SHIVAJI UNIVERSITY

KOLHAPUR

Estd.:1962

NAAC 'A' Grade,

MHRD-NIRF-28th Rank

New Syllabus For

Master of Science (Alcohol Technology)

Part - I (Semester –I, Semester – II & Practical's)

Syllabus to be implemented from June 2016 onwards

A] **Ordinance and Regulations**

B] Shivaji University, Kolhapur

NEW SYLLABUS FOR

Master of Science (Alcohol Technology)(AT)

1. **Title: Subject**: M.Sc. Alcohol Technology

M.Sc. part I syllabus

2. **Year of implementation**:

New Syllabus will be implemented from June 2016 onwards.

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 sprit for industrial application 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 bleeding of alcohol 10% to petrol by 2017 which will force to produce alcohol for fuel ethanol for bleeding. 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 bleeding is 700 million lire's per annum, however at current rate of petrol consumption Ethanol requirement for 5% doping is 1100 million liters and for 10% bleeding 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 sciencetist. This is right time to start M.Sc alcohol technology course.

4-**General object of course**.
Objectives :
The objectives of the M.Sc. (alcohol Technology) Course shall be as follows:-

1) To develop the human recourse in Alcohol technology sector which is the need of the hour?

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 several self-employment opportunities in alcohol and allied industries sectors for modestly-trained and self-trained human resources exist in all geographic locations of the country.
4) It will help to develop the skills required in alcohol technology and alcohol management fields.
5) To develop proficiencies and skills for becoming successful scientist, technicians in AT sector.
6) To develop the expertise for the innovation of different skills and its implementation in AT Sector.
7) To explore the different techniques in Alcohol technology sector

5. DURATION:

The duration of course shall be two years consist of four semesters

6) Pattern for examination

Semester pattern, theory paper and Practical at each end of 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. ELGIBILITY FOR ADMISSION:

B.Sc. Chemistry

B.Sc (Microbiology/Zoology/Botany)

B.Sc. (sugartchnology/bio chemistry)

B.Tech (food/chemical/Sugar)

B.E. Chemical engineering)

10 MEDIUM OF INSTRUCTION: English.

11. TEACHERS Qualification:

- B.Sc DIFT
- M.Sc(Microbiology with NET/SET)
- M.Sc (Alcohol technology)
- BE/B.Tech/ME/M.Tech(Chemical Engg)
- ANSI/AVSI (Engg.)
- BE/ME/M.Tech(Instrumentation)

12 STRUCTURE OF COURSE:

M.Sc,(AT) First year (theory-4 Paper)

Semester 1-theory

Sr no	**Theory –Core Subject**	**Code**	**Credits**	**Marks**
1	Organic chemistry	OC	4	100
2	Basis of fermentation	F T-1	4	100
3	Alcohol technology –I	AT-I	4	100
4	Microbiology –I	MC-I	4	100
5	Total		16	400

First year Semester 2-practical's

Sr no	**Practical –subject**	**Code**	**Credits**	**Marks**
1	Alcohol technology Practical-I	AT	4	100
2	Microbiology-Practical-I	MC	4	100
3	Total		8	200

First year (Theory 4 paper)
Semester 2-theory

Sr no	**Theory –Core Subject**	**Code**	**Credits**	**Marks**
1	Bio-Chemistry.	BC	4	100
2	Fermentation technology- II	FT-II	4	100
3	Alcohol technology-II	AT-II	4	100
4	Microbiology –II	MC-II	4	100
5	Total		16	400

First year **(Practical's-2)**

Semester 2- Practical's

Sr no	**Practical subject**	**Code**	**Credits**	**Marks**
1	Alcohol technology –II	AT-II	**4**	100
2	Microbiology-II	MC-II	**4**	100
3	Total		8	200

Second year (theory -4paper)

Semester 3-theory

Sr no	Theory – core/elective subject	Code	Credits	Marks
1	Alcohol technology –III	AT:III	4	100
2	Microbiology III	MC:III	4	100
3	Chemical engineering –I	CC:II	4	100
4	Elective: 1) Industrial waste treatments 2) Plant engineering 3) Energy conversion and cogeneration	Elective: 1)IWT 2)PE 3)ECC	4	100
5	Total		16	400

Semester 3- practical's

Sr no	**Practical –subject**	**Code**	**Credits**	**Marks**
1	Alcohol technology practical III	AT-III	4	100
2	Microbiology-III	**MC-III**	**4**	**100**
3	Total		**8**	**200**

Second year (theory 4 paper)

Semester 4-theory

Sr no	**Theory – core/elective subject**	**Code**	**Credits**	**Marks**
1	Alcohol production from grain and other sources.	APG	4	100
2	Beverage & IMFL Production Technology.	BIPT	4	100
3	Production of ENA and Ethanol	PEE	4	100
4	Elective: 1) Effluent treatment plant of distillery. 2)Enology	Elective: 1)BC 2)EC	4	100

	3Distilary instrument control.	3)		
5	Total		16	400

Semester 4- practical's

Sr no	Practical –subject	Code	Credits	Marks
1	Technical easy on elective subject	TE	4	100
2	Inplant Training	IE	4	100
3	Total		8	200

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.

- The semester examination will be conducted at the end of each term for theory and practical's .
- 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 log book. .
- 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 question are divided into two sections, namely section-I and section – II. Four questions are to be attempted from these 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 Equivalences in accordance with title and content of paper (for revised syllabus)

New syllabus hence not applicable

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 are given wherever necessary.
ii) General/Specific instructions for Laboratory safety should be given wherever necessary

18) Other feature

Intake capacity: 30

19) Laboratory safety equipments:

Part: I Personal Precautions:

1. All persons must wear safety Goggles at all times.
2. Must wear Lab Aprons/Lab Jacket and proper shoes.
3. Except in emergency, over – hurried activities is forbidden. 8
4. Fume cupboard must be used whenever necessary.
5. Eating, Drinking and Smoking in the laboratories strictly forbidden.

Part: II: Use of Safety and Emergency Equipments:

1. First aid Kits
2. Sand bucket
3. Fire extinguishers (dry chemical and carbon dioxide extinguishers)
4. Chemical Storage cabinet with proper ventilation
5. Material Safety Data sheets.
6. Management of Local exhaust system& fume hoods.
7. Sign in register if using instruments.

20) Credit system (Applicable to University department)

Credits can be defined the workload of a student in

1. Lectures
2. Practical's
3. Seminars
4. Private work in the Library/home
5. Examination
6. Other assessment activities

How much time a student gives for the examination per semester?

1) 4 Theory papers per semester each of the three hour duration. Time required is 12 hours

2) 2 Practical's per paper with 2 experiments per practical. Total 4 practical each of 3 hour duration. Time required is 12 hour.

Total time for a semester examination is 12 + 12 = 24 hrs

Time required for the other activities.

Seminars-as per the requirement of the course (minimum 2, One for each semester)

Library-book issue, Journal reference, reviews writing of research papers, internet access. Reading magazines and relevant information

Private work – project material, Industrial training, book purchase, Xerox,

availing outs ideal facilities etc

Home- Study, notes preparations, computations etc

Types of Credits

1) Credits by examination- test(theory and practical) 9

2) Credits by non examination- Proficiency in the state , national and

international sports achievements, project, Industrial training , participation

in workshop, conference, symposia etc

Social service (NSS) Military service (NCC) Colloquium & debate, Cultural

programs etc

Credits by lectures and Practical's

• Total instructional days as per the UGC norms are 180.

• 1 credit is equivalent to 15 contact hours

• For the M Sc course there are 4 theory papers with 4 hours teaching per week

Therefore the instructional days for the theory papers in semester are 4 x

15(weeks) = 60

• There are 4 practical's (with 1 project) each of 6 hour duration for the 2 practical courses.

Total practical workload is 12 hours per week. Thus instructional days for the practical course of 4 practical's are 2 (practical papers) x 15 = 30

The time for each student is busy in a semester is 90 days (Theory) + 60 days (Practical) = 150 days

• With 4 credits per theory paper will be 4 x 4=16 credits and 4 credits per

practical will be 4 x 2= 08 credits

Credits for the practical's

Every practical (project) of 50 marks carries 2 credits.

Number of credits for M Sc course per semester will be 16 + 8 = 24. Total

no credits for entire M Sc course will be 4 x 24 = 96.

There will be 4 credits for other assessment activities-

Total credits for entire M Sc course will be

Theory course, 4 credits x 16 = 64

Practical course, 4 credits x 8 = 32

Other activities 4 credits = 04

Total = 100 credits

How to restructure the M. Sc course implementation of the credit system?

There will not be a major change in the restructured course. However some minor modification can be made in the syllabus wherever necessary. In order to implement the credit system effectively it is necessary to make every semester duration of at least 12 weeks. The examination must be scheduled in one month's time

The students must get at least 3 weeks time for the examinations preparations. Every theory papers syllabus should consists of 4 units (sub units allowed) each carrying 1 credit. 10

In order to have uniformity in the credit transfer it is necessary to have internal examination in all the P.G. departments of equal weightage. 80 external + 20 internal appears to be ideal to begin with.

Theory paper	contact hours	credits
Unit-1 (sub units if any)	15	1
Unit-2(sub units if any)	15	1
Unit-3 (sub units if any)	15	1
Unit-4(sub units if any)	15	1

The practical course credit distribution

Practical paper	Practical Contact hours	Credits	no of practical's
I (Unit-1) 1	6	2	12
I (Unit-1) 2	6	2	12
II (Unit-1) 3	6	2	12
II (Unit-1) 4	6	2	12

A project of 50 marks will be carrying 2 credits. Where a project of 50 marks is

offered to the student, the student will have to perform 1 project, 1 practical paper

(2 practical) for that semester. Time for the explanation for the practical course

(contact ours) will be 1 week (12 hours) .This makes the practical workload of the student equal to 60 days in a semester.

Grades, grade point and average grade point's calculations

Table showing the grades, grade points and marks scored by a student

Grades	Grade points	marks out of 100
A+	9	91 to 100
A	8	81 to 90
A-	7	71 to 80
B+	6	61 to 70
B	5	51 to 60
B-	4	41 to 50
C+	3	31 to 40
C	2	21 to 30
C-	1	11 to 20
F	0	0 to 10

Sum grade point average SGPA):- It is a semester index grade of a student

1. SGPA = (g1xc1) + (g2xc2) + -------- + (g6xc6)/ Total credits offered by a

student in a semester.

2. Cumulative grade point average (CGPA):- It is cumulative index grade

point average of student

CGPA = (g1xc1) + (g2xc2) + -------- + (g6xc6)/Total no of credits offered by

students up to and including semester for which the cumulative average is

required. 11

3. Final grade point average (FGPA): - It is a final index of student in the

course FGPA=(n/∑ci x gi) /(n/ cl)

Where c1- credit of the course (paper) (4)

gi – grade point secured (see the table for conversion)

n- No of courses (no of paper offered)

cl- Total no credits for the entire M Sc course (100)

Illustration with an hypothetical case

For M Sc I (or II/III/IV)

1 papers	I	II	III	IV	Practicals	I	II	III	IV
2 credits	4	4	4	4		2	2	2	2 = 24
3 grade point	7	6	8	6		7		7	= 41
Obtained									

4 ∑ ci x gi 28 24 32 32 28 28 = 164

5 ∑ ci x gi/cl =164/24 = 6.83

6 Overall grade = 6.83

The cumulative grade point average is the sum of SGPA of student of every semester.

Suppose it is 164(6.83) for semester- I, 170(7.08) for semester -II, 168 (7.0) for semester III and 176 (7.33) for semester IV.

The cumulative average for semester I and II will be = 334/48 = 6.958 = 6.96

Final grade point average for all semesters = 678/96 = 7.0265 = 7.03

Rules for opting the credits

1. A student from same department only will be eligible for opting the

specialization of the choice.

2. It will be mandatory for a student admitted for a specialization to opt for the

papers related to that specialization Other papers cannot be offered as

credits in lieu of these papers

3. Admission to the students from the other specialization for the credits will be restricted to 5 core papers only. A student from other department will be offered credits of his choice in multiples of 4. A theory paper can be offered as the credit. However number of such admissions will depends upon the seats available class room seating capacity.

4. Any student can have credits from the management course. In order to increase the employability of the students it is necessary that add on course in management be offered by the department of management. Separate fees can be charged from the students for taking this course. Such course can be arranged during the vacation.

M.Sc PART-I (SEMESTAR-I)

Paper: I (OC)-ORGANIC CHEMISTRY

Unit 01 **[15]**

Fundamentals of Organic Reaction Mechanism -

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

Unit 02 **[15]**

Alcohol industry –Introduction, Manufacturing of ethyl alcohol from Molasses, Types of Alcohol, by products of Alcohol Industry.

Environmental Chemistry – Introduction, Terms involved in environmental chemistry

Types of pollution, Air pollution – types, source, analysis control.

Unit 03 **[15]**

Chemistry of water –

Properties of water, the characteristics of bodies of water, Alkalinity of water, Source and nature of Acidity -Cause and source of hardness, Methods for the determination of hardness, Types of Hardness, Major aquatic chemical processes, Oxidation – Reduction reactions in water, PE – PH diagram, Complication. Red ox reactions medicated by bacteria. Oxidation, Reduction, Nitrogen transformation by bacteria, Iron & manganese bacteria

Unit 04 **[15]**

Alcohols – Introduction,

Dihydric alcohols – Nomenclature, methods of formation of Ethylene glycol – from ethylene, ethylene dibromide & ethylene oxide physical properties. Chemical reactions of ethylene glycol – acidic nature, reaction with hydrogen halide. Oxidation tetra acetate, HIO4 & Nitric acid. Uses of ethylene glycol, Pinacol.

Trihydric alcohol - Nomenclature, methods of formation of glycerol – from fats & oils synthesis from elements carbon & hydrogen. Physical properties chemical reaction of glycerol – reaction with electro positive metals, reaction with hydrogen halides (HCL & HI) reactions with concentric nitric acid in presence of concentric sulfuric acid. Reactions with potassium hydrogen sulphate. Etherification & oxidation with Fenton's reagent. Uses of glycerol.

RECOMMENDED BOOKS

1. A guide book to mechanism in Organic chemistry (Orient-Longmans)- Peter Sykes
2. Organic reaction mechanism (Benjamin) R. Breslow
3. Mechanism and structure in Organic chemistry (Holt Reinh.)B. S. Gould.
4. Organic chemistry(McGraw-Hill)Hendrickson, Cram and Hammond.
5. Basic principles of Organic chemistry (Benjamin) J. D. Roberts and M. C. Casoria.
6. Reactive Intermediates in Organic chemistry (John Wiley)N. S. Issacs.
7. Stereochemistry of Carbon compounds. (McGraw-Hill) E.L. Eliel
8. Organic Stereochemistry (McGraw-Hill) by Hallas.
9. Organic reaction mechanism (McGraw-Hill) R. K. Bansal.
10. Organic chemistry- R. T. Morrison and R. N. Boyd,(Prentice Hall.)
11. Modern organic reactions(Benjumin) H. O. House.
12. Principle of organic synthesis- R.O.C. Norman and J. M. Coxon.(ELBS)
13. Reaction mechanism in organic chemistry- S. M. Mukharji and S. P. Singh.
14. Stereochemistry of organic compoundsc) D. Nasipuri.

15. Advanced organic chemistry (McGraw-Hill) J. March.
16. Introduction to stereochemistry(Benjumin) K. Mislow.
17. Stereochemistry by P. S. Kalsi (New Age International)

M.Sc PART-I (SEMESTAR-I)

Paper: II (FT) Basics of Fermentation: I

Unit 01 **[15]**

Sugar cane molasses production, molasses quality, composition of molasses, gradation of molasses .storage of molasses, . Effects of various components on quality molasses. Factors affecting **the** composition of molasses on Fermentation. Whey-use of whey .whey powder, lactose manufacture, lactose hydrolysis deminerlised whey .protein recovery from whey . Cassava as food stuff, processing cassava from ethanol production.

Unit: 02 **[15]**

Definition of fermentor and types of fermentor.

a) Introduction, scale of operation, Lab scale, Bench scale, Pilot scale production level.
b) Basics of function of fermentors for microbial cell culture, body construction material.
c) Types of fermentor.
    - Mechanical- waldh of fermentor, Rotatin disc fermentor ,tricling generator
    - Hydrodynamic deep jet fermentor.
    - Pneumatic-air lift fermentor, bubble-cap fermentor, cylindroconical vessels, ucetator,caxitator.
    - Photo-bioreactor tower and packed fermentors,cyclone coloum.

Unit 03 [15]

Fermentation Media, Media composition, Media sterilization and contamination, Inoculums' media and economics.raw material as media , precursor and inducers , repressors , antifoams, Screening for fermentation media and optimization. Medium sterilization, – primary screening and secondary screening .Detection and assay of ferment Inoculums development, broth culture ,continuous culture, the kinetics of continuous culture ,fed batch culture ,production strains improvement of industrial micro-organisms.

Unit 4 – [15]

Cell Immobiization

- Introduction of cell immobilization.
- Immobilization system
  i)surface attachment of cells
  ii) entrapment within porous matrices
  iii) containment behind a barrier
  iv) Self aggrementation of cells
- Mass transport phenomenon in immobilized cell system.
  ii) Reaction and diffusion in immobilization cell system.
  iii) Bireactor deing.
- Physiological of immobilization microbial ce
- Beer production using immobilization cell technology -case study.

Refernces

1)Indudtrial microbiogy-.L.E.Casidazok

2)Principle of fermentation technology-second edition P.F.Standburg,

A.Whotakar, S.J. Hall

3) Biotechnoogy-Walf crueger and Annelise cruengo

4) Fermentation technology & biotechnology second editio

M.Sc PART-I (SEMESTAR-I)

Paper: III (AT)- Alcohol Technology-I

Unit -1 **[15]**

History and development of Alcoholic Beverages Overview of fermentation and microorganisms:- Yeast, Lactic acid bacteria, Molds and Spoilage.Preservatives used in the alcoholic beverages introduction, sulfur dioxide (SO2), Sorbic acid, DMDC(Velcorin),Ascorbic acid (Vit C) pimaricin,(Natamyin) and other preservatives

Unit-2 **[15]**

Yeast structure, Yeast growth requirement, Metabolic pathways of Yeast (Glycol sis), Fate of glucose to pyruvate, Growth of yeast, Propagation of yeast, Preparation of yeast starter culture, Importance of yeast strains in Alcohol making, Maintenance of yeast strains and preservation of strain characteristics, Yeast culture techniques, stability of cultures and autolysis, Types of microbial spoilage of alcohol, Prevention of microbial spoilage of alcohol during fermentation, Primary, secondary and targeted screening of yeast strain, Phage contamination of yeast Culture.

Unit -3 **[15]**

Molasses Quality composition Grades and Factor Affecting on composition of molasses – Sugar cane molasses production , Definition , characteristics and uses of molasses, composition of molasses, Gradation of molasses, storage of molasses, factors affecting composition of molasses and quality of molasses, effect of various components in molasses, control of adverse effect of composition of molasses.

Unit-4 **[15]**

a)Beer Fermentation

Basic Brewing processes, Malting and mashing, Boiling the wort, Top fermentation Bottom fermentation, Modern methods of fermentation, Beer fining, filtration, pasteurization, Packing Oxidation and staling Beer.

b)Cider and Perry

Introduction, Basic ingredients, Harvesting, crushing and pressing, fermentation and Maturation, traditional and small scale cider and Perry production, Large scale production of cider and perry,newer technology, recent developments and innovations.

c)Vinegar Production

History and development, Mechanism of Acetic acid fermentation, Acetic acid production and uses.

Reference Books-

1. The Alcohol Text Book-Jacques T. P. Lyons & D.R. Kelsall
2. Alcoholometry- Satyanarayana Rao
3. Hand Book of Fermentation & Distillation–A.C. Chatterjee
4. Distillation H.C. Barron.

M.Sc. PART-I (SEMESTAR-I)

Paper: IV -MC-Microbiology: I

Unit -01 **[15]**

a)Historical developments of microbiology and scope of microbiology.

b)Brief account of organization and classification of microorganisms. Differences between prokaryotic and eukaryotic cell. Overview of bacterial cell structure, (size, shape, arrangement membrane, cell wall, cytoplasmic inclusions, mesosomes, flagella and motility, slime, capsule, pile, chemo taxis, endospore) The brief account of fungi, structure, physiology and classification,

brief account of virus (bacteriophages) structure, life cycle (lytic and lysogenic).

Unit-02 **[15]**

a)Microscopy: Principles and applications in microbiology, bright field microscopy dark field microscopy, fluorescence and immune fluorescence microscopy, phase contrast and electron (transmission and scanning) microscopy.

b)Staining of microorganisms.

c)Reproduction and Growth: Life cycles of representative microorganisms including bacteria, Fungi and viruses, population growth and its measurement, effect of environmental condition on growth pH, temp., aeration etc, continuous culture, diauxic, synchronous growth cultures and anaerobic cultures.

Unit-03 **[15]**

Nutrition and Metabolism: Modern concepts of bacterial nutrition, nutritional categories. Transport of nutrients (diffusion, active transport, group translocation) Introduction to oxidative and substrate level phosphorylations, brief account of metabolism of carbohydrates, EMP, ED, TCA and glyoxylate cycle and nucleic acids as building block in biosynthesis of cell constituents synthesis of peptidogyl can polymer of cell wall.

UNIT:04 **[15]**

Microbial Genetics: A general account of prokaryotic and eukaryotic genome,

recombination, brief account of transformation, conjugation, transduction. concept of operon, induction, repression, catabolism repression. Control of Microorganisms: Control of microbes by physical and chemical agents. Antibiotics, properties and mode of action; Drug resistance and its significance. Antibiotic sensitivity test. Industrial uses of bacteria yeast & molds.

Recommended Books.

1. Stanier, R.Y. Adel berg, E.A. and Ingraham, J.L. (1984), General Microbiology, IV edn.

Mac Millan Press.

2. Pelczar, M.J. Chan, E.C.S. and Krieg, N.R. (1986), Microbiology, V

Ed. Mc

3. Graw Hill.

4. Prescott. L.M. Harley J.P. and L. Kreig D.A. (1990). Microbiology,

5. Rosenberg, E & Cohen I.R. (1983). Microbial Biology. H.S.

International Editions.

5. By Products Of Suger Industry- Paturao

6. Whisky Technology,Production & Marketing -Inge Russell

M.Sc. PART-I (SEMESTAR-II)

Paper: I –BIO-CHEMISTRY –BC

UNIT01 **[15]**

a) Biochemistry of living cells

Classification of living cells, structure and function of cells DNA/RNA and protein synthesis.

Photosynthesis: Definition, importance and mechanism, light reaction,Dark reactions and factors affecting the photosynthesis rate.

b) Biochemistry of alcoholic fermentation

Pathways involved in alcoholic fermentation, Transport of carbohydrates in yeast.Inter relationship between sugar uptake during alcoholic fermentation (Pasteurand Crabtree Effect).

UNIT02 [15]

Proteins,carbohydrates and lipids

Characteristics and classification of proteins, protein structure and proteins in sugarcane juice Amino Acids: Classification and properties, amino acids in sugarcane juice and molasses. Classification of carbohydrates, Examples and structures of various carbohydrates, Important carbohydrates for production of alcohol, , Pentose Phosphate pathway,, Metabolism of amino acids. Definition, nomenclature, classification - (simple, complex, derived lipids - structure & example) phospholipids, glycolipids, - (structure, composition).

Unit03 **[15]**

a) Protein Synthesis

Definition, Structure of protein, Classification (Primary, Secondary, Tertiary, Quaternary- definition, examples) Types and functions of proteins, Biological importance, mechanism of protein synthesis.

b) Production of biogenic amines & ethyl carbamate

Usage & formation of sulphur compound. Microbial formation & modification of

unit04 **[15]**

DNA and Chromosomes

DNA as the molecule of information: DNA as the genetic material and its organization. DNA structure, Purine, pyrimidine - definition and structure.Nucleoside, nucleotide: definition and structure. Chemical Properties: Hydrolysis (acid, alkali), enzymatic hydrolysis of DNA. DNA replication and it's regulation. DNA damage and repair. Chromosomes: Structure and shapes of metaphase chromosomes histone, non histone proteins Nucleosome and packing of DNA into chromosome.
flavor & off-flavor compounds in wine. Exoenzymes of wine microorganisms.

Reference Books:

1. Biochemistry –Lehninger
2. Biochemistry – West and Todd
3. Wine Microbiology and Biotechnology- Graham H. Fleet.
4. Concepts on wine chemistry- the wine appreciation guide- Yair Margalit, James Crum.
5. Chemical analysis of grapes and wine techniques and concepts- Patrick ILAND, Nick BRUER, Andrew EWART, Andrew MARKIDES, John SITTERS.

M.Sc. PART-I (SEMESTAR-II)

Paper: II –INDUSTRIAL FERMENTATION.(IF)

Unit01 **[15]**

Microbiology of yeast

Definition, comparison with other microorganisms, yeast morphology and taxonomy, yeast cell structure and functions of various cellular components. Nutritional requirements of yeast, Aerobic and anaerobic metabolic pathways in
Yeast for sugar dissimilation, Isolation and Maintenance of yeast, Staichiometry of alcohol production.

Unito2 **[15]**

Solid state fermentation

Comparison of solid state fermentation with other types of fermentations,
Importance of solid state fermentation, the industrial production of various SSF based products.

Unito3 **[15]**

Contamination control in alcoholic fermentations

Introduction to antibiotics, Mechanism of various antibiotics, Effect of microbial contaminants on alcoholic fermentations. Role of antimicrobial substances controlling contamination in alcoholic fermentation,

unit04 **[15]**

Industrially important fermentation products

Role of fungi in various fermentations, Examples of various fermentations using

Refernces

1)Indudtrial microbiogy-.L.E.Casidazok

2)Principle of fermentation technology-second edition P.F.Standburg,

A.Whotakar, S.J. Hall

3) Biotechnoogy-Walf crueger and Annelise cruengo

4) Fermentation technology & biotechnology second editio

M.Sc PART-I (SEMESTAR-II)

PaperIII:(AT-II) Alcohol Technology II

Unit 01: **[15]**

a)Distillation theory pot & continuous distillation, Control of congener levels, spirit maturation, Relative volatility & liquid vapor equilibrium diagrams, Daltons,

Raoults & Henry laws

b)Azeo tropic mixtures –minimum & maximum boiling, Top & bottom operating

lines Lewis organisms, commercial vinegar production, finished vinegar, processing of vinegar, Annual Sorel & Mc Cube Thiele method for calculating theoretical plate's extractive distillation.

Unit 02. **[15]**

a)Q line & feed condition calculation, Reflux ratio minimum & total reflux

Calculation, Types of plate & plate efficiency, Heat loss by convection & radiation

from stills.

b)Multiple effect evaporations of pot ale, theory & industrial examples. Mechanical

& thermal compression. Pot still shape & design & its effect on spirit quality

purifiers.

Unit 03 **[15]**

a) Cereal cooking energy calculation, Co2 recovery, Dark grains processing, Effluent treatment, anaerobic & aerobic digestion, cooperage.

b) Warehouse & maturation, Wood chemistry & physical changes during maturation, flavor evaluation of remake & mature spirits Co2 /dark grain recovery, Cooperage wood chemistry, Chemical charges during distillation & maturation of whiskey. Flavor of Scotch whisky.

Unit 04 **[15]**

Various aspects & production of distilled beverages other than Scotch whisky as well as blending,

Packaging & marketing of beers & whisky.

Reference Books-

1. The Alcohol Text Book-Jacques T. P. Lyons & D.R. Kelsall

2. Alcoholometry- Satyanarayana Rao

3. Hand Book of Fermentation & Distillation–A.C. Chatterjee

4. Distillation H.C. Barron.

5. By Products Of Suger Industry- Paturao

6. Whisky Technology,Production & Marketing -Inge Rus

M.Sc PART-I (SEMESTAR-II)

Paper: IV (MC) MICROBIOLOGY II

Unit No 1: **[15]**

Techniques in Microbiology

a)Culture media and pure culture techniques: Preparation of media , roll of ingredients of media, types of media, preparation of slant and plates.

b)Sterilization and disinfection : definition of sterilization and disinfection; **physical agents :** moist heat, dry heat , osmotic pressure ,radiations(UV, X ray and gamma rays)

c)chemical agents – characteristics of ideal disinfectant , selection of chemical antimicrobial agents- phenol and phenol compound ,alcohol.

Unit No 2 : [15]

Alcoholic fermentation: Potential source of contamination: stock culture, water, air ,molasses, chemical, additives .Effect of contamination Types of contaminants: yeast, bacteria, virus. Detection of specific contaminants and control of microbial contaminants. Factors affecting on alcoholic fermentation.

Unit No 3: [15]

Alcoholic production from grain: Types of raw material used for alcoholic fermentation. Main constituents of a grain. Selection of a grain. Grain quality and storage. Grain processing. Types of milling , wet milling process. Liquefaction/ mashing, factors affecting on mashing efficiency.

Unit No 4: [15]

a)Alcoholic beverages

Alcoholic beverages: Beer manufacturing process, production of a malt alcohol. Grape wine- definition, types , production of table wine(Red and White wine),microbial defects of a wine. Whiskey, shampen, Vodka, Sherry, Gin

b)Alcohol Production Molasses

Organism used, Inoculums preparation, Fermentation media, fermentation condition, extraction and recovery Bi- products: Spent wash,yiest cells,CO2

Recommended Books.

1. Stanier, R.Y. Adel berg, E.A. and Ingraham, J.L. (1984), General Microbiology, IV edn.

Mac Millan Press.

2. Pelczar, M.J. Chan, E.C.S. and Krieg, N.R. (1986), Microbiology, V

Ed. Mc

3. Graw Hill.

4. Prescott. L.M. Harley J.P. and L. Kreig D.A. (1990). Microbiology,

5. Rosenberg, E & Cohen I.R. (1983). Microbial Biology. H.S.

International Editions.

5. By Products Of Suger Industry- Paturao

6. Whisky Technology,Production & Marketing -Inge Russell

Syllabus of Practical Courses - M.Sc. Alcohol Technology

SEMESTER I

1)MICROBIOLOGY

1) Basic requirements of a microbiology laboratory

1 Apparatus

a) petriplate

b) Pipette

c) Erlenmeyer flask

d) Glass spreader

e) Wire loop

f) Cotton plug

2 Equipments

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 (Darners process)

ii) Flagella staining (Bailey's method)

iii) Nucleus staining (Giemsas method)

4) Preparation of media

i) Nutrient agar

ii) Nutrient broth

iii) Starch agar

iv) Potato dextrose agar

v) Macconkeys agar

5) Demonstration of technique for pure culture of micro-organisms

i) Streak plate method

ii) Pour plate method

iii) Spread plate method

6) Preparation of wine from grapes.

7) Determination of pH and total acidity of wine.

8) Determination of microbial contamination in beer.

9) Determination of microbial contamination in wine.

2) Alcohol technology (part-I)

1) Determination of reducing sugar by Nelson-Somogy method.
2) Estimation of reducing sugars by DNSA method.
3) Determination of glucose by glucose oxide method.
4) Phenol sulphuric acid method for total carbohydrate.
5) Estimation of starch by anthrone reagents.
6) Estimation of proteins by Biuret method.
7) Effect of pH by enzyme activity.
8) Effect of temperature on enzyme activity.
9) Effect of enzyme concentration of amylases activity.
10) Effect of substrate concentration on enzyme activity.
11) Estimation of vitamin c.

Microbiology -II

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 proteolytic 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 and molasses medium slant.
8) Enumeration of micro-organisms by four quadrant method.
9) Enumeration of micro-organisms by using spread plant technique.
10) counting of micro-organisms by using pour plate method.
11) Preparation of slide culture of yeast.
12) Negative staining and monochrome staining and gram staining.
13) Determination of ethyl alcohol, content of spirit by specific gravity method.

Practical Alcohol technology. II

1) To determine the total sugar as invert sugars in final molasses.
2) Estimation of calcium content of molasses by EDTA method.
3) Determination of total organic volatile acids of molasses.
4) To determine the reducing sugars in the given sample of final molasses.
5) Estimation of calcium content of molasses by ammonium oxalate method.
6) Alcohol determination by Ebuliometry method.
7) Determination of ethanol by oxidation method.
8) Estimation of ethanol content by dichromate method (spectrophotometry).
9) Determination of aldehyde content of rectified spirit.
10) Determination of ethyl alcohol content of Sikes glass hydrometer.