SHIVAJI UNIVERSITY,KOLHAPUR

Established:1962

NAAC 'A' Grade,

MHRD NIRF 28th Rank

Syllabus for

Master of Science (Alcohol Technology)

(Part I)

(Semester I, Semester II
Theory & Practicals)

As per New CBCS Pattern Including

1st and 2nd Semester

Academic Year:2020-2021

Syllabus to be Implemented From June 2020

For Affiliated Colleges / Centers

M.Sc. Programme Structure (CBCS Pattern) (2020-21) 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**	**--**	**--**	

• Student contact hours per week : **32** Hours(Min.)	• Total Marks forM.Sc.-I : **1200**
• Theory and Practical : **60** Minutes Each Lectures	• Total Credits forM.Sc.-I (Semester I & II) : **48**
• CC-Core Course • CCPR-Core Course Practical • AEC-Mandatory Non-CGPA compulsory Ability Enhancement Course • SEC-Mandatory Non-CGPA compulsory Skill Enhancement Course	• Practical Examination isannual. • Examination for CCPR-105shall be based on Semester I Practicals. • Examination for CCPR-205shall 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***

M.Sc. Programme Structure (CBCS Pattern) (2020-21) M.Sc. Part – II

Semester-III (Duration- Six Month)												
	Sr. No.	Course Code	Teaching Scheme			Examination Scheme					
			Theory and Practical			University Assessment (UA)			Theory and Practical		
			Lectures (Per week)	Hours (Per week)	Credit	Maximum Marks	Minimum Marks	Exam. Hours	Maximum Marks	Minimum Marks	Exam. Hours
CGPA	1	CC 301	4	4	4	80	32	3	20	8	1
	2	CC 302	4	4	4	80	32	3	20	8	1
	3	CC 303	4	4	4	80	32	3	20	8	1
	4	CC 304	4	4	4	80	32	3	20	8	1
	5	CC PR 305	16	16	8	--	--	--	200	80	*
Total (C)			**--**	**--**	**24**	**320**	**--**	**--**	**280**	**--**	
Non-CGPA	1	AEC	2	2	2	--	--	--	20	8	1
	2	EC (SWM MOOC)	Number of lectures and credit shall be as specified on SWAYAM MOOC								
Semester-IV (Duration- Six Month)											
CGPA	1	CC 401	4	4	4	80	32	3	20	8	1
	2	CC 402	4	4	4	80	32	3	20	8	1
	3	CC 403	4	4	4	80	32	3	20	8	1
	4	CC 404	4	4	4	80	32	3	20	8	1
	5	CC PR 405	16	16	8	--	--	--	200	80	*
Total (D)			**--**	**--**	**24**	**320**	**--**	**--**	**280**	**--**	**--**
Non-CGPA	1	SEC	2	2	2	--	--	--	20	8	1
	2	GE	2	2	2	--	--	--	20	8	1
Total (C+D)					**48**	**640**	**--**	**--**	**560**	**--**	**--**

- Student contact hours per week : **32** Hours (Min.)
- TheoryandPracticalLectures : **60** Minutes Each
- TotalMarksforM.Sc.-II : **1200**
- Total Credits forM.Sc.-II (Semester III &IV) : **48**

- CC-CoreCourse
- CCS-Core CourseSpecialization
- CCPR-Core CoursePractical
- AEC-MandatoryNon-CGPAcompulsoryAbilityEnhancementCourse
- SEC-MandatoryNon-CGPAcompulsorySkillEnhancementCourse
- EC (SWM MOOC) - Non-CGPA ElectiveCourse
- GE-GenericElective

- Practical Examination isannual.
- ExaminationforCCPR-305shallbebasedonSemesterIIIPracticals.
- ExaminationforCCPR-405shallbebasedonSemesterIVPracticals.
- *DurationofPracticalExaminationasperrespectiveBOSguidelines
- ***SeparatepassingismandatoryforTheory,InternalandPractical Examination***

Total Credits for M.Sc. Program: 96
Total Marks for M.Sc. Program: 2400

I. CGPA course:

1. There shall be 14 Core Courses (CC) perprogram.
2. Thereshallbe 02DisciplineSpecificElective(DSE)coursesof08creditsperprogram.
3. Thereshallbe04CoreCourseSpecialization(CCS)coursesof16creditsperprogram.
4. Total credits for CGPA courses shall be of 96 credits perprogram.

II. Mandatory Non-CGPACourses:

1. Thereshallbe02MandatoryNon-CGPAcompulsoryAbilityEnhancementCourses(AEC)of02creditseachperprogram.
2. There shall be 01 Mandatory Non-CGPA compulsory Skill Enhancement Course (SEC) of 02 credits perprogram.
3. ThereshallbeoneElectiveCourse(EC)(SWAYAM/MOOC).Thecreditsofthisco urseshallbeasspecifiedonSWAYAM/MOOC portal.
4. ThereshallbeoneGenericElective(GE)courseof02creditsperprogram.Eachstud enthastotakeGenericElectivefromthe department other than parentdepartment.
5. ThetotalcreditsforNon-CGPAcourseshallbeof08credits+2to 4credits,asspecifiedontheSWAYAM/MOOCportal.
6. Thecreditsassignedtothecourseandtheprogramshallhavenorelationwiththework-loadoftheteacher.

M. Sc. I(Alcohol Technology), Semester-I

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

	Course code	**Paper No.**		**Title of course**	
CGPA	CC-101	I	AT.1.1	Alcohol Technology-I	All courses are compulsory.
	CC-102	II	AT.1.2	Microbiology	
	CC-103	III	AT.1.3	Bio-Chemistry	
	CC-104	IV	AT.1.4	Applied Chemistry	
	CCPR-105		ATP.1	Alcohol Technology Practical- I	
Non-CGPA	AEC -106				

M. Sc. I (Alcohol Technology), Semester-II

(Alcohol Technology-II, Applied Microbiology,Industrial Fermentation–I,

Applied ProcessInstrumentation)

	Course code	**Paper No.**		**Title of course**	
CGPA	CC-201	V	AT.2.1	Alcohol Technology-II	All courses are compulsory.
	CC-202	VI	AT.2.2	Applied Microbiology	
	CC-203	VII	AT.2.3	Industrial Fermentation-I	
	CC-204	VIII	AT.2.4	Applied Process Instrumentation	
	CCPR-205		ATP.2	Alcohol Technology Practical-II	
Non-CGPA	SEC – 206				

M. Sc. II(Alcohol Technology), Semester-III

(Alcohol Technology-III, Industrial Microbiology, Chemical Engineering, Industrial Waste Treatment, Pollution: Prevention and control)

	Course code	**Paper No.**			**Title of course**
CGPA	CC-301	IX	AT.3.1	Compulsory Course	Alcohol Technology-III
	CC-302	X	AT.3.2	Compulsory Course	Industrial Microbiology
	CC-303	XI	AT.3.3	Compulsory Course	Chemical Engineering
	CC-304	XII	AT.3.4 (A)	Choose any one	Industrial Waste Treatment
			AT.3.4 (B)	Choose any one	Pollution: Prevention and control
	CCPR-305		ATP.3	Compulsory Course	Alcohol Technology Practical-III
Non-CGPA	AEC -306				

M. Sc. II(Alcohol Technology), Semester-IV

(Alcohol Technology-IV,Alcohol Technology-V,Industrial Fermentation-II, General Engineering, Business management and Marketing)

	Course code	**Paper No.**			**Title of course**
CGPA	CC-301	XIII	AT.4.1	Compulsory Course	Alcohol Technology-IV
	CC-302	XIV	AT.4.2	Compulsory Course	Alcohol Technology-V
	CC-303	XV	AT.4.3	Compulsory Course	Industrial Fermentation-II
	CC-304	XVI	AT.4.4 (A)	Choose any one	General Engineering
			AT.4.4 (B)	Choose any one	Business Management and Marketing
	CCPR-305		ATP.4	Compulsory Course	Alcohol Technology Practical-IV
Non-CGPA	AEC -306				

Shivaji University, Kolhapur
SyllabusFor

Master of Science I (Alcohol technology)

1.Title: M.Sc. Alcohol Technology

M.Sc. PartIsyllabus.

2 Year of implementation:

Syllabus willbe applicablefromJune2020

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
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 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% 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.
InIndiathereisno provisionfortheBachelorandMasterdegreesinAlcohol Technology. RecentlyMaharashtragovt.permittedtostartsuchacareerorientedcoursesunderscience & Technology faculty,accordinglywe arerunningB. Sc.(SugarTechnology) coursesincelastfiveacademicyears. Duetogrowingdemandfromindustries we started M.Sc. (Alcohol Technology).

4.General objects of the course:
The objectives of the M.Sc. (alcohol Technology) course 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 durationofM.Sc. (Alcohol technology)courseshall be oftwoyears.

6)Patternforexamination

Semesterpattern, theorypaperandpracticalatendofeachsemester.

7) Feestructure.-
Decided bycompetent authority of university / SSS

8) Implementation of fee structure:-
In case of revisionoffeestructure,thisrevisionwillbe implementedinphasewisemanner

9) Eligibility ofadmission

- B.Sc.(SugarTechnology)
- 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

10) Medium of instruction:

Themediumof instructionshallbe in English

11)TeachersQualification:

- B.Sc. DIFT
- M.Sc. (Microbiology with NET/SET& or Ph.D.)
- M. Sc. (Biotechnology with NET/SET & or Ph.D.)
- M.Sc. (Alcoholtechnology with NET/SET& or Ph. D.)
- M.Sc. (Chemistrywith 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) Structureof-course:

M. Sc. I (Alcohol Technology), (Theory– 4 papers, Practicals: 2)
Semester – 1: 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 ProcessInstrumentation	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**

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

Sr. No.	Theory– Core Subjects	Code	Credits	Marks
1	Alcohol Technology-III	AT.3.1	4	100
2	Industrial Microbiology	AT.3.2	4	100
3	Chemical Engineering	AT.3.3	4	100
4	A. Industrial Waste Treatment **or** B. Pollution: Prevention & Control	AT.3.4 (A/B)	4	100
5	Total		16	400
Practicals				
Sr.no	**Practical– Subject**	**Code**	**Credits**	**Marks**
1	Alcohol Technology-I	ATP.3.1	4	100
2	Microbiology Practical-I	ATP.3.2	4	100
	Total		24	600

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

Sr. No.	Theory– Core Subjects	Code	Credits	Marks
1	Alcohol Technology-IV	AT.4.1	4	100
2	Alcohol Technology-V	AT.4.2	4	100
3	Industrial Fermentation-II	AT.4.3	4	100
4	A. General Engineering **or** B. Business Management & Marketing	AT.4.4 (A/B)	4	100
5	Total		16	400
Practicals				
Sr.no	**Practical– Subject**	**Code**	**Credits**	**Marks**
1	In Plant Training	ATP.4.1.	4	100
2	Technical Essay	ATP.4.2	4	100
	Total		24	600

13) Schemeofteaching 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 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 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

Theoryquestionpaper (Maximummarks – 80)

TotalNo.ofquestion –7

All questionsareofequal marks.

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

- Question No.1is compulsoryandobjective Total no.ofbits– 16, Totalmarks– 16(which covermultiplechoices,fill in theblanks, definition,trueorfalse).
- Thesequestionswill beansweredalongwith otherquestionsinthe sameanswerbook.
- Remaining6 questionsaredividedinto twosections, namelysection – I and section– II.
- Fourquestionsare tobe attemptedfromthesetwosectionssuchthatnotmorethan two questionsfromany ofthesection.
- Bothsectionsare to bewritten in the same answer book.

16. Equivalence in Accordance with titles and contents of thepapers

M. Sc. Alcohol Technology Semester I

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

Old Core Course(2016)	New Core Course (2020)
Organic Chemistry (OC)	Applied Chemistry (AT.1.4)
Basics of Fermentation-I (FT)	Biochemistry (AT.1.3)
Alcohol Technology-I (AT)	Alcohol Technology-I (AT.1.1)
Microbiology-I (MC)	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(2016)	New Core Course (2020)
Bio-Chemistry (BC)	Applied Process Instrumentation (AT.2.4)
Industrial Fermentation (IF)	Industrial Fermentation-I (AT.2.3)
Alcohol Technology-II (AT-II)	Alcohol Technology-II (AT.2.1)
Microbiology-II (MC-II)	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) Specialinstructionifany

Not applicable at the first stage

Suggestions:Afterimplementation

NOTE:

i) Thedetailsoffieldwork,seminar,groupdiscussionandoralexaminationbegiven wherevernecessary.

ii) General/Specificinstructionsforlaboratorysafetyshouldbegivenwherevernecessary

18) Other feature

Intake capacity: 50

19)Laboratorysafetyequipments:

Part: I PersonalPrecautions:

- All personsmustwear safetyGogglesat all times.
- Must wear LabAprons/LabJacket and proper shoes.
- Except in emergency,over – hurried activitiesis forbidden.
- Fumecupboardmustbeused whenevernecessary.
- Eating,Drinking andSmokingin thelaboratoriesstrictlyforbidden.

Part:II: Useof SafetyandEmergency Equipments:

- First-aidKits
- SandBucket
- Fireextinguishers (drychemicalandcarbondioxideextinguishers)
- ChemicalStorage cabinetwith properventilation
- MaterialSafetyDatasheets.
- Management of Local exhaust system& fumehoods.
- Sign in registerif using instruments.

M.Sc. I (Alcohol Technology) **Semester-I**
Paper: I, Alcohol Technology-I (Code AT.1.1) **Max Marks: 100**

Unit 1. Introduction of Alcoholic beverages (15)

History and development of Alcoholic Beverages

Overview of fermentation and microorganisms: - Yeast, Lactic acid bacteria, Molds and Spoilage.

Alcoholometry:

Proof spirit, (British and USA) over proof, under proof, specific gravity of alcohol strength of alcohol in terms of concentration – related examples and solution

Unit 2. Basics concepts related to Alcohol Technology (15)

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

Unit 3.Molasses: Major Raw material used in Alcoholic Fermentations (15)

Molasses: 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 Affectingcomposition 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.

Unit 4. Details of Alcoholic Fermentation fromCane Molasses (15)

Process of Batch fermentation, factor influencing efficiency of fermentation, characteristics 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 andAttenuation 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.

Reference Books:

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- Paturao

M.Sc. I (Alcohol Technology) **Semester-I**
Paper: II, Microbiology (Code AT.1.2) **Max Marks: 100**

Unit 1: History and Scope of Microbiology [15]

a) Historical developments of microbiology and scope of microbiology.

Important contribution

b) Brief account of organization and classification of microorganisms. Differences between prokaryotic and eukaryotic cell

c) Overview of bacterial cell structure (size, shape, arrangement membrane, cell wall,cytoplasmic inclusions, mesosomes, flagella and motility, slime, capsule, pile, chemo taxis, endospore)

e) Distribution of microorganism in nature and their beneficial and harmful effects

Unit 2: Microscopy and Staining [15]

Principles and Applications of Microscopy: (i) Compound microscope (ii) fluorescence and (iii) immune fluorescence 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 (Manevals method), Endospore staining

Unit 3:Microbial Nutrition and Pure Culture Techniques [15]

A) Microbial Nutrition

a)Modern concepts 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)Semi synthetic

iv)Diffencetialv) 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 structureand 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, Mac Millan Press.
2. General Microbiology- Plezar, Tata McGraw Hill Pub.Co.Ltd., New Delhi.
3. Prescott'sMicrobiology V edn.- Prescott 2002.
4.Bergey'sManual ofSystematic Bacteriology, Springer.
5. Foundations in Microbiology- Talaro and Chess,McGraw Hill.

M.Sc. I (Alcohol Technology) **Semester-I**
Paper: III, Bio-Chemistry (Code AT.1.3) **Max Marks: 100**

Unit 1.A. Biochemistry of Living Cells: (15)

Introduction of living world, five kingdom classification, Cell, Modern Cell theory, Cell types, Significance of biochemistry to the living systems. Introduction to biomolecules and cellular pool, Introduction to Metabolism

B. Molecule of Life: Water

Importance of water in living systems, Properties of water, Weak Interactions in Aqueous Systems, Ionization of Water, Weak Acids, and Weak Bases (alkalinity and acidity of water), Types of water based on hardness, causes and sources of hardness, Buffering against pH Changes in Biological Systems, Water as a Reactant

Unit 2. Biochemistry of Carbohydrates (15)

Carbohydrates: Definition, functions and their importance in the living systems,
Classification of Carbohydrates:

a. Monosaccharides:

Classification, properties and reactions of monosaccharides taking glucose as an example, Inter-conversions of monosaccharides, Configurations of aldopentoses&aldohexoses, Epimers&epimerisation, mutarotation, Cyclic structures of glucose, fructose (pyranose &furanose forms).

b. Disaccharides:

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

c. Oligosaccharides and Polysaccharides:

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

d. Overview of the Metabolism of Carbohydrates

Including glycolysis, HMP pathway, glyoxalate cycle, TCA cycle, Entner-Duodoroff pathway, gluconeogenesis

Reducing and Non-reducing sugars
Qualitative and Quantitativeestimationof Carbohydrates;

Unit 3. Biochemistry of Proteins and Amino Acids (15)

a. Proteins:

Classification of proteins, functions of proteins, Biological importance, Common properties of proteins, colour reactions of proteins, Methods for protein Isolation,

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 propertiesand 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 functions 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, TheMacmillanCo.Newyork
2. Advanced Organic Chemistry- Behel&Behel, S. Chand & Co. Ltd, New Delhi
3. Organic Chemistry- Morrison &Byot, Pearson
4. Principles of Biochemistry- Lehninger, C.B.S. Publishers, Delhi

M.Sc. I (Alcohol Technology) **Semester-I**
Paper: IV, Applied Chemistry (Code AT.1.4) **Max Marks: 100**

Unit 1: Basic concept of Chemistry **[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 Mesoisomers, Resolution of Racemic modifications

Unit 2: Fundamentals of Organic Reaction Mechanism **[15]**

- 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 Carbene, Arynes, Nitrates.

Unit 3: 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 ethylene, 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 & 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 sulphuric acid. Reactions with potassium hydrogen sulphate.

  Uses of glycerol.

- Distinction between ethyl and methyl alcohol, amyl alcohol and its isomers, Alcohols of fuseloil, Preparation of anhydrous alcohol by azeotropic distillation
- Industrial production of ethyl alcohol from petroleum gases,
- Chemicals derived from ethyl alcohol, Gasohol,
- Detail study of reactions involved, manufacturing process, uses, list of manufacturers- Acetaldehyde, Acetic acid, Acetic Anahydride, 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 superheaters

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 pH of molasses.

2. Determination of moisture, total solids, suspended solids, dissolved solids and ash content of molasses.

3. Determination of nitrogen by colorimetric method.

4. Estimation of calcium content of molasses by: EDTA method

5. Determination of reducing sugar by Nelson-Somogy method.

6.Determination of Total Reducing Sugars in molasses by DNSA method

7. Phenol sulphuric acid method for total carbohydrate.

8.Determination of proteins by Folin-Lowry method.

9. Estimation of proteins by Biuret method.

10. Determination of Total Reducing Sugars 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 hand book- 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, stabbingaseptic 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 stabs.

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 s tri-iodomethaneiodo form.
13) Determination of pKa and pKb 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 normalityof 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) **Semester-II**

Paper:V, Alcohol Technology: II (Code AT.2.3) **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 vapor equilibrium diagrams,
- **Laws of Distillation**: Daltons, Raoults& Henry laws
- **Distillation equipments:** Columns (its design & construction, its maintenance), trays, condenser, Reboiles (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 Fermentation 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 andnational 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 tobottling,
  ii. Detailed White wine production stages - harvesting tobottling
  iii. Sparkling wine production stages - Traditional method, transferprocess 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 tonutrition, 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)

Quality 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, Compositions 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 ofSugar Industry- Paturao
6. Hand book of alcohol technology- S.V. Patil
7. Industrial alcohol technology hand book- NPCS Board of consultant &engineer
8.Hand book of enology volume–I- Pascal Ribereau
9. Wine Science Principles Practices & Perception- Ron S. Jockson
10. Wine MakingBasics-C. S. Ough
11. Principles and practices of winemaking-Roger B.Boulton

M.Sc. I (Alcohol Technology) **Semester-II**
Paper:VI, Applied Microbiology (Code AT.2.2) **Max Marks: 100**

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 and assays;

- Production strains improvement of industrial micro-organisms: Introduction of strain improvement, its application, advantages and disadvantages, methods of strain improvement, factor affecting in strain improvement program, targeted stain 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

UNIT 4: Hygiene in Alcohol Industry **(15)**

a) **Sterilization and Disinfection:** definition of sterilization and disinfection;

Physical agents: moist heat, dry heat, osmotic pressure, radiations (UV, X ray and gamma rays)**;**

Chemical Agents- characteristics of ideal disinfectant, selection of chemical antimicrobial agents phenoland phenol compound, alcohol.

d)Hygiene- Plant cleanliness and sterility; Cleanliness/sterility requirements of different stages of the process; Influence of process plant surfaces: cast iron, copper, stainless steel, wood; Importance of design features of pipe work and fittings; Principles of layout and operation of a cleaning-in-place system; The range and main constituents of cleaning and sterilizing agents; Safety requirements for handling detergents and sanitizers; Advantages and disadvantages of hot vs cold sterilization; Detection and quantification of residual surface contamination: visual inspection rinse sampling; swab sampling;

Reference Books:

1. General Microbiology- Stanier, Adel berg, and Ingraham, MacMillan Press
2. Bergey's Manual of Systematic Bacteriology- Springer
3. Foundations in Microbiology- Talaro and chess McGraw Hill.
4. Yeast Biotechnology: Diversity and Applications- Satyanarayana&Kunze; Springer
5. The Alcohol Textbook-Jacques, Lyons and Kelsall, Nottingham University Press
6. Brewing Yeast Fermentation Performance-Katherine Smart,Wiley-Blackwell
7. Brewing yeast and fermentation-Chris Boulton& David Quain, Wiley-Blackwell

M. Sc. I (Alcohol Technology) **Semester II**

Theory paper: VII,Industrial Fermentation (AT.2.3) **Max. Marks 100**

Unit 1. a. Basics of Fermentation **(15)**

Introduction: Fermentation,Aerobic and anaerobic fermentations, industrially important fermentation products, Role of fungi in various fermentations, Examples of various fermentations using fungi role of microorganisms, Factors affecting fermentation.

b. Fermenter design and types of fermenters

i) Basic components of fermenters for microbial cell culture, body construction material.

ii) Types of fermenter.Mechanical- Waldh of fermenter, Rotating disc fermenter, trickling generator, Hydrodynamic deep jet fermenter.Pneumatic-air lift fermented, Bubble-cap fermenter, Cylindroconical vessels, Ucetator, Caxitator, Photo-bioreactor tower, Packed fermenters, Cyclone column

c. Scale of operation: Introduction,Lab scale, Bench scale, Pilot scale production level.

Unit 2: Types of Fermentation **(15)**

- Introduction to Batch, Semi-continuous (Fed Batch), Continuous etc.,
- Submerged fermentation/liquid state fermentation (SmF/LSF), Solid state fermentation
- History of 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. Principles of Solid-State Fermentation Engineering and Its Scale-Up:Design and Scale-Up of Solid-State Fermentation Bioreactors,Factors Affecting Solid-state Fermentation
- Xanthan Production by SSF; Bacterial Cellulase Production by SSF
- Applications of Saccharification Using Fungal Solid State Fermentation

Unit 3. Cell Immobilization **(15)**

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) Bioreactor dying.

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, Inter relationship 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, sweet sorghum, 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 offlavor& off-flavor compounds in wine; Exo-enzymes of wine microorganisms

Reference Books—

1. Industrial Fermentations- Koeffler, Chemical Pub.Co.,Newyork

2. Modern Solid State FermentationTheory 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

M.Sc. I (Alcohol Technology) **Semester-II**

Paper: VIII, Applied Process Instrumentation (Code AT.2.4) **Max. Marks: 100**

Unit: I Basic Instrumentation and Measurement System **[15]**

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)FlowMeasurement: Orifice Plate, Magnetic Flow meter, Capacitance type, Rota meter

Unit: II Analytical Instrumentation in Distillery **[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 the following types of valve: butterfly diaphragm; gate globe; Design features and

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, temp control 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 DCVS system; SCADA system and its applications in Distillery, Programming Development Techniques related to Distillery system

Reference Books-

1)Instrument Technology, Vol.1 to 4- JonesE.B., English Language Book Society

2)Instrument Engineers hand Book-LiptakB.G., Butterworths Heinmann Ltd., Oxford

3)Industrial instrumentation and control-SinghH. 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 **100 Marks**

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 by enzyme activity.

10) Effect of temperature on enzyme activity.

11) Effect of enzyme concentration of amylases 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 hand book- 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) **Semester I**
Subject: Microbiology-II (ATP.2.2)
Practical **100 Marks**

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 plant 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

The end