsperprogram.
4. TotalcreditsforCGPAcoursesshallbeof96creditsperprogram.

II. MandatoryNon-CGPACourses:

1. Thereshallbe02MandatoryNon-CGPAcompulsoryAbilityEnhancementCourses(AEC)of02creditseachperprogram.
2. Thereshallbe01MandatoryNon-CGPA compulsorySkillEnhancementCourse(SEC)of02creditsperprogram.
3. ThereshallbeoneElectiveCourse(EC)(SWAYAM/MOOC).Thecreditsofthiscourse shallbeasspecifiedonSWAYAM/MOOCportal.
4. ThereshallbeoneGenericElective(GE)courseof02creditsperprogram.Eachstudenthas to takeGenericElectivefromthe department other thanparentdepartment.
5. ThetotalcreditsforNon-CGPAcoursesshallbeof08credits+2to4credits,asspecifiedonthesWYAM/MOOCportal.
6. Thecreditsassignedtothecourseandtheprogramshallhavenorelationwiththeworkloadoftheteacher.

M.Sc.I(AlcoholTechnology),Semester-I

(AlcoholTechnology-I,Microbiology,Bio-Chemistry,AppliedChemistry)

	Coursecode	PaperNo.		Titleofcourse	
CGPA	CC-101	I	AT.1.1	AlcoholTechnology-I	Allcoursesarecompulsory.
	CC-102	II	AT.1.2	Microbiology	
	CC-103	III	AT.1.3	Bio-Chemistry	
	CC-104	IV	AT.1.4	AppliedChemistry	
	CCPR-105		ATP.1	AlcoholTechnologyPractical-I	
Non-CGPA	AEC-106				

M.Sc.I(AlcoholTechnology),Semester-II

**(AlcoholTechnology-II,AppliedMicrobiology,IndustrialFermentation–
I,AppliedProcessInstrumentation)**

	Coursecode	PaperNo.		Titleofcourse	
CGPA	CC-201	V	AT.2.1	AlcoholTechnology-II	Allcoursesarecompulsory.
	CC-202	VI	AT.2.2	AppliedMicrobiology	
	CC-203	VII	AT.2.3	IndustrialFermentation-I	
	CC-204	VIII	AT.2.4	AppliedProcessInstrumentation	
	CCPR-205		ATP.2	AlcoholTechnologyPractical-II	
Non-CGPA	SEC–206				

Shivaji University, Kolhapur

Syllabus For

Master of Science I (Alcohol Technology)

1. Title: M.Sc. Alcohol Technology

M.Sc. Part I syllabus.

2. Year of implementation:

Syllabus will be applicable from June 2022

3. Preamble/Introduction

India is fourth largest Producer of alcohol in the world. It is also the leading producer of alcohol in the South-East Asian region with about 65% of the share. In India alcohol is largely produced

- 1) in the form of Rectified spirit for industrial application
- 2) in the form of ENA for portable liquor and
- 3) in the form of fuel ethanol for blending with petrol.

Now Govt. of India looking ethanol as renewable energy and national biofuels policies envisages the blending of alcohol 10% to petrol by 2020 which will force to produce alcohol for fuel ethanol for blending. Existing production of alcohol is about 2500 million liter per annum, out that 1800 million liter is consumed in portable liquor and industrial sector. Therefore net availability of ethanol for blending is 700 million liter per annum, however at current rate of petrol consumption Ethanol requirement for 5% doping is 1100 million liters and for 10% blending 2200 million liters per annum. As such there will be huge demand of alcohol for ethanol production, it may be noted that industries need alcohol technologist and scientist.

In India there is no provision for the Bachelor and Master degrees in Alcohol Technology. Recently Maharashtra govt. permitted to start such a career oriented courses under science & Technology faculty, accordingly we are running B.Sc. (Sugar Technology) courses since last five academic years. Due to growing demand from industries we started M.Sc. (Alcohol Technology).

4. General object of the course:

The objectives of the M.Sc. (alcohol Technology) courses shall be as follows:-

- 1) To develop the human resource in Alcohol technology sector.
- 2) To create the people who will teach the science of alcohol technology, this will be also helpful for the promotion of Research in this field.
- 3) To create self-employment opportunities in alcohol and allied industries for modestly trained and self-trained human resources of the country.
- 4) To develop the skills required in AT and alcohol management fields.
- 5) To develop proficiencies and skills for becoming scientist, technicians in AT sector.
- 6) To develop the expertise for the innovation of different skills and its implementation in alcohol and allied industries.
- 7) To explore the different techniques in Alcohol technology sector.

5) Duration:-

The duration of M.Sc. (Alcohol technology) courses shall be of two years.

6) Pattern for examination

Semester pattern, theory paper and practical at end of each semester.

7) Fee structure.-

Decided by competent authority of university/SSS

8) Implementation of fee structure:-

In case of revision of fee structure, this revision will be implemented in phase wise manner

9) Eligibility of admission

- B.Sc.(Sugar Technology)
- B.Sc.(Biotechnology/Biotechnology(Entire)/Bio-Chemistry/Chemistry/Food Technology/Microbiology/Zoology/Botany/Wine Technology)
- B.Tech.(Biotechnology/Food/Chemical technology)
- B.Sc.(Agriculture/Agricultural-Biotechnology)
- Post Graduate Diploma in Industrial Fermentation and Alcohol Technology
- B.E.Biotechnology/Chemical engineering/Instrumentation
- B.Sc Agriculture

10) Medium of instruction:

The medium of instructions shall be in English

11) Teachers Qualification:

- B.Sc.DIFT
- M.Sc. (Microbiology with NET/SET & or Ph.D.)
- M.Sc.(Biotechnology with NET /SET & or Ph.D.)
- M.Sc. (Alcohol technology with NET/SET & or Ph. D.)
- M.Sc. (Chemistry with NET/SET & or Ph. D.)
- M.Sc. (Botany NET/SET) & or Ph. D.)
- BE/B.Tech. /ME/M.Tech.(Chemical Engineering)
- ANSI/AVSI(Eng.)
- BE/ME/M.Tech.(Instrumentation/Electronics)
- BE/ME(Mechanical)

12) Structure of course:**M.Sc. I (Alcohol Technology), (Theory – 4 papers, Practicals: 2)****Semester – I: Theory**

Sr.No.	Theory – Core Subjects	Code	Credits	Marks
1	Alcohol Technology-I	AT.1.1	4	100
2	Microbiology-I	AT.1.2	4	100
3	Bio-Chemistry	AT.1.3	4	100
4	Applied Chemistry	AT.1.4	4	100
5	Total		16	400
Practicals				
Sr.no	Practical – Subject	Code	Credits	Marks
1	Alcohol Technology-I	ATP1.1	4	100
2	Microbiology Practical-I	ATP.1.2	4	100
	Total		24	600

M.Sc.I (Alcohol Technology) (Theory – 4 papers, Practicals: 2)**Semester – II: Theory**

Sr. No.	Theory – Core Subjects	Code	Credits	Marks
1	Alcohol Technology-II	AT.2.1	4	100
2	Applied Microbiology	AT.2.2	4	100
3	Industrial Fermentation-I	AT.2.3	4	100
4	Applied Process Instrumentation	AT.2.4	4	100
5	Total		16	400
Practicals				
Sr.no	Practical – Subject	Code	Credits	Marks
1	Alcohol Technology-II	ATP.2.1	4	100
2	Applied Microbiology Practical-II	ATP.2.2	4	100
	Total		24	600

13) Scheme of teaching and Examination

The scheme of teaching and examination should be given as applicable to the course /paper concerned.

A) Teaching

Teaching consists of lectures followed by term work and practicals. There are 4 papers of 100 marks at end of each semester and 2 practicals of 100 marks at end of each semester.

B) Examination.

- This semester examination will be conducted at the end of each term for theory and practicals.
- Theory paper will be of 80 marks each and 20 marks for internal evaluation test conducted in the mid of the term.
- Practical's will be of 80 marks and 20 marks reserved for presentation of practical logbook.
- Question papers will be set in the view of the entire syllabus and preferably covering each unit of the syllabus.

14 Standard of passing

As per rules and regulation of M.Sc. course.

15) Nature of question paper and scheme of marking Theory question paper

(Maximum marks – 80) Total No. of question – 7

All questions are of equal marks.

Out of these seven questions five questions are to be attempted.

- Question No. 1 is compulsory and objective Total no. of bits – 16, Total marks – 16 (which cover multiple choices, fill in the blanks, definition, true or false).
- These questions will be answered along with other questions in the same answer book.
- Remaining 6 questions are divided into two sections, namely section – I and section – II.
- Four questions are to be attempted from the set two sections such that not more than two questions from any of the section.
- Both sections are to be written in the same answer book.

16. Equivalence in Accordance with titles and contents of the papers

M.Sc. Alcohol Technology Semester I

(Alcohol Technology-I, Microbiology, Biochemistry, Applied Chemistry)

Old Core Course (2020)	New Core Course (2022)
Applied Chemistry (AT.1.4)	Applied Chemistry (AT.1.4)
Biochemistry (AT.1.3)	Biochemistry (AT.1.3)
Alcohol Technology-I (AT.1.1)	Alcohol Technology-I (AT.1.1)
Microbiology (AT.1.2)	Microbiology (AT.1.2)
Practical courses:	
Alcohol Technology-I (AT)	Alcohol Technology-I (ATP.1.1)
Microbiology-I (MC)	Microbiology-I (ATP.1.2)

M.Sc. Alcohol Technology Semester II

(Alcohol Technology-II, Applied Microbiology, Industrial Fermentation-I, Applied Process Instrumentation)

Old Core Course (2020)	New Core Course (2022)
Applied Process Instrumentation (AT.2.4)	Applied Process Instrumentation (AT.2.4)
Industrial Fermentation-I (AT.2.3)	Industrial Fermentation-I (AT.2.3)
Alcohol Technology-II (AT.2.1)	Alcohol Technology-II (AT.2.1)
Applied Microbiology (AT.2.2)	Applied Microbiology (AT.2.2)
Practical courses	
Alcohol Technology-II (AT-II)	Alcohol Technology-II (ATP.2.1)
Microbiology-II (MC-II)	Microbiology-II (ATP.2.2)

17) Special instruction if any

Not applicable at the first stage
Suggestions: After implementation

NOTE:

- i) The details of field work, seminar, group discussion and oral examination be given wherever necessary.
- ii) General/Specific instructions for laboratory safety should be given wherever necessary

18) Other feature

Intake capacity: 50

19) Laboratory safety equipments:

Part: I Personal Precautions:

- All persons must wear safety Goggles at all times.
- Must wear Lab Aprons/Lab Jacket and proper shoes.
- Except in emergency, over-hurried activities is forbidden.
- Fume cupboard must be used whenever necessary.
- Eating, Drinking and Smoking in the laboratories strictly forbidden.

Part: II: Use of Safety and Emergency Equipments:

- First-aid Kits
- Sand Bucket
- Fire extinguishers (dry chemical and carbon dioxide extinguishers)
- Chemical Storage cabinet with proper ventilation
- Material Safety Data sheets.
- Management of Local exhaust system & fume hoods.
- Sign in register if using instruments.

M.Sc.I(AlcoholTechnology)
IPaper:I,AlcoholTechnology-I(CodeAT.1.1)

Semester-
MaxMarks:100

Unit1.IntroductionofAlcoholicbeverages (15)

HistoryanddevelopmentofAlcoholicBeverages

Overviewofermentationandmicroorganisms:- Yeast,Lacticacidbacteria,MoldsandSpoilage.

Alcoholometry:

Proofspirit,(BritishandUSA)overproof,underproof,specificgravityofalcoholstrengthofalcoholintermsofconcentration-relatedexamplesandsolution

Unit2.BasicsconceptsrelatedtoAlcoholTechnology (15)M

lasses, Total reducing sugar, Fermentable/Unfermentable sugar, Residual sugar, Wort, Brix, Specific gravity, Distillation, Industrial alcohol, Proof spirit, Strength of spirit, Reflux, Reduction of spirit, Blending of spirit, Vaporization, Saccharification, Scaling, Scrubber, Starch, Sucrose, Rectification, Gelatinization, liquefaction, Reboiler, DDGS, DWG S, Spent wash, ZLD system etc.

Unit3.Molasses:Major RawmaterialusedinAlcoholicFermentations (15)M

lasses: Definition, Different sources of molasses; Sugar cane molasses

production, Characteristics and uses of molasses: Molasses for production of alcohol, yeast, acetone, glycerin, cattle feed - (process), Composition of molasses, F/N ratio, Grades of molasses,

Factor Affecting composition of molasses, storage of molasses,

Pre-

clarification of molasses, effect of various components of molasses on alcoholic fermentation, control of adverse effect of composition of molasses.

Unit4.Detailsof AlcoholicFermentationfromCaneMolasses (15) Process of Batch fermentation, factor influencing efficiency of

fermentation, characteristic of Batch Fermentation Process, Control over fermentation operation, contamination control, design and material of construction of fermenters, maintenance of

fermenter and operational conditions on plant scale, flowsheet of Batch Fermentation process, Efficiency of Fermentation and Attenuation data calculations – Related examples and solutions.

Prevention of losses of alcohol during fermentation, post-fermentation practices/scrubbing etc. Post clarification of fermented wash; advantages and disadvantages.

ReferenceBooks:

1. The Alcohol Text Book- Lyons & Kelsall
2. Alcoholometry- Satyanarayana Rao
3. Hand Book of Fermentation & Distillation- A.C. Chatterjee

4. Distillation-H.C.Barron.
5. Technical excise manual-Excise Dept., Govt. of India.
6. By-products of Sugar Industry-Patur

Unit1:HistoryandScopeof Microbiology [15]

- a) Historicaldevelopmentsofmicrobiologyandscopeofmicrobiology.
Importantcontribution
- b) Briefaccountoforganizationandclassificationofmicroorganisms.Differencesbetweenprokaryoticand eukaryotic cell
- c) Overviewofbacterialcellstructure(size,shape, arrangement membrane, cell wall, cytoplasmic inclusions, mesosomes, flagella and motility, slime, capsule, pile, chemotaxis, endospore)
- e) Distribution of microorganism in nature and their beneficial and harmful effects

Unit2:MicroscopyandStaining [15]

Principles and Applications of Microscopy: (i) Compound microscope (ii) fluorescence and (iii) immunofluorescence microscopy, a) image formation, b) Ray diagram, c) special feature, d) magnification e) numerical aperture, f) resolving power, g) working distance Introduction to bright field microscopy, dark field microscopy, phase contrast and electron (transmission and scanning) microscopy

Staining of Microorganisms

- i) Definition of dye and stain, classification of stain—acidic, basic and neutral stains
- ii) Principal, Procedure, mechanism and application of staining procedure:
 - 1) Simple staining, 2) negative staining, 3) differential staining: Gram staining and acid fast staining
 - 4) Special staining methods—cell wall (Chances method), capsule (Mane val method), Endospore staining

Unit3:MicrobialNutrition andPureCultureTechniques [15]

A) Microbial Nutrition

- a) **Modern concept of Microbial nutrition**, nutritional categories of microorganism, transport of nutrients to the cell (osmosis, facilitated diffusion, passive transport active transport.
- b) **Microbial Culture media**-Definition, media components (water, various C&N sources, minerals, chelators, growth factors, precursor, inducers, inhibitors antifoaming agents, buffers) Common components of media & their function—peptone yeast

extract, vitamin, NaCl, agar etc.

Media formulation & optimization, Sterilization of media (filtration and autoclaving) Ex. of commonly used carbon and nitrogenous sources, factors influencing their choices

c) Classification of Microbial Culture Media

Living media, non-living media –

i) Natural ii) Synthetic iii) Semisynthetic iv) Differential v) Enriched vi) Selective vii) Enrichment

B) Pure Culture Techniques

Pure culture definition and its importance, Methods for isolation of pure culture i) Streak plate ii) Pour plate iii) Spread plate

C) Maintainers of pure culture

UNIT 4: Yeast Microbiology

[15]

- A) Definition, yeast morphology and taxonomy, comparison with other microorganisms, yeast cell structure and functions of various cellular components of yeast.
- B) Nutritional requirements of yeast, Factors (Physical Requirements) That Should Be Considered Regarding Yeast Nutrition; yeast growth curve and measurement of growth; factor affecting growth, phases of yeast growth, determination of cell mass, cell number, generation time etc., Timings for nutrient addition during alcoholic fermentations
- C) Yeast reproduction, *Saccharomyces cerevisiae* life cycle; mechanism of budding

Recommended Books:

1. General Microbiology, IV edn. - Stanier, Adelberg and Ingraham, MacMillan Press.
2. General Microbiology - Plezar, Tata McGraw Hill Pub. Co. Ltd., New Delhi.
3. Prescott's Microbiology V edn. - Prescott
2002. 4. Bergey's Manual of Systematic Bacteriology, Springer.
5. Foundations in Microbiology - Talaro and Chess, McGraw Hill.

Unit1.A.Biochemistryof LivingCells: (15)

Introduction of living world, five kingdom classification, Cell, Modern Cell theory, Celltypes, Significance of biochemistry to the living systems. Introduction to biomoleculesandcellularpool,IntroductiontoMetabolism

B.Moleculeof Life:Water

Importance of water in living systems, Properties of water, Weak Interactions in AqueousSystems, Ionization of Water, Weak Acids, and Weak Bases (alkalinity and acidity ofwater), Types of water based on hardness, causes and sources of hardness,BufferingagainstpHChangesinBiologicalSystems,WaterasaReactant

Unit2.BiochemistryofCarbohydrates (15)

Carbohydrates:Definition,functionsandtheirimportanceinthelivingsystems,ClassificationofCarbohydrates:

a. Monosaccharides:

Classification,propertiesandreactionsofmonosaccharidestakingglucoseasanexample,Inter-conversionsofmonosaccharides,Configurationsofaldopentoses&aldohexoses,Epimers&epimerisation, mutarotation, Cyclic structures of glucose, fructose (pyranose&furanoseforms).

b. Disaccharides:

Classification, nomenclature and general detailed study of the structure and functions ofmaltose,cellobiose,lactose,sucrose,melibiose&trehalose

c. OligosaccharidesandPolysaccharides:

Classification,Occurrence,detailed study of the structures and their uses with examples.(Raffinose,Cellulose,Starch,GlucogenandDextran)

d. OverviewoftheMetabolismofCarbohydrates

Includingglycolysis,HMPpathway,glyoxalatecycle,TCAcycle,Entner-Duodoroffpathway,gluconeogenesis

ReducingandNon-reducingsugars

QualitativeandQuantitativeestimationofCarbohydrates;

Unit3.Biochemistryof Proteinsand AminoAcids (15)

a. Proteins:

Classificationofproteins,functions,ofproteins,Biologicalimportance,Commonpropertiesofproteins,colourreactions,ofproteins,MethodsforproteinIsolation,

purification and quantification

Structure of proteins: Primary, Secondary, Tertiary, Quaternary

b. Amino Acids:

Outline of structure of common amino acids present in proteins, classification, their properties and chemical reactions, Maillard reaction

Metabolism of amino acids: Transamination, deamination and decarboxylation of amino acids, Composition of cane juice and molasses with special reference to carbohydrates, proteins and amino acids

c. Enzymes–

General Properties, Mechanism of enzyme catalyzed reaction, nomenclature and types of enzymes. Introduction to enzyme kinetics: outline of enzyme kinetics, competitive, non-competitive and uncompetitive inhibition.

Unit 4. Biochemistry of Lipids, Nucleic Acids and Vitamins

(15)

a. Lipids:

Outline of structure and function of fatty acids, Types of fatty acids and their importance; Classification of lipids: - simple, complex, derived lipids - structure & example; phospholipids, glycolipids & steroids - structure, composition.

b. DNA

The genetic material, DNA its organization, Outline of structure, Nucleoside, nucleotide: definition and structure, Watson Crick model of DNA structure, RNA & DNA,

Overview of Central Dogma of life; DNA Replication, transcription and translation process.

Introduction to Chromosomes and the concept of Gene: Chromosomes: Structure and shapes of metaphase chromosomes, histone, Nucleosome and packing of DNA into chromosome.

c. Vitamins:

Classification, types, sources, structure, function & coenzyme function of vitamins.

Reference Books

1. Text Book of Biochemistry - West and Todd, The Macmillan Co. New York
2. Advanced Organic Chemistry - Behel & Behel, S. Chand & Co. Ltd, New Delhi
3. Organic Chemistry - Morrison & Boyd, Pearson
4. Principles of Biochemistry - Lehninger, C.B.S. Publishers, Delhi

Unit1:BasicconceptofChemistry

[15]

- Normality, Molarity, Molality, Mole fraction, ppm, ppb, ppt, weight fraction, Equivalent weight and numericals based on it
- Acids and Bases: Arrhenius concept, Proton transfer theory, Lewis concept, Dissociation of weak acid, the pH Scale, pH measurement using Hydrogen electrode, Glass electrode, Buffer mixture of weak acid and its salts. Calculation of pH values of buffer mixtures.
- Optical Isomerism: Definition, Cause of optical activity and chirality, and R/S configuration. Enantiomers, Diastereomers, Racemic modification and Meso isomers, Resolution of Racemic modifications

Unit2:Fundamentals of Organic Reaction Mechanism

[15]

- Introduction, Meaning of reaction mechanism, curved arrow notation,
- Nature of covalent bond Fission, Types of Reagents,
- Types and subtypes of organic reaction,
- Reactive Intermediates – carbonation, Carbanion, Carbon free radicals, Carbene, Arynes, Nitrates.

Unit3:Alcohols

[15]

Introduction, Nomenclature, Classification, Methods of preparation, General properties and chemical reactions of alcohols

Types of alcohol-

- **Monohydric alcohol** – Types, Structure and uses.
- **Dihydric alcohols** – Nomenclature, methods of formation of Ethylene glycol – from methylene, ethylene dibromide & ethylene oxide, physical & Chemical reactions of ethylene glycol, Reaction with hydrogen halide; Oxidation tetra acetate, HIO₄ & Nitric acid.
- Uses of ethylene glycol
- **Trihydric alcohol** - Nomenclature, methods of formation of glycerol – from fats & oil synthesis from elements carbon & hydrogen. Physical properties.
- Chemical reaction of glycerol – reaction with electro positive metals, reaction with hydrogen halides (HCl & HI) reactions with concentrated nitric acid in presence of concentrated sulphuric acid. Reactions with potassium hydrogen sulphate. Uses of glycerol.

- Distinction between ethyl and methyl alcohol, amyl alcohol and its isomers, Alcohol solfusel oil, Preparation of anhydrous alcohol by azeotropic distillation
- Industrial production of ethyl alcohol from petroleum gases,
- Chemicals derived from methyl alcohol, Gasohol,
- Detail study of reactions involved, manufacturing process, uses, list of manufacturers- Acetaldehyde, Acetic acid, Acetic Anhydride, Butanol, Ethyl acetate, Butyl acetate, acetone, Ethyl ether, Diethyl oxalate.

Unit 4: Chromatographic Method

[15]

- Introduction, Classification of chromatographic method, introduction of the terms used in chromatography
- Principle methods and applications of Paper chromatography, TLC, HPLC, GC.
- Uses of chromatography in alcohol industry.
- Basic concepts of measurement of electrical conductivity and its relation with ions in solution.
- Strong and weak electrolyte, Specific conductivity, Molar conductivity, Equivalent conductivity. Application of conductance measurement conductivity based super heaters

Recommended Books:

1. A Guide Book to Mechanism in Organic Chemistry- Sykes, Orient-Longmans.
2. Organic Reaction Mechanism- Ahluwalia.
3. Basic Principles of Organic Chemistry- Roberts and Casoria, Benjamin
4. Stereochemistry of Carbon Compounds- Eliel, McGraw-Hill
5. Organic Stereochemistry- Hallas, McGraw-Hill.
6. Organic Chemistry- Morrison and Boyd, Prentice Hall.
7. Analytical Chemistry for Technicians, Fourth Edition- John Kenkel
8. Stereochemistry of Organic Compounds- Nasipuri
9. Bio-Chemistry and Molecular Biology- Wilsons and Walker Cambridge University Press.

Syllabus of Practical Courses

M.Sc.I(Alcohol Technology)

Semester I

Subject: Alcohol Technology-I(ATP.1.1)

Practical

100 Marks

1. Determination of brix, specific gravity and p_H of molasses.
2. Determination of moisture, total solids, suspended solids, dissolved solids and ash content of molasses.
3. Determination of sludge % of molasses
4. Estimation of calcium content of molasses by EDTA method
5. Determination of total organic volatile acid of molasses
6. Determination of total reducing sugar by Fehling reagent.
7. Phenol sulphuric acid method for total carbohydrate.
8. Determination of yeast count of fermented broth.
9. Estimation of proteins by Biuret method.
10. Determination of Total Reducing Sugar in molasses by Lane & Eynon Method.
11. Determination of ethyl alcohol content of spirit by Specific gravity method
12. Determination of ethyl alcohol content of spirit by Sikes hydrometer
- 13) Separation and identification of chemical compounds by paper chromatography.
- 14) Separation and identification of chemical compounds by TLC.

Reference Books:

1. The Alcohol Text Book- Lyons & Kelsall
2. Hand Book of Fermentation & Distillation- A.C. Chatterjee
3. Hand book of alcohol technology- S.V. Patil
4. Industrial alcohol technology handbook- NPCS Board of consultant & engineer
5. Experiments in the Purification and Characterization of Enzymes. A Laboratory Manual- Thomas E. Crowley and Jack Kyte
6. Biochemistry explained_ a practical guide to learning biochemistry- Millar, Thomas, CRC Press

Syllabus of Practical Courses

M.Sc.I(Alcohol Technology)

Semester I

Subject: Microbiology-I(ATP.1.2)

Practical

100 Marks

Basic requirements of a microbiology laboratory

1. Apparatus

- | | | | |
|----------------|----------------|---------------------|-------------------|
| a) Petri-plate | b) Pipette | c) Erlenmeyer flask | d) Glass spreader |
| e) Wire loop | f) Cotton plug | | |

2. Equipments: Handling and use of,

- | | | | |
|------------------------|------------------|---------------|-----------------|
| 1) Compound microscope | 2) Bunsen burner | 3) Autoclave | 4) Hot air oven |
| 5) Incubator | 6) Refrigerator | 7) Centrifuge | |

3. Stains and staining procedures:

- i) Spore staining (Darner's process)
- ii) Flagella staining (Bailey's method)
- iii) Nucleus staining (Giemsa's method)

4. Preparation and sterilization of culture media like

- | | | |
|---------------------------------|---------------------|--------------------------|
| i) Nutrient agar | ii) Nutrient broth | iii) Starch agar |
| iv) Potato dextrose agar | v) MacConkey's agar | vi) malt extract medium, |
| vii) Molasses agar medium etc., | | |

5) Acquaintance with different microbiological techniques like inoculation, streaking, plating, stabbing, aseptic handling of culture media and pure cultures etc.

6. Demonstration of technique for pure culture of micro-organisms

- i) Streak plate method
- ii) Pour plate method
- iii) Spread plate method

7. Microscopic examination of microorganisms like bacteria, yeast, fungi etc. preparation of slants and stab.

8. Isolation and development of a pure yeast culture.

9. Preparation of bacterial culture slides and staining by Gram stain.

10. Dilution and plating of culture for total viable cell count

11. Differential counting of living and dead yeast cells by direct microscopic examination

- 12) Detection of primary, secondary and tertiary hydroxyl groups and preparation of stri-iodomethane iodoform.
- 13) Determination of pK_a and pK_b values of any chemical compounds by using PH meter.
- 14) To study of chemical synthesis to alcohol preparation.
- 15) To determine the actual normality of strong acid and weak base by using conductometer.
- 16) To determine the actual normality of weak acid and strong base by using conductometer.

Reference Books:

1. Handbook of Microbiology-Lyons & Kelsall
2. Microbiological Applications: A Laboratory Manual in General Microbiology-Harold J. Benson, McGraw-Hill
3. Microbiology: A Laboratory Manual, Global Edition-Cappuccino, James, Welsh, Chad-Pearson Education Limited

Syllabus of Semester II

M.Sc.I(Alcohol Technology)

Paper: V, Alcohol Technology: II (Code AT.2.3)

Semester-II

Max Marks: 100

Unit 01: Basics of Distillation

(15)

- **Distillation:** theory, Introduction to Types of distillation process: i. pot & continuous distillation, ii. Atmospheric and MPR distillation; Relative volatility & liquid vapour equilibrium diagrams,
- **Laws of Distillation:** Daltons, Raoult's & Henry's laws
- **Distillation equipments:** Columns (its design & construction, its maintenance), trays, condenser, Reboilers (Types and MOC)

Unit 02: Continuous fermentation

(15)

- Theoretical aspects of continuous fermentation,
- Continuous Vs Batch Fermentation Systems
- Various types of continuous fermentation systems,
- **Single Fermenter Continuous System (Biostil):** Process Details with flow diagrams, Operational aspects, details of plant & machinery. Merits & demerits of the technology
- **Cascade continuous Fermentations system:** Process details with flow diagram, operational aspects, details of plant & machinery, merits and demerits of technology
- **Hiferm-xp continuous fermentation process without yeast recycling:** Process Details with flow diagrams, Operational aspects, details of plant & machinery. Merits & demerits of the technology
- Yeast Flocculation Continuous Fermentation System (Encillium -NCL): Merits & Demerits of technology,
- Contamination control with special reference to continuous fermentation process.

Unit 3: Wines

(15)

- Introduction, History of wine, present international and national status of wine production, Process of wine making: grapes varieties and harvesting, must treatment, alcoholic fermentation, post fermentation operations, microbiological stabilization, sulphur dioxide addition, economic future.
 - i. Detailed Red wine production stages - harvesting to bottling,
 - ii. Detailed White wine production stages - harvesting to bottling
 - iii. Sparkling wine production stages - Traditional method, transfer process method, Tank method and Carbonation.

- Classification of wine- table wines, sparkling wine, dessert wines, aperitif wine, pop wine
- Nutritional and therapeutic value of wine: Chemical contents of grapes and wine in relation to nutrition, Contribution of Antioxidant with respect to human health, Comparison of Red, white and sparkling wine at nutritional point of view.
- Overview of world and Indian wine scenario: The current and future wine prospectus in India

Unit 4. Effluent and Effluent Treatment Systems Adapted in Distilleries

(15) Qu

ality of effluent based on various technologies adapted for alcoholic fermentations (Batch/Fed batch/Continuous), IS specification of effluent: Effluent composition; The meaning, and relevance to distillery effluent of: biological oxygen demand; chemical oxygen demand; suspended solids; pH;

Overview of conventional treatments: Aerobic treatments, Anaerobic treatments: aerobic digestion (bio-filters); anaerobic digestion spraying on farmland; discharge to sea; Environmental implications of these methods;

Advances in the effluent treatment systems: ZLD systems

a. Manufacturing of methane gas (biogas production), Raw material requirement of biogas plant, Design & capacity of biogas plant, Moisture free methane generation, Composition of biogas

b. Solid waste treatments: Composting, Types of composting, Factors affecting composting process, Requirements for composting (land), Economics consideration in composting process, analysis of the produced composted material

c. Incineration boilers for spent wash treatments

Reference books:

1. The Alcohol Text Book- Lyons & Kelsall
3. Hand Book of Fermentation & Distillation- A.C. Chatterjee
4. Distillation- H.C. Barron.
5. By-Products of Sugar Industry- Paturao
6. Hand book of alcohol technology- S.V. Patil
7. Industrial alcohol technology handbook- NPCS Board of consultant & engineer
8. Handbook of enology volume-I- Pascal Ribereau
9. Wine Science Principles Practices & Perception- Ron S. Jackson
10. Wine Making Basics- C.S. Ough
11. Principles and practices of winemaking- Roger B. Boulton

UNIT 1: Isolation, Identification and Maintenance of Yeast (15)

- **Yeast Isolation and Culturing:** Habitat Description; Characteristics of culture yeasts; Principles of yeast classification; concept of genus and species cell and spore morphology; Identification of *Saccharomyces cerevisiae* and yeasts involved in natural fermentations, different methods for identification; fermentation and aerobic growth (Biochemical) tests for yeast identification; Molecular identification of yeasts (rDNA sequencing);
- **Yeast Propagation and Maintenance:** principle and practices, Tips for handling yeast cultures, Methods used for preservation and maintenance of the yeast cultures: storage at reduced temperature, storage on agar slopes, Storage under liquid nitrogen, Storage in a dehydrated form: -dried culture, Lyophilization, Quality control of preserved stock cultures

Unit 2: Production Yeast Strains and Strain Improvement (15)

- Industrial applications of yeast; Difference between wild strain and industrial strain; Different production yeast strains used in the industry and their Characteristics; Screening for industrially important yeast strains, primary screening and secondary screening. Detection assays;
- Production strain improvement of industrial micro-organisms: Introduction of strain improvement, its application, advantages and disadvantages, methods of strain improvement, factors affecting strain improvement program, targeted strain improvement, (mutagenesis, recombination, genetic engineering),

Unit 3: Contamination and its Control in Alcoholic Fermentations (15)

- Factors affecting alcoholic fermentation
- Introduction to contamination,
- Potential source of contamination: stock culture, water, air, molasses, chemical, additives
- Effect of microbial contaminants on alcoholic fermentations: Types of contaminants: yeast, bacteria, viruses, Pathogenic Fungi;
- Methods for Detection of specific contaminants (molecular, biochemical)
- Control of microbial contaminants; by physical and chemical agents; Antimicrobial substances controlling contamination in industrial alcoholic fermentation and their mode of action, Introduction to antibiotics, Mechanism of various antibiotics

UNIT4:HygieneinAlcohol Industry

(15)

a)Sterilizationand Disinfection:definitionofsterilizationand disinfection;

Physicalagents:moistheat,dry heat,osmoticpressure,radiations(UV, Xray andgammaray);

ChemicalAgents-

characteristicsofidealdisinfectant,selectionofchemicalantimicrobialagentsphenolandpheno lcompound,alcohol.

d)Hygiene- Plant cleanliness and sterility; Cleanliness/sterility requirements of differentstages of the process;Influence of process plant surfaces:castiron, copper, stainlesssteel, wood; Importance of design features of pipe work and fittings; Principles of layoutand operation of a cleaning-in-place system; The range and main constituents of cleaningandsterilizingagents;Safetyrequirementsforhandlingdetergentsandsanitizers;Adva ntages and disadvantages of hot vs cold sterilization; Detection and quantification ofresidualsurfacecontamination:visualinspectionrinsesampling;swabsampling;

ReferenceBooks:

1. GeneralMicrobiology-Stanier,Adelberg,and Ingraham,MacMillanPress
2. Bergey'sManualofSystematicBacteriology-Springer
3. Foundationsin Microbiology-Talaroand chess McGraw Hill.
4. YeastBiotechnology:DiversityandApplications-Satyanarayana&Kunze;Springer
5. TheAlcoholTextbook-Jacques, LyonsandKelsall,NottinghamUniversityPress
6. BrewingYeastFermentationPerformance-KatherineSmart,Wiley-Blackwell
7. Brewingyeastandfermentation-ChrisBoulton&DavidQuain,Wiley-Blackwell

100Unit1.a.Basicsof Fermentation

(15)

Introduction: Fermentation,Aerobic and anaerobic fermentations, industrially importantfermentationproducts,Roleoffungiinvariousfermentations,Examplesofvariousfermentationsusingfungiroleofmicroorganisms,Factors affectingfermentation.

b.Fermenterdesignandtypesoffermenters

i) Basic components offermenters formicrobial cellculture,bodyconstructionmaterial.

ii) Typesoffermenter.Mechanical-

Waldhoffermenter,Rotatingdiscfermenter,tricklinggenerator,Hydrodynamicdeepjetfermenter.Pneumatic-airliftfermented,Bubble-capfermenter,Cylindroconicalvessels,Ucetator,Caxitator,Photo-bioreactortower,Packedfermenters,Cyclonecolumn

c.Scaleofoperation:Introduction,Labscale, Benchscale,Pilotscaleproductionlevel.

Unit2:Typesof Fermentation

(15)

- IntroductiontoBatch,Semi-continuous(Fed Batch),Continuousetc.,
- Submergedfermentation/liquidstatefermentation(SmF/LSF),Solidstatefermentation
- History of solid state fermentation: Comparison of solid state fermentation with othertypesoffermentations,
- Importance of solid state fermentation, the industrial production of various SSF basedproducts. Principles of Solid-State Fermentation Engineering and Its Scale-Up:Designand Scale-Up of Solid-State Fermentation Bioreactors,Factors Affecting Solid-stateFermentation
- XanthanProductionbySSF;BacterialCellulaseProductionbySSF
- ApplicationsofSaccharificationUsingFungalSolidStateFermentation

Unit3.CellImmobilization

(15)

Introductionofcellimmobilization,Immobilizationsystem

i) Surfaceattachment ofcells

ii) Entrapmentwithinporousmatrices

iii) Containmentbehindabarrier

iv) Self-aggrementationofcells

Masstransportphenomenonin immobilizedcell system.

ii) Reactionand diffusioninimmobilizationcellsystem.

iii) Bioreactordying.

Physiological effects of microbial cell (yeast) immobilization: Beer production using immobilization cell technology – a case study.

Unit 4. Biochemistry of Alcoholic Fermentation (15)

a. Biochemistry of Alcoholic Fermentation:

Transport of carbohydrates in yeast, Aerobic and anaerobic metabolic pathways in Yeast for sugar dissimilation, Importance of Pentose Phosphate pathway in yeast cell, Interrelationship between sugar uptake during alcoholic fermentation (Pasteur and Crabtree Effect) Stoichiometry of alcohol production

b. Carbon Sources in Alcoholic Fermentations:

Important carbohydrates for production of alcohol; Molasses, cane juice, beet juice, sweetsorghum, mahua flowers, fruits' juices, etc.; Starchy and Cellulosic Materials Unit: Culture stability and autolysis, Outline of alcohol production by batch fermentation process

c) Production of biogenic amines & ethyl carbamate

Usage & formation of Sulphur compound, Microbial formation & modification of flavor & off-flavor compounds in wine; Exo-enzymes of wine microorganisms

Reference Books—

1. Industrial Fermentations - Koeffler, Chemical Pub. Co., New York
2. Modern Solid State Fermentation Theory and Practice - Hongzhang Chen, Springer Netherlands
3. Biofuels from food waste: applications of saccharification using fungal solid state fermentation - Trzcinski, Antoine Prandota - CRC Press
4. The Alcohol Textbook - Jacques, Lyons & Kelsall, Nottingham University Press

a) Basic Instrumentation:

What is Instrumentation, Need of Instrumentation in Distillery, Characteristics (Static and Dynamic), Transducers and Sensors – Primary and Secondary Transducers, Classification of transducers

b) Physical Variables:

Like Pressure, Velocity, Temperature, Flow, Vacuum, Level with respect to distillery.

c) Applications and Measurements of

Variables from Distillery: i) Pressure Measurement: DP Transmitter,

Capacitance Method

ii) Level Measurement: Indirect methods like Capacitance and radiation type level indicator

iii) Temperature Measurement: Thermocouple, RTD, Thermistors

iv) Flow Measurement: Orifice Plate, Magnetic Flowmeter, Capacitance type, Rotameter

Unit: II Analytical Instrumentation in Distiller [15]

a) Analytical Instrumentation:

Colorimeters and spectrophotometers-their principle, working diagrams, Beer-Lambert's law and its derivation, Colour and its measurement

b) Refractometer and pH meter:

Refractive index, Hand refractometer, Abbe's refractometer, pH and conductivity measurement - Introduction, pH meter and different types of sensors for pH meter and conductivity meter

c) Flame Photometer:

Instrumentation, Principle, Working and Applications

Unit: III Electronics System and Control System [15]

a) Basics of Electronics:

What is AC and DC Signal, What is I to V Convertor, What is V to I Convertor, Standard Signal Used in Instrumentation system, What is A to D convertor and D to A convertor, Amplifier.

b) Control Valves:

The basic design features, respective merits and typical distillery applications of

thefollowingtypesofvalve:butterflydiaphragm;gateglobe;Designfeaturesand

application in distillery plant of the following types of valve: pressure relief
pressure reducing; anti-vacuum

c) Types of Control valves:

Construction, Types, flow characteristics, valve body material & selection of control valve. Process Control System – Open and closed Loop; on and off control; P, PI, PD, PID controller. Process Control System – Open and closed Loop; on and off control; P, PI, PD, PID controller;

Different Control schemes used in distillery i.e. Reflux to Distillate ratio control, temperature of a distillation column tray, reflux drum level control

Unit: IV Process Instrumentation and Automation in Distillery [15]

a) Process Instrumentation:

What is PI, Need of Distillery automation, Scope of automation, Automatic Process Control System, Terminology of automation systems

b) PLC and DCS:

What is PLC, Block Diagram of PLC, Programming System of PLC, Advantages, DCS: What is DCS system, Block Diagram of DCS, Difference between PLC and DCS.

c) Process Flow System in Distillery and Programming system:

Process flow chart of Distillery, Flow chart using DCS system; SCADA system and its applications in Distillery, Programming Development Techniques related to Distillery system

Reference Books-

- 1) Instrument Technology, Vol.1 to 4- Jones E.B., English Language Book Society
- 2) Instrument Engineers Handbook- Liptak B.G., Butterworths Heinemann Ltd., Oxford
- 3) Industrial instrumentation and control- Singh H.K.
- 4) Analytical instrumentation- Khandpur
- 5) Analytical instrumentation- Skoog and Holler.

Syllabus of Practical Courses

M.Sc.I(Alcohol Technology) Semester I
Subject Alcohol Technology-II(ATP.2.1)
Practical

100Marks

1. Determination of fermentation efficiency of yeast growing on molasses medium.
4. Determination of total, volatile and fixed acids in spirit.
5. Determination of aldehyde content of spirit.
6. Determination of ester content of spirit.
7. Determination of fusel oil content of spirit.
8. Isolation of amylase enzyme and study of effects of different factors on its activity.
- 9) Effect of pH on enzyme activity.
- 10) Effect of temperature on enzyme activity.
- 11) Effect of enzyme concentration on amylase activity.
- 12) Effect of substrate concentration on enzyme activity
- 13) Preparation of wine from grapes.
- 14) Determination of pH and total acidity of wine.
15. Alcoholic fermentation by using immobilized cell

Reference Books:

1. The Alcohol Text Book- Lyons & Kelsall
2. Hand Book of Fermentation & Distillation- A.C. Chatterjee
3. Hand book of alcohol technology- S.V. Patil
4. Industrial alcohol technology handbook- NPCS Board of consultant & engineer
5. Hand book of enology volume-I- Pascal Ribereau
6. Alcoholmetry- Satyanarayana Rao

Syllabus of Practical Courses

M.Sc.I(Alcohol Technology)
Subject:Microbiology-II(ATP.2.2)
Practical

Semester I

100Marks

1. Isolation and purification of yeast from flowers, fruits and berries.
2. Cell wall staining of bacteria.
3. Measurement of growth of bacteria.
4. Measurement of proteolysis activity of yeast.
5. Preparation of culture media and sterilization.
6. Preparation of MGYP medium for growth and identification of yeast.
7. Preparation of MGYP slant.
8. Enumeration of micro-organisms by four quadrant method.
9. Enumeration of micro-organisms by using spread plate technique.
10. Counting of micro-organisms by using pour plate method.
11. Determination of microbial contamination in beer.
12. Determination of microbial contamination in wine.

Reference Books:

1. Handbook of Microbiology-Lyons & Kelsall
2. Microbiological Applications: A Laboratory Manual in General Microbiology- Harold J. Benson, McGraw-Hill
3. Microbiology: A Laboratory Manual, Global Edition-Cappuccino, James, Welsh, Chad-Pearson Education Limited
4. Hand book of enology volume-I-Pascal Ribereau