



Estd. 1962
"A++" Accredited by
NAAC (2021)
With CGPA 3.52

**SHIVAJI UNIVERSITY, KOLHAPUR - 416004,
MAHARASHTRA**

PHONE: EPABX-2609000, www.unishivaji.ac.in, bos@unishivaji.ac.in

शिवाजी विद्यापीठ, कोल्हापूर - ४१६००४, महाराष्ट्र

दूरध्वनी-ईपीएबीएक्स -२६०९०००, अभ्यासमंडळे विभाग दुरध्वनी ०२३१-२६०९०९४
०२३१-२६०९४८७



SU/BOS/Science/347

Date: 24/06/2024.

To,

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

Subject: Regarding Minor Change syllabi of M.Sc. Part-II (Sem.III & IV) as per NEP-2020 (2.0) degree programme under the Faculty of Science and Technology.

Ref: SU/BOS/Science/09/ Date: 02/01/2024 Letter.

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 Minor Change in syllabi, nature of question paper and equivalence of M.Sc. Part-II (Sem. III & IV) as per NEP-2020 (2.0) degree programme under the Faculty of Science and Technology.

M.Sc.Part-II (Sem. III & IV) as per NEP-2020 (2.0)			
1.	Alcohol Technology (Entire)	2.	Sugar Technology (Entire)

This syllabus, nature of question shall be implemented from the academic year 2024-2025 onwards. A soft copy containing the syllabus is attached herewith and it is also available on university website www.unishivaji.ac.in, NEP-2020@suk(Online Syllabus).

The question papers on the pre-revised syllabi of above-mentioned course will be set for the examinations to be held in October /November 2024 & March/April 2025. These chances are available for repeater students, if any.

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

Thanking you,

**Dy Registrar
Dr. S. M. Kubal**

Copy to:

1	The Dean, Faculty of Science & Technology	4	P.G Admission / Eligibility Section
2	The Chairman, Respective Board of Studies	5	Computer Centre/ Eligibility Section
3	B.Sc. Exam/ Appointment Section	6	Affiliation Section (U.G.) (P.G.)

SHIVAJIUNIVERSITY,KOLHAPUR



Syllabus

for

M.Sc. Part-II

Alcohol Technology (Entire)

(Under Faculty of Science & Technology)

AS PER NEP– 2020

(To be implemented from Academic Year 2024 -25)

M. Sc. Programme Structure of Alcohol Technology
NEP-2020 with Multiple Entry and Multiple Exit Option
M. Sc. Part II (Semester III & IV) (Academic Year-2024-25)

Year (2 Yrs. PG)	Level	Semester	Major		Research Methodology (RM) (04 Credits)	OJT/FP (04 Credits)	Research Project	Cumulative Credits	Degree
			Mandatory Degree	Elective					
I	6.5	Sem III	MMAT 301: (4 Credits) MMAT 302: (4 Credits) MMAT 303: (4 Credits) PR-MMAT 305:(2 Credits)	E-MAT 304: (4 Credits)	FP- MMAT306 :(4credits)	---	---	22	PG Degree After Three Year UG OR PG Degree After Four Year UG Note: All the Practical's /Project will be discipline specific i.e. MMAT oriented.
		Sem IV	MMAT 401: (4 Credits) MMAT 402: (4 Credits) MMAT 403: (4 Credits)	E-MAT 404: (4 credit)	RP- In plant Training Report 405: (6 Credits)	----	---	22	
Cumulative Credits for PG Degree			26	08	10	---	--	44	
Total Cumulative Credits for 2 Year PG Degree			54	16	04	14	---	88	

Abbreviations:

PG: Post Graduation, **Yrs.:** Years, **Sem.:** Semester, **MMAT:** Major

Mandatory Alcohol Tech, **PR-MMAT:** Major Mandatory Alcohol Tech
Practical,

MEAT: Major Elective Alcohol Tech, **RM:** Research Methodology, **IT:**

Inplant Training, **RP:** Research Project. **FP:** Field Project

Semester III (Duration – Six Month)

Sr. No.	Course Code	Teaching Scheme			Examination Scheme					
		Theory & Practical			University Assessment (UA)			Internal Assessment (IA) & Practical		
		Lecture (Per week)	Hours (Per week)	Credits	Maximum Marks	Minimum Marks	Exam Hours	Maximum Marks	Minimum Marks	Exam Hours
1	MMAT 301: Alcohol Technology -III	4	4	4	80	32	3	20	8	1
2	MMAT 302: Industrial Microbiology	4	4	4	80	32	3	20	8	1
3	MMAT 303: Process Instrumentation	4	4	4	80	32	3	20	8	1
4	E-MAT 304: Industrial Waste Water Treatment/ OR Pollution, Prevention and control	4	4	4	80	40	8	20	8	1
5	PR-MMAT 305: Alcohol Technology III (Major)	--	4	2	50	20	3	--	--	12
6	RP-MMAT306: Research Project	--	--	4	--	--	---	100	40	--
	TOTAL	---	---	22	370	---	---	180	---	---

M. Sc. Programm Structure of Alcohol Technology

NEP-2020 with Multiple Entry and Multiple Exit Option

M. Sc. Part II (Semester III & IV) (Academic Year-2024-25)

Semester IV(Duration – Six Month)										
Sr. No.	Course Code	Teaching Scheme			Examination Scheme					
		Theory & Practical			University Assessment (UA)			Internal Assessment (IA) & Practical		
		Lecture re (Per week)	Hour s (Per week)	Credits	Maxi mum Mark s	Mini mum Mark s	Exam Hours	Maxi mum Mark s	Minim um Marks	Exam Hour s
1	MMAT 401: Alcohol Technology - IV	4	4	4	80	32	3	20	8	1
2	MMAT 402: Alcohol Technology - V	4	4	4	80	32	3	20	8	1
3	MMAT 403: Industrial Fermentation-II	4	4	4	80	32	3	20	8	1
4	E-MAT 404: General Engineering OR Energy conversion and Co generation	4	4	4	80	32	3	20	8	1
5	RP- 405: In plant Training	4	4	6	150	60	--	--	---	--
	TOTAL	---	---	22	470	---	---	80	---	---

M. Sc. PART-II (Semester-III)
Alcohol Technology-III (MMAT301)

At the end of the course, students will be able to-----

CO1	Understand chemical pesticides and botanical pesticides.
CO2	Learn pesticide structure chemical names and physical and chemical properties.
CO3	Acquire knowledge of pesticide formulations.
CO4	Acquire skill of using different devices which are used in pesticide application.
CO5	Get knowledge about recent advances in pest control

Unit	Syllabus	Period
01	<p>Fed batch fermentation process: Theoretical aspects of fed batch fermentation process, growth curve of fed batch fermentation process, modes of fed batch fermentation process. Process details of fed batch fermentation. Operational aspects, details of plant & machinery. Merits & demerits of the technology, Difference between continuous fermentation, batch fermentation and fed batch fermentation Systems.</p> <p>Ethanol from sugarcane Juice. Importance of ethanol from sugarcane Juice, Production details: Milling, Clarification, Evaporation (Making Syrup), Fermentation, Distillation and Dehydration</p>	15
02	<p>Alcohol from Non-molasses sources Characterization of various types of non-molasses sources for alcohol production. Process details of alcohol production from Corn, Sweet Sorghum, Tapioca, Quality aspects of alcohol from non-molasses sources, Production of alcohol from non-molasses sources in the existing molasses-based distillery.</p> <p>Production of IMFL (Whisky, Rum and Brandy)</p> <p>Whisky Introduction, history of whisky production, outline of the whisky producing process, individual operations, organoleptically important components of whisky, World-wide production of whiskies.</p> <p>Rum Introduction, production of rum, aroma compounds of rum & their formation, conclusion</p> <p>Brandy</p>	15

	Introduction, types of brandy, production of brandy, aroma compounds of brandy & their formation, conclusion	
--	--	--

<p>03</p>	<p>Multipressure distillation and Molecular sieve dehydration system. Mechanism, flow diagram and concepts behind Molecular sieve and MPR distillation. The quality aspects of spirit using MPR distillation.</p> <p>Importance of Spectroscopic and chromatographic techniques in alcohol industries Introduction to various spectroscopic and chromatographic techniques useful for alcohol industry. Role of GC-MS, GC, HPLC, HPTLC and other sophisticated instruments in analysis of molasses, fermented wash, RS, ENA, AA, SDS, beer, wine and various beverages</p>	<p>15</p>
<p>04</p>	<p>Yeast & its uses</p> <p>Introduction, Production of Brewer's yeasts Production of Baker's yeast Production of food & foodery yeasts Use of yeast and its products. Propagation of cell industrial uses of the yeast</p>	<p>15</p>

Reference Book:

1. The Alcohol Textbook – Jacques, T.P. Lyons & D.R. Kelsall
2. Alcoholometry – Satyanarayana Rao
3. Handbook of Fermentation & Distillation – A.C. Chatterjee
4. Distillation – H.C. Barron
5. Technical Excise Manual
6. Byproducts of sugar industry

M.Sc. PART-II (Semester-III)
Industrial Microbiology (MMAT302)

At the end of the course, students will be able to-----

CO1	Understand chemical pesticides and botanical pesticides.
CO2	Learn pesticide structure chemical names and physical and chemical properties.
CO3	Acquire knowledge of pesticide formulations.
CO4	Acquire skill of using different devices which are used in pesticide application.
CO5	Get knowledge about recent advances in pest control

Unit	Syllabus	Period
01	<p>History & developments Introduction, Pasteur & fermentation, The era of the discovery of antibiotics A century of growth of industrial fermentation. Enzymatic inactivation, molasses.</p>	15
02	<p>Microbiological cell & fermentation products. Baker's yeast, food and feed yeasts, bacterial insecticides, legume inoculants, mushroom Cultivation, Algae, Vitamin and growth stimulants, vitamin B12 (Cobamide), Riboflavin, vitamin A, Gibberellins, Organic acids-citric acid, fumaric acid, Itaconic acid, Kojic acid, Bacterial gluconic acid, α Ketoglutaric acid, Biofertilizer Products, Bioreactor</p>	15
03	<p>Production of single-cell proteins Introduction, Single cell protein –production, Importance and Applications, process of single cell protein Bacterial proteins, Actinomycetous, proteins, Yeast portions Fungal portions Algal portions economic aspects, future</p>	15

04	<p>Antibiotics IntroductionClassificationofAntibioticsUsesofant ibiotic,antibiotic discovery</p> <p>a) Penicillin,Streptomycin,Tetracycline, Griseofulvin,</p> <p>b)Enzymetypes,classificationanduses General aspects of Enzymes production,Amylases,Proteases,Pectinases OtherEnzymes</p> <p>c) Enzymes Discovery, Activation energy, contamination process</p>	15
----	--	----

ReferenceBook:

1. GeneralMicrobiology,IVedn.MacMillanPress.Stanier,R. Y.,Adelberg, E.A.andIngraham,J.L.
2. Microbiology,VEd.,Pelczar,M.J.,Chan,E.C.S.andKrieg,N.R.,
3. Microbiology,Prescott.L.M.,HarleyJ.P.andL.KreigD.A.
4. MicrobialBiology,Rosenberg,E&CohenI.R.
5. ByProductsofSugerIndustry-Paturao
6. WhiskyTechnology,Production&Marketing-IngeRussell

M.Sc. PART-II (Semester -III)
Process Instrumentation (MMAT 303)

At the end of the course, students will be able to-----

CO1	Understand instrument.
CO2	To understand the concept of physical variable.
CO3	To understand the concept of analytical instrumentation.
CO4	To understand the concept of signal system.
CO5	To understand the concept of automation system in distillaery.

Unit	Syllabus	Period
01	<p>Basic Instrumentation and Measurement System:</p> <ul style="list-style-type: none"> 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 Flow meter, Capacitance type, Rota meter 	15
02	<p>Analytical Instrumentation in Distillery</p> <ul style="list-style-type: none"> a) 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 	15
03	<p>Electronics System and Control System</p> <ul style="list-style-type: none"> 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 29 application in distillery plant of the 	15

	<p>following types of valve: pressure relief pressure reducing; anti-vacuum</p> <p>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.</p>	
04	<p>Process Instrumentation and Automation in Distillery</p> <p>a) Process Instrumentation: What is PI, Need of Distillery automation, Scope of automation, Automatic Process Control System, Terminology of automation</p> <p>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.</p> <p>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</p>	15

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.

ELECTIVE SUBJECT

M. Sc. PART-II (SEMESTAR III)

Industrial Waste Treatments & Environmental Management (MMAT 304)

At the end of the course, students will be able to-----

CO1	To understand the concept of waste generation.
CO2	To understand the concept of effluent.
CO3	To understand the disposal system.
CO4	To understand the concept of water disposal in distillery.
CO5	To understand the concept of environment management.

Unit	Syllabus	Period
01	<p>Waste generation & characteristics of effluent. IS norms. Biological treatment fundamentals, Waste treatment methods- Types & Selection Criteria, Aeration principles, Aeration & types of system, Composting – microbial aspects & silent features, Economics consideration in composting process, Microbiology & Conversion process in anaerobic fermentation, Kinetics of methane fermentation. Energy generation of anaerobic system, Incineration – Theoretical, considerations, types, incineration systems in practice, Type of secondary treatment system</p>	15
02	<p>Winery and brewery sanitization and waste disposal regulations Winery sanitization- The Importance of Cleaning and Sanitation in the Winery, Basic Cleaning, Water Quality, The Solution: Cleaning compounds, Cleaning Equipment, Sanitizing and Sanitizers, Sterilizing and Sterilizers, Hardware: Tanks, Pumps, Hops, Walls, Floors, Ceilings, Drains, Solid and Liquid Waste Disposal, Government Regulations, Safety, OSHA, EPA, DNR, MSDS, Sanitation Plan</p>	15
03	<p>Waste water disposal systems in industries Waste Beer, solid waste materials, waste water disposal and treatments. treatment, Disposal and Utilization, Land application of Brewery Effluents, Production of single cell protein from Brewery Effluents.</p>	15

04	Water conservation in distilleries Requirement of total water for process and non-process in typical 30KLPD molasses based distillery. Scope for water recycles of various streams for process. Cost economics of saving of water in distillery with typical case study. Importance of water conservation in distilleries Air pollution: Air pollution control principles & equipment's, Environmental Audit, Disposal of effluent & soil fertility, Environmental laws, Case studies.	15
-----------	--	-----------

Reference Books:

1. Biology of Microorganisms-T.D.Brock
2. Introduction of Waste water treatment-R.S.Ramalho.
3. Soil Biology & Ecology in India- C.A. Edwards & G.U. Veeresu, Published by university of Agricultural Sciences, Hebbal, Bangalore,
4. Environmental and Industrial Pollution control. Vol.I, R.K. Trivedi

ELECTIVE SUBJECT
Pollution Prevention & Control (MMAT304)

At the end of the course, students will be able to-----

CO1 To understand the importance of environment.

CO2 To understand the concept of BOD and COD.

CO3 To understand the concept of water treatments.

CO4 To understand the concept of pollution.

CO5 To understand the concept of

Unit	Syllabus	Period
01	<ul style="list-style-type: none"> • Importance of environments. • Bio sphere and layers of atmosphere. • Hydrological& nutrient cycles • Types of pollution, damages from environmental pollution. • Need of environmental legislations and environmental acts. Function of state &central Pollution control boards 	15
02	<p>Source, classification and characterization of wastewater.</p> <ul style="list-style-type: none"> • Physical &chemical characteristics' of waste. • BOD, COD and their importance • Types of water pollution and their effects. • Sampling and method of analysis. 	15
03	<ul style="list-style-type: none"> • Preliminary, primary, secondary &tertiary treatments of wastewater, • Sludge treatments and disposal. • Advance waste water treatments. • Recovery of material from process effluents. • Application to industries. • Norms and of treated water, 	15

<p>04</p>	<ul style="list-style-type: none"> • Air pollution-classification and source of air pollution. Air quality criteria and standard effects of air pollution on health. Vegetation and material. Air pollution control methods. • Equipment's used in industries. • Solid waste treatments-origin, classification and microbiology, properties and their variation .engineering system for solid waste management's. Generation, Handling, storage collection, transport, composting and land filling. • Noise pollution-source and determination of level .noise control criteria and noise exposure index and administrative and engineering control, Acoustic absorptive material 	<p>15</p>
------------------	---	------------------

Reference Books:

1. Environmental Pollution Control Engineering-C.S.Rao
2. Pollution Control in Process Industries-S.P.Mahajan,
3. Introduction to Environmental Engineering-Davis
4. Waste Water Engineering Treatment Disposal Reuse- Metcalf & Eddy
5. Environmental Engineering- G.N.Pandey and G.C.Carney
6. Industrial pollution– Technologies for Abatement and Control –RN Mukherjea, etal
7. HandBookofWasteManagementinSugarMillsandDistilleries–AshwaniKumar

Syllabus of Practical Courses

M. Sc. II Sem- III

Part I: Alcohol Technology-III (PR-MMAT 305)

1. Determination of Brix, Specific gravity & pH of the molasses.
2. Determination of moisture, total solid & suspended & ash content of molasses.
3. Determination of starch percent Jawar.
4. Determination of total fixed & volatile acidity of rectified spirit.
5. Fusel oil determination in Rectified spirit sample.
6. Determination of un-fermentable sugar in molasses sample.
7. Potassium Permanganate (KMnO_4) test for checking quality of spirit.
8. To determine the volatile acids in fermented wash
9. To determine the volatile acids in molasses
10. Determination of sludge percentage in molasses
11. Determination of Brix, Specific gravity & pH of sugar cane syrup.
12. Determination of total reducing sugars of sugar cane syrup.
13. Determination of un fermentable sugars of sugar cane juice syrup.
14. Screening of antibiotics producing organism by crowded plate technique.
15. Screening of amylase producing organism by replica plate technique.
16. Determination of α -amylase activity from germinating seed.
17. Determination of specific activity of inverts Enzyme.
18. Production of alcohol from fruit juice & estimation by colorimetric method.

M. Sc. II Alcohol Technology Semester-III

Title of Course: Research Project (RP-MMAT 306)

Credits= 04, 120 Hours, 100 Marks

- The students should write synopsis of proposed research work.
- The students should perform detail literature survey related to research problem.
- The students should write review article related to research problem.
- It is expected to publish the review article either in Shivaji University Journal or peer reviewed journals.
- The students should design the problem and start experimental work. The students should complete at least 25% of their experimental work during the semester III and the same work to be continued in semester IV.
- The student should submit the spiral bound copy of research work carried out during semester III including the synopsis, research proposal, review article and certified progress report.
- The Research Project will be examined jointly by internal and external examiners during the practical examination at the end of the semester.
- The students should present their work during the evaluation in the form of power point presentation (PPT) .
- Marking Scheme:

Sr. No.	Description	Marks
1	Synopsis	10
2	Research Proposal	20
3	Review article on proposed work	20
4	Daily Lab notebook record	10
5	Progress of Experimental work	20
6	Quality and effectiveness of presentation	20
	Total	100

Broad guidelines for preparation of synopsis

A. The proposed synopsis for research should be self contained and should cover the rationale for carrying out research.

B. There should not be repetition of the work or topic or theme.

C. The synopsis of the proposed research shall contain the following points :

1. Title of the Research Proposal
2. Motivation with reasoning and significance of the proposed research
3. Statement of the problem
4. Review of the relevant literature
5. Objectives of the study
6. The methodology comprising
 - a. Methods of research
 - b. Sampling design and assumptions
 - c. Conceptual framework if any
 - d. Research design (explanation of how research is being conducted and the tools used for the same)
 - e. Methods of data collection
 - f. Methods of data analysis (use of parametric and non-parametric tools and techniques as the case may be)
7. Expected outcome
8. Bibliography.

Template for Research Proposal

- Title
- Introduction
- Origin of the research problem
- Interdisciplinary relevance
- Review of Research and Development in the Subject
- Significance of the study
- Objectives
- Plan of research work

Students need to visit at least 2 sugar factory /distillery/Wine/Brewage industry and take two any issues in ongoing season from sugar industry and make project report on the same problem with their solution. Students should complete above task.

M. Sc. PART-II (Semester-IV)

Alcohol Technology-IV (MMAT401)

At the end of the course, students will be able to-----

CO1	To understand the concept of alcohol production from grain.
CO2	To understand the production of Beer.
CO3	To understand the production of malt alcohol.
CO4	To understand the concept of CPU
CO5	To understand the concept of fruits and honey wines.

Unit	Syllabus	Period
01	Alcohol production from grain Types of raw material used for alcoholic fermentation, main constituents of grain, selection of grain, grain quality & storage, grain processing, types of milling, wet milling process, liquefaction/mashing, factors affecting mashing efficiency. Alcohol production from jaggaery.	15
02	Alcoholic beverage:(Beer) Beer manufacturing process, production of malt alcohol, alcoholic beverages types and classification, Introduction, historical aspects of brewing, outline of the brewing process, malting, mashing, direct conversion of barley to wort, wort boiling and cooling, fermentation, beer treatments, beer properties, beer defects, the state of industry, acknowledgements, distilled beverages and non distilled beverages	15
03	Details of production of malt alcohol: Steeping germination, kilning, milling, mashing, fermentation, distillation and maturation and aging of malt spirit Cooling Tower: Introduction of cooling tower, types of cooling tower, a) Cross flow b) Counter flow c) Natural draft d) Forced draft. Working of cooling tower, maintenance of cooling tower, specification of distillery cooling tower, losses in cooling tower, Blow down of cooling tower. Condensate Polishing Unit (CPU) technology used in distillery industry.	15
04	Fruit & honey wines Introduction, general information, raw materials, technological processing, procedure, plum wine, pomegranate wine, rosehip wine, cherry wine, orange wine, honey wine (mead), cider production and Perry production	15

ReferenceBooks:

1. Brewingyeast&fermentation–ChrisBoulton&DavidQuain
2. ConceptsinWine Technology– YairMargalic
3. UnderstandingWineTechnology.

M. Sc. PART-II (Semester-IV)

Alcohol Technology-V (MMAT402)

At the end of the course, students will be able to-----

CO1	Understand instrument.
CO2	To understand the production of ENA.
CO3	To understand the concept of Liquors.
CO4	To understand the concept of water treatment.
CO5	To understand the concept of production of country liquor.

Unit	Syllabus	Period
01	Manufacturing of ENA from rectified sprit, detailsofprocessflowdiagram,equipment'srequiredo perationofplant.ClassificationofENA	15
02	Manufacturing of fuel alcohol, various process flow diagram, equipment's required in each process, Operation of plant.	15
03	Production of Liquors Gin &Vodka (IMFL) Introduction,productionofspiritforgin&vodka,botanicals,pr oductionofgin&vodka,compositionofspirit,gin&vodka,fini shing&bottling Cachaca & Tequila , bottling, packing of liquors. Reduction & blending of spirit. Blending and sensory analysis of various spirit and liquors. Water treatment: Importance of water in distillery industry, hard water and soft water. Process water treatment, making of soft water, and de mineralized water. Uses of soft water and D. M. water in the distillery industry. Specifications of distillery process water.	15
04	Manufacturing of the country liquor: detailed process, equipment process, bottling process, various brands of market. Cellulosic ethanol -various raw material its composition pre treatment, enzymatic treatment, fermentation, distillation Cane molasses distillery by products: Carbon dioxide, Fusel oil, Spent wash. Generation and uses of these by products.	15

Reference Books:

1. Distillation–H.C. Barron
2. Principle of fermentation technology– S.J.Hall
3. Whisky Technology production &Marketing–Tang&Rus.
4. By products of the cane sugar industry—J.M. Paturau

M.Sc.,PART-II(SEMESTAR-IV)
Industrial Fermentation Technology– II (MMAT403)

At the end of the course, students will be able to-----	
CO1	To understand the concept of fermentation.
CO2	To understand the concept of microorganism.
CO3	To understand the concept of media formation.
CO4	To understand the concept of metabolism.
CO5	To understand the concept of pH.

Unit	Syllabus	Period
01	Introduction to fermentation process Microbial biomass, Microbial enzyme, Microbial metabolites, Recombinant products, Transformation Processes	15
02	Batch culture, Continuous culture, multistage systems, feedback systems:- Internal feedback, external feedback, Comparison of Batch & Continuous culture in industrial processes, Biomass productivity, Metabolite productivity, continuous brewing, continuous culture & Biomass production, comparison of batch & continuous culture as investigative tools.	15
03	The isolation, preservation & improvement of industrially important microorganism The isolation of industrially important microorganisms, isolation methods utilizing selection of the desired characteristics:- Enrichment culture, Enrichment cultures using solidified media, Isolation methods not utilizing selection of the desired characteristics screening methods, The preservation of industrially important microorganisms, storage at reduced temperature, storage on agar slopes, Storage under liquid nitrogen, Storage in dehydrated form:- dried culture, Lyophilization, Quality control of preserved stock cultures, the improvement of industrial microorganisms, the selection of induced mutants synthesizing improved levels of primary metabolites, modification of the permeability, the isolation of mutants that do not recognize the presence of inhibitors or repressor, the isolation of mutants that do not recognize the presence of inhibitors & repressor the isolation of induced mutants producing improved yields of secondary metabolites.	15

04	Introduction, typical media, medium formulation, water, energy source, carbon source, factors influencing the choice of Carbon source: example of commonly used carbon source, carbohydrates, oil & fats, Hydrocarbons & their derivatives, Nitrogen source: - examples of commonly used nitrogen source, factors influencing the choice of nitrogen source, Minerals: chelators, growth factors, Nutrient recycle, buffers, the addition of precursors & metabolic regulators to media: precursors, Inhibitors, Inducers, oxygen requirements: Fast metabolism, Rheology, Antifoams, Medium optimization: Animal cell media, serum, serum free media supplements, protein-free media, Trace elements, Osmolality, pH, Non-nutritional media supplements.	15
-----------	---	-----------

ReferenceBooks:

- 1) Industrialmicro-biology-L.E.Casidazok
- 2) Principleoffermentationtechnology
secondeditionP.F.Standburg,A.Whotakar,S.J.Hall
- 3) Bio-technology-WalfruegerandAnnelisecruengo
- 4) Fermentationtechnology&biotechnologysecondedition

ELECTIVESUBJECTS

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

General Engineering (E-MMAT404)

At the end of the course, students will be able to-----

CO1	To understand the quality of water.
CO2	To understand the concept of pump, theorem.
CO3	To understand the concept of heat exchanger system.
CO4	To understand the concept of steam generation.
CO5	To understand the concept of Valves and types of valves.

Unit	Syllabus	Period
01	Waterquality- surfacewater,groundwater,hardwater,industrialwater,drinkingwater,domesticwater. Treatments of water - Drinking: screening or prese dimentation, coagulation, flocculation, sedimentation, filtration & disinfection. Hard groundwater-aerationsoftening,filtration,chlorination,disinfection.In dustrialwater(boilerandcooling):D.M. water, water softening, reverse osmosis, processing for TDS-membrane, distillation, freezing	15
02	Pumps - centrifugal pumps, Bernoulli's theorem, understanding of head, BHP, NPSH, impellers, other components, total suction head, total discharge head &efficiency of pumps. Valves- different type of valves, gate, ball, diaphragm, check, non return globe, butterfly plug, needle and safety/relief valves etc. valve function &basic parts of valve.	15
03	Heat exchanger unit- shell and tube heat exchanger ,condenser (vertical & horizontal), Re-boilers, Plate type heat exchanger, Evaporation- natural circulation, forced circulation, agitated film type Evaporator type- 1.single,double&multiple,2.longtuberisingorfallin g film, conventional Robert, 3. forward feed, backward feed, mixed feed, parallel feed etc.	15
04	Steam generation system Use of steam, properties of steam, boiler and its components, type of boiler ,fire tube water tube, packed FBC ,furnace its type, stoke fire, spreader stoker, travelling grate stoker. Boiler blows down method its benefits. Boiler feed water treatments, internal& external treatment.	15

Reference Books:

1. Pumps & piping handbook, IgorJ.
2. Chemicalengineeringvolume1st&2nd,J.M.Coulson.
3. Hand book of sugarcane engineering

M.Sc.–Alcohol technology Part II (Semester -IV)
Energy conversion and Cogeneration (E-MMAT404)

At the end of the course students will be able to-----

CO1	To know the concept of energy.
CO2	To understand the sources of energy
CO3	To understand the concept of transformer.
CO4	To understand the concept of DG set.
CO5	To understand the concept of motors.

Unit	Syllabus	Period
01	<p>Elements of Electro Mechanical Energy Conversion</p> <p>Introduction, Salient aspects of conversion, Energy Balance, Magnetic field system: Energy and Co energy, A simple Electromechanical system, Energy in terms ofElectricalParameters,RotaryMotion,DynamicEquationandsystemmodelofa simple system</p> <p>b) D.G. Generators Simple loop generator, Practical Generator, Yoke, pole cores and pole shoes, .pole coils ArmaturecoreArmaturewindingsCommentatorBrushesandBearingsPolepitchConductorTypesofGenerators, Measurement of generate or Efficiency charterstics of generator.</p>	15
02	<p>Manufacturing cost</p> <p>Raw material cost, harvesting& sport cost, repairing and maintenance cost, chemical cost,storeconsumptioncost,packingcost,sellingcost,distribution&admExpenses.Auditsystem.Promoterscontribution,Govt.contribution,loansfrombank,Govt.subsidy,taxcreditandrefunds,workingcapital.Managements –need, sources and determinant</p>	15

<p>03</p>	<p>a) Transformer Working principle of a Transformer, Transformer Construction Core-type Transformers. Shell -type Transformers, Elementary Theory of an ideal Transformer, D.M.F. equation of Transformer, Voltage Transformation Ratio (K) Transformer with losses but nonmagnetic Leakage, Transformer on No-load Transformer on load, Transformer with winding resistance but no magnetic Leakage Magnetic Leakage Transformer with resistance and leakage reactance, Estimation of Transformer Efficiency (at Full Load & Actual Load)</p> <p>b) Transformer Three phase Three-Phase Transformer Connection, Star/star Y/Y</p>	<p>15</p>
------------------	---	------------------

	<p>Connection,Delta-deltaconnection,Wye/delta-connection,Delta/wyeconnection</p> <p>•</p>	
04	<p>Induction Motor</p> <p>Classification of A.C. Motors, Induction Motor: General Principle & Construction, Squirrel- cage rotor, Phase-wound rotor, Production of Rotating Field; Id, Three-Phase Supply, Mathematical proof</p> <p>Why does the rotor rotate?, Slip ,Frequency of rotor current, Starting Torque of as squirrel-cage motor ,Starting Torque of a slip – ring motor Torque/Speed Curve , Current / speed curve of on induction motor</p> <p>Single- Phase Motor</p> <p>Types of single-</p> <p>phase motors, single – phase induction motor, Double – field revolving Theory, Making single– phase induction motor self-starting Types of capacitor-star motors, Repulsion type motors, Repulsion motor, Repulsion Principle</p>	15

Reference book-

- Financial management-Ravi Kishor
- Cost accounting-Jawaher Lal
- Marketing management- Tapan Panda

M.Sc.–Alcohol technology Part II (Semester -IV)
(MMAT RP405) Research Project: In plant project report
Credits= 06, 180 Hours, 150 Marks

- The student should submit the final bound dissertation/thesis copy of research work carried out during semester III and IV.
- It should include title page, certificate, declaration, acknowledgement, abbreviations, index, abstract, introduction, experimental section, results and discussion, conclusions, references, participation in conferences/seminars and publications if any.
- The students should present their work during the evaluation in the form of power point presentation (PPT) .
- **Marking Scheme:**

Sr. No.	Description	Marks
1	Dissertation/thesis bound copy	30
2	Quality of work (Innovative concepts, social relevance, extent of work etc.)	50
3	Publications	20
4	Participation in conferences	10 maximum
	a) Oral/Poster Presentation (10 marks)	
	b) Only attended (7 marks)	
5	Final Dissertation/thesis defense	40
	Total	150

Note: The Project will be examined jointly by internal (Project Supervisor) and external examiners (preferably Associate professor and above with Ph. D.) at the end of the semester. The project can be given individually or a maximum group of three students is allowed. (Not more than three students allowed).

In this course short thesis regarding scheme of project & Actual practical work. The report contents following points

- a) Factory Practice (Internship/In-Plant Training)
- b) Molasses handling and storage
- c) Yeast propagation
- d) Pre fermentation Process
- e) Main Fermentation Process
- f) Distillation process/RS mode/ENA mode
- g) Molecular sieve dehydration system/Ethanol production
- h) Effluent Treatment system
- i) CPU treatment

Nature of Question Paper for Theory and Practical:

	Theory paper	marks
1	Q.1 Answer in one sentence types of question. Attempt any two from section I. Section I: Q2: Long questions on Unit I Q3: Long questions on Unit II Q4: a) Short answer questions on Unit I b) Short answer questions on Unit II Attempt any two from section II. Section II: Q5: Long questions on Unit III Q6: Long questions on Unit IV Q7: a) Short answer questions on Unit III b) Short answer questions on Unit IV	16marks Each Question 16 marks Each Question 16 marks
2	Internal exam - It consists of 20 questions for 1 mark each.	20marks
3	Practical Examination will be Semester wise (Sem III-150+Sem IV-150)	300marks
4	<p>MMATP304</p> <p style="text-align: center;">Major Practical Minor practical Spotting Journal Viva</p> <p>MMATP305</p> <p style="text-align: center;">Major Practical Minor practical Spotting Journal Viva</p>	40Marks 20marks 20marks 10marks 10marks 20Marks 10marks 10marks 05marks 05marks
5	<p>MMATRP 405:</p> <p style="text-align: center;">In plant Project Report Presentation and viva</p>	75Marks 25Marks 50 Marks