SHIVAJI UNIVERSITY, KOLHAPUR - 416004,
MAHARASHTRA
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शिवाजी विद्यापीठ, कोल्हापूर -४१६००४,महाराष्ट्र
दूरध्वनी-ईपीएबीएक्स -२६०९०००, अभ्यासमंडळे विभाग दुरध्वनी ०२३१—२६०९०९४
०२३१—२६०९४८७

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

Ref.No.SU/BOS/Science/146 **Date: 26/05/2026**

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

Subject: Regarding revised syllabi of B.Sc. Part-III (Sem.V & VI) degree programme under the Faculty of Science and Technology as per NEP-2020 (2.0).

Sir/Madam,

With reference to the subject mentioned above, I am directed to inform you that the university authorities have accepted and granted approval to the syllabi, nature of question paper B.Sc. Part-III (Sem.V & VI) degree programme under the Faculty of Science and Technology as per NEP-2020 (2.0).

B.Sc.Part-III (Sem. V & VI) as per NEP-2020 (2.0)			
1.	Animation (Entire)	6.	Food Science and Technology (Entire)
2.	Food Science (Entire)	7.	Food Technology & Management (Entire)
3.	Biotechnology (Entire)	8.	Environmental Science (Entire)
4.	Computer Science (Entire)	9.	Sugar Technology (Entire)
5.	Information Technology (Entire)		

This syllabus, nature of question and equivalence shall be implemented from the academic year 2026-2027 onwards. A soft copy containing the syllabus is attached herewith and it is also available on university website **www.unishivaji.ac.in>Syllabus>Syllabus as per NEP2020.**

The question papers on the pre-revised syllabi of above-mentioned course will be set for the examinations to be held in October /November 2026 & March/April 2027. 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,

Yours faithfully,

Dy Registrar

Encl: as above

for information and necessary action

Copy to:

1	Dean, Faculty of Science & Technology	6	Appointment Section A & B
2	Director, Board of Examinations and Evaluation	7	I.T.Cell /Computer Centre
3	Chairman, Respective Board of Studies	8	Eligibility Section
4	B.Sc.-M.Sc. Exam Section	9	Affiliation Section (T.1) (T.2)
5	Internal Quality Assurance Cell (IQAC Cell)	10	P.G. Seminar Section

SHIVAJI UNIVERSITY, KOLHAPUR

Syllabusfor

B.Sc. Part-III Sugar Technology

(Under Faculty of Science & Technology)

ASPERNEP– 2020

(To be implemented from Academic Year 2026 – 27)

SHIVAJI UNIVERSITY, KOLHAPUR

Revised Syllabus for the Bachelor of Science in Sugar Technology (As per NEP- 2.0)

Applicable from the Academic Year 2025–26

1. **Title**: B.Sc. III Sugar Technology, Shivaji University, Kolhapur Revised Syllabus as per NEP–2.0
2. **Faculty**: Faculty of Science and Technology.
3. **Year of Implementation**: From June 2026
4. **Objectives of a Bachelor of Science (B.Sc.) in Sugar Technology program include**:
    - Understand the fundamental principles, laws, concepts and formulas of Sugar Technology.
    - Develop problem-solving skills of students.
    - Gain practical experience by hands-on experience with instruments and develop laboratory skills.
    - Learn about advanced sugar technology and its applications for higher studies.
    - Learn to apply conceptual knowledge to practical work.
    - Learn to interpret chemical and physical phenomena through experimental evidence.
    - Learn to analyze and interpret data accurately through scientific reasoning and experimental hypothesis testing.

5. **Program Outcomes:**

PO-1:-**Domain Knowledge**- Acquire advanced knowledge of in sugar industry scientific principles, theories, models and methods in the disciplines of their study.

PO-2:-**Applications**-Able to use scientific knowledge and tools deriving from domain knowledge of sugar production.

PO-3:-**Problem Analysis**- Able to identify, formulate and analyse complex problems and find out working solutions using scientific knowledge and tools in the sugar industry.

PO-4:-**Project Management**-Able to handle individual and/or group tasks and use critical thinking, problem solving and research-related skills in the sugar industry.

PO-5:-**Individual and Team work**- Able to function effectively as an individual and as a member in diverse teams and in multidisciplinary settings sugar industry.

PO-6:-**Communication Skills**-Able to communicate effectively with the surrounding people and society at large and write reports, documents and make effective presentations sugar industry.

PO-7:-**Social Awareness**- Able to demonstrate social values through acts of social commitment, display professional ethics and responsibilities showing appropriate consideration for public health, safety and welfare sugar industry.

PO-8:-**Ethics and Human Values**- Able to acquire human values and integrity of character and display moral behavior sugar industry.

PO-9:-**Lifelong Learning**- Able to recognize the need for and have the ability to engage in an independent and life-long learning in the context of drastic technological changes.

6. **Program Specific Outcomes:**

PSO-1. Students will be able to explain fundamental concepts of sugar industry.

PSO-2. Identify chemical formulae and solve numerical problems.

PSO-3. Students can use modern chemical tools, models, charts, and equipment.

PSO-4. Students will be able to prepare and qualify for competitive examinations

PSO-5. Students will understand good laboratory practices and safety.

PSO-6. Students will develop research-oriented skills.

7. The B.Sc. III Course (Sugar Technology) will be of **Two Semesters (Sem. V and Sem VI)**.
8. Pattern of Examination: The Examinations will be conducted **semester-wise for theory and practicals.**
9. **Fee structure**: As per Shivaji University guidelines.
10. **Eligibility criteria for Admission to B.Sc. Part III**:

i) The students passing or ATKT the B. Sc. Part-II (or Undergraduate Certificate in Science) shall be allowed to enter upon the B. Sc. Part-III (or Undergraduate Diploma in Science).

OR

ii) An Examination of any other Statutory University or an examining Body recognized as equivalent there to.

11. **Medium of Instruction**: English

12. **Structure of the course:** Given in the Framework Chart.

13. Scheme of Teaching and Examination:

a. Each theory course paper consists of 4 units requiring 30 hours of teaching lectures, and there shall be two lectures per theory (2 Cr) course per week.

b. B.Sc. III Sugar Technology Course will be of 44 Credits(1100 Marks).

c. Examination of each **theory course** shall be of **50 marks** (40 university examination + 10 internal assessment). University examination of 40 marks (1.5 hours' duration) will be conducted at the end of each Semester. An internal assessment of 10 marks (1 hour duration) will be done before the semester examination during each semester.

d. Examination of practical course shall be of 50 marks (2Cr) & 100 marks (4 Cr.) per semester.

e. Pattern and Nature, marking scheme for theory and Practical Examination for major-specific SEC and VSC courses are included in the syllabus.

f. Question papers will be set in view of the entire syllabus and preferably covering each unit of the syllabus. Weightage should be provided to each unit as per the hours allotted for teaching.

14. Standard of Passing: The standard of passing shall be as per the following table.

	Semester End Exam	Internal Assessment	Course Exam (Total)
Maximum Marks	40	10	50
Minimum Marks required for passing	14	4	18

i) There shall be a separate head of passing for the semester-end examination and internal examination.

ii) A minimum of 18 marks out of 50 is required for passing the practical examination of each course.

iii) Passing criteria for Co-Curricular Activities (CC) and community Engagement Program (CEP) as per the University guidelines.

15. Nature of the question paper and scheme of marking:

Theory question paper: Maximum marks - 40 Total No. of questions– 3

All questions are compulsory. Question No.1 is an MCQ type (8 Marks). Question number 2 is a long-answer type question carrying 16 marks. Question number 3 is a short-answer type question, and it carries 16 marks. (Details are provided at the end of the syllabus.)

Sem	Courses			OE	VSC/SEC	ASE/VEC/ IKS	OJT/FP	Total Credits
	Course I	**Course II**	**Course III**					
	Major		**Minor**					
Sem V	**Major IX (2)** Capacity Calculation	**Major I (2)** Alcohol Technology /Industrial Microbiology		**OE- 3(2) (T/P)**	**VSC II (2) (Major Specific) (P)** Analytical Chemistry	**AEC III (2)** (English)	**OJT (4)**	**22**
	Major X (2) Process Instrumentation	**Major P I (2)** Alcohol Technology /Industrial Microbiology						
	Major P V (a) (2) Capacity Calculation I **Major P V (b) (2)** Capacity Calculation II							
Sem VI	**Major XI (2)** Advanced Sugar Technology	**Major I (2)** Water Management in Co-generation/Applied Chemistry			**VSC III (2) (Major Specific) (P)** Sugar Analysis **SEC III (2) (P)** Sugar Instrumentation	**AEC IV (2)** (English) IKS 2 (Major Specific) (2)	**FP (2)**	**22**
	Major XII (2) Allied Sugar Manufacturing & Co products	**Major P II (2)** Water Management in Co-generation/Applied Chemistry						
	Major P VI (a) (2) Sugar Technology V **Major P VI (b) (2)** Sugar Technology VI							
Credits	**8 (T) + 8 (P) = 16**	**4 (T) + 4 (P) = 8**		**2 (T/P)**	**2(T/P) + 4 (P) = 6**	**2 + 4 = 6**	**4 + 2 = 6**	**44**

Major IX (2) Capacity Calculation

Course Outcomes (Cos): Students will be able to

CO1: Juice Heating System Design
CO2: Clarification and Juice Treatment Equipment
CO3: Evaporation and Vacuum Pan Operations
CO4: Crystallization and Centrifugation Systems
CO5: Process Design and Industrial Application

Unit– 1 **[7]**

Capacity of the juice heater

- Calculation of Juice Heater Capacity
- Calculation of juice velocity in the juice heater.
- Calculation of the number of tubes and passes in the juice heater.
- Calculation of juice inlet/outlet pipe size. Calculation of steam/vapor pipe size. Calculation of condensate pipe size, calculation of non-condensable gases pipe size. Calculation of tube plate diameter.

Unit – 2 **[7]**

Capacity of clarifier.

- Juice retention time in different types of clarifiers
- Capacity of clarifier
- Capacity of the clear juice pump, capacity of the mud pump. Capacity of flash tank, Capacity of rotary vacuum filter.
- Capacity of the Sulphitor and syrup pumps.

Unit– 3 **[9]**

Capacity of Evaporator

- Coefficient of heat transmission,
- Quantity of water evaporated,
- Properties of steam,
- Boiling point elevation.
- Heating surface of the evaporator station.
- Calculation of individual Brix
- Calculation of vapour piping.
- Steam requirement without vapour bleeding, steam requirement with vapour bleeding to the juice heater and pan.

Vacuum pan

- Optimum S/V ratio of different pans.
- Pan capacity by massecuite % cane method.
- Calculation of heating surface and number of tubes.
- Pan capacity by the solid balance method,
- Calculation of the vapour pipe& condensate pipe size, capacity of the injection pump

Unit– 4 **[7]**

Centrifugals

- Capacity of cooling crystallizers, quantity of water required for cooling
- Capacity of centrifugal, Capacity of runoff pump.
- Capacity of Melter and Melt Pump
- Capacity of the final molasses weighing scale.
- Capacity of the superheated wash water system.

Reference books:

1) Introduction of cane sugar technology by Jenkins
2) Unit operation of cane sugar production by Jon .H. Payne.
3) Manufacturing of sugar from cane sugar by G.M.Park.
4) Efficient management in the sugar factory by Mangalsing
5) Cane sugar manufacturing in India by D.P.Kulkarni

Major X (2) Process Instrumentation & Control

Course Outcomes (Cos): Students will be able to

CO1: Automation in Milling and Cane Preparation
CO2: Automation and Control in Vacuum Pan Operation
CO3: Automation in Centrifugal and Washing Systems
CO4: Distributed Control Systems (DCS) in Boiler and Turbine Sections
CO5: Industrial Automation Competency

Unit – 1 Auto Cane Feeding System **[7]**

a) Auto cane feed control system.
Introduction, Need &scope, Classification, Functional elements, Calibration
b) Imbibitions water flow rate &temperature control system.
Introduction, Need &scope, Classification, Functional elements, Calibration

Unit – 2 Mill Automation system **[8]**

a) Central lubricant control system.
Introduction, Need &scope, Classification, Functional elements, Calibration.

b) Mill drive section.
Thyristor Controlled Variable Speed D.C. Drives, Thruster Converter Station (Digital type).

Unit -3 Automation of Pan System **[8]**

a) Auto pan control system.
Introduction, Need & scope, Vacuum control system, Super saturation, control system, Feed control system, Flow diagram, Working.
b) Auto feed control of centrifugal feed. Introduction, Need &scope, Flow control, advantages, Working, DCS System for centrifugal operation, Introduction, need and scope, Massecuite charging control, Screen & sugar wash control, Sugar discharging control, flow diagram.
Auto super-heated wash system for centrifugal. Introduction, Need & scope, Temperature & pressure control, advantages, Working.

Unit-4 Automation of Power House **[7]**

a) DCS for boiler control.
Introduction, need and scope, classification, level measuring instruments, flow measuring instruments, flow diagram.
b) Turbine section.
DCS for turbine control, Introduction, need and scope, Flow diagram, Construction and working, Advantages.

Reference Book:

1) Handbook of Sugar Engineering by H. Eugot
2) Industrial automation –process control &instrumentation- By S. Medida
3) The complete book on sugar cane processing –chapter 24 By H-panda
4) Instrumentation &automation in sugar industries By-S.S. Engineering.
5) Instrumentation –Shivaji University by Anand M.S.
6) Industrial Instrumentation by H.K. Sigh

Major P V (a) (2)
Capacity Calculation I
Course Outcomes (Cos): Students will be able to

CO1: Weighing and Pumping System Calculations
CO2: Juice Treatment and Chemical Dosing Systems
CO3: Material Handling Equipment Design
CO4: Storage System Design
CO5: Practical Industrial Application

Practicals -

1. Calculate the Capacity of the juice weighing scale.
2. Calculate the Capacity of the imbibition water weighing scale.
3. Calculate the Capacity of raw juice.
4. Calculate the Capacity of imbibition water pumps.
5. Calculate the Capacity of the reaction tank, and calculate the retention time of juice in the reaction tank.
6. Calculate the Calculation for the SO2 gas distribution system.
7. Calculate the optimum dose of phosphoric acid.
8. Calculate the Capacity of lime preparation equipment with lime pumps.
9. Calculate the Capacity of the sulphur burner and air compressor.
10. Calculate the Capacity of the hopper, elevator and grader.

Major P V (b) (2)
Capacity Calculation II
Course Outcomes (Cos): Students will be able to

CO1: Perform process calculations used in sugar industries.
CO2: Understand equipment sizing and utility requirements.
CO3: Analyse thermal and material balance systems.
CO4: Improve plant efficiency, energy conservation, and sugar recovery.
CO5: Develop troubleshooting and industrial problem-solving skills.

Practical's -

1. Calculate the Capacity of the hot and cold air blower.
2. Calculate the Capacity of the sugar silo.
3. Calculate the Capacity of the molasses storage tank.
4. Calculate the Capacity of sugar storage go down.
5. Calculate sizing of mud pump, mud mixer, drum filtering area, vacuum pump, and condensers.
6. Calculate enthalpy, sensible heat, and latent heat for process steam.
7. Determine crushing capacity per hour and juice extraction rate.
8. Determine Brix, PO1, moisture, sucrose, and reducing sugar content using lab instruments.
9. Calculate main and auxiliary cooling water system flow required for plant operations.
10. Pump capacities, storage volume, and heat removal for turbine lube oil systems.

Major I

Alcohol Technology

Course Outcomes (Cos): Students will be able to

CO1: Distillation Technology and Alcohol Production
CO2: Alcoholic Beverages and Biogas Technology
CO3: Molasses and Fermentation Technology
CO4: Applied Microbiology in Alcohol Production
CO5: Industrial Application and Process Integration

Unit – I

a) **Commercial Distillation Process:** Atmospheric Distillation, MPR Distillation, MPR benefits of distillation, RS, ENA production, Production of anhydrous alcohol by dehydration with molecular sieve process.
b) **Distillation Equipments:** Columns design & construction, Maintenance, Type of trays, Type of Condenser, Type of Re-boilers.

Unit – II

a) **Alcoholic beverages:**

History of Indian alcoholic beverages, Classification of alcoholic beverages, Introduction of wine, Introduction of beer, Introduction of Indian made foreign liquor &, Country liquor
Manufacturing of methane gas, Raw material Requirement of biogas plant.

Unit – III

a) **Cane Molasses:** Composition of molasses, Gradation of molasses, storage of molasses, factors responsible for reducing the ratio (F/N) of molasses, and other uses of molasses, Definition of molasses, Total reducing sugar, and Fermentable Unfermentable sugar, Residual sugar.
b) **Definition& Type of fermenter:** Traditional batch, fed batch & continuous fermentation, Difference between batch & continuous fermentation, Alcohol production from sweet sorghum, Alcohol production from cane syrup.

Unit – IV

a) **Applied Microbiology:** Definition of yeast, Taxonomy of yeast, Morphology of yeast, Type of microorganism, Common strain of yeast used for alcoholic fermentation, Growth requirement of yeast, Yeast structure & function of cellular components, metabolic pathways of yeast, Alcoholic pathway Glycolysis of EMP pathway.
b) **Propagation of pure yeast culture:** Isolation of yeast, preservation of pure culture on agar slant, purpose of propagation, Fundamental of yeast growth(Aerobic& Anaerobic), Propagation stage & Aseptic condition.

Reference Book:

1) Text book of alcohol technology by T.P. Lyons & D.R. Kelsall.
2) Hand book of by fermentation & Distillation by A.C. Chatterjii.
3) By product of sugar industry – Paturao

OR

Industrial Microbiology

Course Outcomes (Cos): Student will able to

CO1: Fundamentals of Industrial Microbiology
CO2: Fermentation Technology and Processing
CO3: Production of Industrial Microbial Products
CO4: Applied and Environmental Industrial Microbiology
CO5: Industrial Application and Skill Development

UNIT 1: Introduction to Industrial Microbiology

1. **Scope and Importance**
   – Role of microbes in industries
   – Applications in food, agriculture, medicine
2. **Microbial Strains Used in Industry**
   – Bacteria, fungi, yeast
3. **Basic Concepts of Fermentation**

- Fermentation- Introduction
– Types of fermentation (batch, continuous, fed-batch)
– Industrial fermentation medium and formulation

UNIT 2: Fermentation Technology

1. **Bioreactors / Fermenters**
   – Structure and working of fermenters
   – Types: stirred-tank, air-lift, packed-bed
2. **Upstream Processing**
   – Sterilization, inoculum preparation
   – Media ingredients and optimization
3. **Downstream Processing**
   – Cell harvesting, filtration, centrifugation
   – Product extraction and purification

UNIT 3: Production of Industrial Products

1. **Microbial Enzymes**
   – Production of amylase, protease.
   – Applications in industry
2. **Pharmaceutical Products**
   – Antibiotics (penicillin, streptomycin)
3. **Food & Beverage Products**
   – Alcoholic beverages (ethanol)
   – Grape wine production.

UNIT 4: Applied & Environmental Industrial Microbiology

1. **Biotechnology Applications**
   – Genetic engineering in industry
2. **Microbial Fuel & Energy**
   – Biogas production
   – Bioethanol & biodiesel
3. **Waste & Pollution Management**
   – Microbial degradation of pollutants
   – Wastewater treatment using microbes

Reference Book

1. Industrial Microbiology – Prescott & Dunn

Authors: Gerald Reed, J. P. Dunne

2. Principles of Fermentation Technology

Authors: P. F. Stanbury, A. Whitaker, S. J. Hall

3. Industrial Microbiology – L. E. Casida Jr.

4. Industrial Microbiology – A. H. Patel

5. General Microbiology – Peczar, Reid & Chan

6. Bioprocess Engineering Principles – Pauline M. Doran

7. Biochemistry of Industrial Microorganisms – Prescott, Dunn & Reed

8. Fermentation Microbiology and Biotechnology

Authors: E. M. T. El-Mansi, C. Bryce, A. Demain

9. Textbook of Biotechnology – R. C. Dubey

10. Industrial Microbiology – P. Ananthanarayan & Paniker (Sections)

Major P I (2)

Alcohol Technology Practical

Course Outcomes (Cos): Students will be able to

CO1: Physico-Chemical Analysis of Molasses and Syrup
CO2: Sugar Analysis for Fermentation Suitability
CO3: Alcohol Determination Techniques
CO4: Microbiological Techniques and Yeast Handling
CO5: Laboratory Skills and Industrial Relevance

Practicals-

1) Determine the Brix of cane molasses.
2) Determination of the specific gravity of cane molasses.
3) Determination of the moisture content of cane molasses.
4) Determination of suspended solids of cane molasses/syrup.
5) Determination of P^Hmolasses / syrup.
6) Determine the reducing sugars of cane molasses/ syrup.
7) Determine the total reducing sugar of cane molasses/syrup.
8) Determine the alcohol percentage of a given alcoholic solution by the specific gravity method.
9) Determine the alcohol concentration by Sikes' hydrometer.
10) Isolation & Development of pure yeast culture.
11) Preparation & Sterilisation of culture media like: 1) MGYP 2) Nutrient Agar.
12) Preparation of MGYP slant.

OR

Industrial Microbiology Practical

Course Outcomes (Cos): Students will be able to

CO1: Laboratory Instruments and Aseptic Techniques
CO2: Media Preparation and Pure Culture Techniques
CO3: Screening and Production of Industrially Important Microorganisms
CO4: Fermentation Technology Applications
CO5: Environmental and Industrial Analysis

Practicals -

1. Study of Laboratory Instruments
– Autoclave, fermenter, laminar airflow, incubator, pH meter
– Working principles and uses

2. Preparation of Culture Media
– Nutrient agar, potato dextrose agar& Malt extract yeast extract glucose peptone agar
– Sterilisation and pouring plates

3. Isolation of Industrially Important Microorganisms
– Isolation of bacteria/yeast/fungi from soil or fermented foods

4. Maintenance of Pure Culture

– Streak plate and slant preparation
– Storage of pure cultures

5. Screening of Amylase-Producing Microorganisms
– Starch agar plate preparation
– Iodine test for clear zones

6. Screening of Antibiotic -Producing Microorganisms
– Crowded plate technique

7. Alcohol Fermentation Using Yeast
– Fermentation of sugar solution
– Detection of CO_2 production

8. Study of Fermenter / Bioreactor Components
– Parts of fermenter (aeration, agitation, sampling)
– Diagram and working

9. Citric acid fermentation, recovery and estimation by titration
– Using *Aspergillus niger*
– Simple flask fermentation

10. Amylase Production by using *Bacillus* species
11. Microbial Production of Antibiotic (Demonstration)
– Penicillium culture
– Measurement of inhibition zone (antibacterial assay)

12. Determination of COD Of sewage.

References -
1. Laboratory Manual in Microbiology – Cappuccino & Sherman
2. Microbiology: A Laboratory Manual – James G. Cappuccino
3. Industrial Microbiology Laboratory Manual – A. H. Patel

OE 3 (2) (T/P)

VSC III (2) (Major Specific) Practical

Analytical Chemistry

Course Outcomes (Cos): Students will be able to

CO1: Determine the **purity of chemical substances** such as sodium hydroxide and soda ash using standard titrimetric methods.
CO2: Prepare and standardise chemical indicators, including **Bromothymol Blue (BTB) solution** and BTB pH paper for laboratory applications.
CO3: Analyse food samples (jaggery powder and sugar) for quality parameters such as purity, reducing sugars, starch content, moisture content, and net rendement using appropriate analytical techniques.
CO4: Perform quantitative estimation of acetic acid in commercial vinegar using acid–base titration with standard sodium hydroxide solution.
CO5: Determine nitrogen content in nitrogenous fertilisers using standard chemical analysis methods (e.g., Kjeldahl method).
Practicals -

1. Determination of Purity of Sodium Hydroxide.
2. Preparation of B.T. B. solution.
3. Preparation BTB pH Paper.
4. To determine the purity of the Jaggery Powder.
5. To determine the reducing sugar of the Jaggery Powder.
6. To determine the Net Rendement of the Jaggery Powder.
7. To determine the Net moisture of the Jaggery Powder.
8. To determine starch content in the sugar.
9. Determination of Percentage of Acetic Acid In Commercial Vinegar Using NaOH
10. Determination of the percentage of nitrogen present in the given sample of Nitrogenous fertilizer.
11. Determination of the percentage purity of a given sample of soda ash.
12. Determination of total hardness of water using 0.01M EDTA solution.

AEC III (2)

English

OJT (4)

The course will be run as per the guidelines of Shivaji University and the Government of Maharashtra. Under this course, students are required to enroll for on Job Training(OJT) in the sugar Industry. This course is designed to offer students for gaining practical skills hands on experience that complements their academic learning and enhances their professional readiness.

To support students in this transition, the department needs to organise lectures, workshops, and seminars to mentor them with the necessary knowledge and skills. Most of our graduates are expected to seek employment in industries, pursue teaching careers or establish small enterprises after obtaining their B.Sc. Degree.

Note – Students have to spend a minimum of 120 hrs for OJT

Report Submission and Evaluation

i) Student of the University Department is required to submit a hard copy of a detailed report of their OJT to the department.
ii) Students from affiliated colleges must submit their detailed report of OJT at their respective colleges for further evaluation.
iii) The OJT will be evaluated as per the guidelines.

B.Sc. Part III Sugar Technology Semester VI

Major XI Advanced Sugar Technology

Course Outcomes (Cos): Students will be able to

CO1: Understand juice screening, bagasse removal, and the advantages of rotary and DSM screens.
CO2: Operate juice stabilisation and automatic pH control systems.
CO3: Analyse modern clarification methods like filtrate and syrup clarification.
CO4: Explain SRT clarifiers, decanters, and muddy juice treatment.
CO5: Understand film-type sulphur burners and their automation.
CO6: Apply steam economy principles and use steam-saving devices.
CO7: Operate pan automation systems for batch and continuous processes.
CO8: Control centrifugal operations with auto-feed and wash water systems.
CO9: Integrate instrumentation and automation for process efficiency and product quality.

Unit - I **[7]**

a) screening of the juice
Effect of bagasillo on manufacturing process, its removal by DSM screen, rotary screen & two stage rotary screens, Advantage of rotary Screen
b) Juice stabilisation & pH control system
An online mass flow meter for juice weighing, and an auto pH control system for juice clarification.

Unit –II **[8]**

a) New trends in clarification
New trend in juice clarification- filtrate and syrup clarification, Advantages of both processes above
b) S.R.T
Tray less clarifier or short retention time (S.R.T.) Clarifier, construction and working
c) Decanter
Muddyjuice treatments, construction and working
d) Sulphur Burner
Film-type sulphur burner, Instrumentation and automation for film-type sulphur burner.

Unit – III **[7]**

a) Steam Economy
Vapour bleeding and steam economy, Basic requirement of steam, Steam requirement when vapor are used for entire juice heating, Steam requirement when vapor are used for juice heating and pan boiling, Online conductivity measurement of condensate water, Flashing of condensate, Different steam saving devices used in sugar industries

Unit IV **[8]**

a) Pan Automation
Pan boiling instrumentation and automation system for batch and continuous pan, Automatic Brix and temperature measurement of molasses conditioner, Automatic Brix and temperature measurement of Melter
b) Centrifugal control

Auto feed control system for centrifugal, Wash water system for centrifugal.

Reference Books:

1) Hand book of sugar engineering By-H.Eugot
2) Hand book of cane sugar By-R.B.L.Mathur
3) Cane sugar engineering By-Peter Rein
4) Machinery and equipments of cane sugar factory- By Tromp.

Major XII (2) Allied Sugar Manufacturing& Co products

Course Outcomes (Cos): Students will be able to

CO1: Understand the manufacturing of raw sugar, jaggery, and jaggery powder.
CO2: Explain the production of refined and Khandsari sugar.
CO3: Analyse composition and industrial uses of molasses.
CO4: Evaluate utilisation of bagasse for energy, boards, furfural, and paper.
CO5: Assess uses of filter cake in fertiliser, bio-gas, fuel, and cattle feed.

Unit - 1 **[8]**

Manufacturing of raw sugar: Clarification process, Crystallisation process, Centrifugal process, Manufacturing of Jaggery &Jaggery powder: Extraction &clarification of juice, Concentration of juice to rab, Drying & packing of Jaggery, Crystallisation process of Jaggery powder, Curing, Drying and packing of Jaggery powder

Unit - 2 **[7]**

Manufacturing of refined sugar: Types of refineries, Mingling and affination process, Clarification of. Refine Melt Evaporation & crystallisation, Specification of refined sugar b) Manufacturing of Khandsari sugar Specification of Khandsari sugar, Extraction &clarification of cane juice, Open pan boiling system, Purging, drying & packing system

Unit – 3 **[7]**

Molasses Composition of molasses, storage of molasses, Quality of molasses –pre clarification of molasses, Molasses for production of alcohol process, Molasses for production of yeast process, Molasses for production of acetone process, Molasses for production of glycerin process, Molasses for production of cattle feed process, other uses of molasses in different countries, Production of ethanol from cane juice

Unit - 4 **[8]**

Composition of bagasse, storage of bagasse, Separation of pith from bagasse, Production of pulp and paper from bagasse process, Production of particle board and fiber board from bagasse process, Production of corrugated boards and boxes from bagasse process, Production of furfural from bagasse process, Production of methane & product gas from bagasse process, Other use of bagasse and bagasse ash, Generation of surplus power from bagasse, Composition of filter cake, Use of filter cake as fertilizer process, Use of filter cake for production of cane wax process, Use of filter cake for production of bio-gas process, Use of filter cake as fuel process, Use of filter cake as cattle feed process

Reference Books:

1) Handbook of Sugar Refinery by Chung Chi Chou
2) Manufacture &refining of raw sugar By-v.e.Baikow
3) Ethanol & distillation by H.C. Barron
4) The book on sugarcane processing & by-products of molasses – H. Panda.

5) Process synthesis for fuel ethanol production - C.A. Cardona.
6) Kale U.M
7) (1990) glance at distillery by-products DSTA 40thconvention.

Major P VI (a) (2)
Sugar Technology V

Course Outcomes (Cos): Student will able to

CO1: Determine dextran levels, turbidity, and intermediate color in juice, molasses, sugar, syrup, and massecuite.
CO2: Measure preparative index and Java ratio for assessing sugarcane quality.
CO3: Quantify chemical parameters such as CaO% and SO_2% in sugar.
CO4: Evaluate primary extraction efficiency and sugar quality through analytical tests.
CO5: Apply laboratory techniques for sugar quality control, data analysis, and interpretation of results.

Practical's -

1. Determination of Dextran in PJ,MJ,CJ.
2. Determination of Intermediate colour in Juice and molasses.
3. Determination of Turbidity in Juice.
4. Determine Preparatory index of Cane Sample.
5. Determination of Java Ratio.
6. Determination of primary extraction.
7. Determination of CaO % in Sugar.
8. Determination of SO_2 % in Sugar.
9. Determination of Dextran in Sugar.
10. Determination of Turbidity in Sugar.

Major P VI (b) (2)
Sugar Technology VI

Course Outcomes (Cos): Students will be able to

CO1: Determine intermediate colour in syrup, massecuite, melt, CFW, and CAW.
CO2: Determine Fehling factor of Fehling Solution A & B.
CO3: Analyse sludge content in final molasses.
CO4: Estimate ash content in raw, brown, white, refined sugar, and molasses using GS methods.
CO5: Apply laboratory techniques for sugar quality control, data analysis, and interpretation of results.

Practicals -

1. Determination of intermediate colour in syrup & massecuite.
2. Determination of intermediate colour in melt & CFW, CAW.
3. Determination of the fehiling factor of the fehiling solution A & B.
4. Determination of sludge in final molasses.
5. Determination of Ash in Raw Sugar by GS1/3/4/7/8- 13.
6. Determination of Ash in Brown Sugar by GS1/3/4/7/8- 13.
7. Determination of Ash in white & Refine sugar by GS2/3/9- 17.
8. Determination of Ash in Molasses by GS 1/3/4/7/8- 13.
9. Study of DCS system at Mill & Boiler Section.
10. Study of the DCS system at the Pan Section.

Major I (2) Water Management In Cogeneration

Course Outcomes (Cos): Students will be able to

CO1: Understand water properties, sources, and industrial uses.

CO2: Apply water treatment methods including filtration, chlorination, and ion-exchange.

CO3: Explain membrane technologies and their industrial applications.

CO4: Manage boiler and cooling water treatments and maintenance.

CO5: Perform water analysis and interpret laboratory results.

CO6: Implement automation, safety, and environmental control measures.

Unit – I **[7]**

a) Water

Water properties &nature, Source of water, Uses of water &basic chemistry, Water-related table

b) Treatments

Filtration, Clarification, Oxidation, Chlorination, De-aeration

c) Ion–exchange method

Softner, De-alkalization, Demineralisation application &limitation, Resin

Unit – II **[8]**

a) Membrane technology

Ultrafiltration, Nanofiltration, Reverse Osmosis, Electro-dialysis

b) Boiler water treatments

Feed water treatment, Condensate treatment, Boiler water treatment, Boiler blow down, Reasons of boiler failures, Boiler preventive maintenance, tubes internal chemical cleaning, Boiler feed & boiler water treatments, Boiler water limits, Carryover& priming in boiler.

Unit – III **[7]**

a) Cooling tower &cooling water treatments

Need for a cooling tower, Classification of cooling tower, Cooling tower maintenance, Cooling tower technical definition &calculations, Treatment of cooling water (physical &chemical), Problems in cooling water treatments

b) Analytical methods &lab equipments

Recommended analytical methods, Recommended analytical equipment, Composition of reagents, Expression &interpretation of analytical results

Unit – IV **[8]**

a) Analysis of

Raw water, clarifier water, filter water, soft water, ultra filtration water, R.O.water, D.M.Water &mixed bed water, make-up and recalculating water

b) Automation and Instrumentation for safe working at

Water treatment, Effluent treatment, In-plant control method, Environmental acts and guidelines

c) Air pollution

Source& control equipment's

Reference Books:

1) Efficient management in sugar industries by Mangalsingh
2) Geoeconomical study of waste water management of sugar industries by-S. A.Manglekar
3) Gebetz hand book
4) Nalco water treatments
5) Albtros hand books
6) AppaAwha hand book

OR

Major I Applied Chemistry

Course Outcomes (Cos): Students will be able to

CO1: Apply colourimetry methods for measurement and comparison.
CO2: Perform gravimetric and titrimetric (acid–base & complexometric) analyses.
CO3: Understand soaps, synthetic detergents, and their differences.
CO4: Apply basic principles of green chemistry and modern reaction techniques.

Unit I:

Colorimetry-

General Discussion, Classification of Methods of Colour, Measurement or Comparison, Exercises

Unit II:

Theory of Gravimetric & Titrimetric Analysis-

Introduction, precipitation, process of precipitation, purity of precipitation, Role of Organic precipitation in Gravimetric Analysis, Exercises

Introduction, Acid –Base Titration or Neutralisation Titrations, Complex Metric Titration Exercises

Unit III:

Soaps and Detergents-

Introduction, Soaps Detergents (Synthetic Detergents) or Syndets, Comparison between Soaps and Detergents, Exercises

Unit IV:

Introduction, Twelve Principles of Green Chemistry, Zeolites, Biocatalytic Reactions, Introduction to Microwave Assisted Reaction, Exercises

References

1. Textbook of Quantitative Inorganic Analysis – A.I.Vogel
2. Instrumental Methods of Chemical Analysis- Willard, Merit Dean
3. Instrumental Methods of Chemical Analysis- Chatwal & Anand
4. Principal of Electroplating & Electroforming-Blum &Hogaboom
5. Vogel's Text Book of Quantitative Inorganic Analysis-Bassett, Denny, Jeffrey, Mendham
6. Chemical Process Industries-Shreve & Brink
7. Environmental Chemistry-A.K. De
8. Basic Concept of Analytical Chemistry- S.M.Khopkar
9. Industrial Chemistry-R.K.Das

10. Analytical Chemistry- Walton

11. Green Chemistry: Environment-Friendly Alternatives-Rashmi Sanghi and M.M.Srivastava

12. Advances in Green Chemistry Chemical Synthesis Using MW-irradiation- R.S.Varma

Major P II (2)
Water Management in Co-Generation Practical

Course Outcomes (Cos): Students will be able to

CO1: Determine chemical parameters of water, including ammonia, chloride, dissolved oxygen, pH, and silica.

CO2: Measure physical properties like electrical conductance and oil/grease content.

CO3: Analyse boiler feed water and blow-down water for quality assessment.

CO4: Evaluate scaling and corrosion indices to prevent boiler and plant issues.

Practicals -

1. Determination of Ammonia in water.
2. Determination of Chloride in water.
3. Determination of Electrical Conductance of Water.
4. Determination of Higher Silica in Boiler Water.
5. Determination of Lower Silica in Boiler Water.
6. Determination of Dissolved Oxygen in Water.
7. Determination of Oil Grease in Waste Water & Water.
8. Determination of pH of boiler feed water.
9. Analysis of boiler feed water quality.
10. Analysis of boiler blow-down water.
11. Determination of scaling and corrosion indices.

Major P II (2)

Applied Chemistry Practical

Course Outcomes (Cos): Students will be able to

CO1: Determine chemical content and purity of substances like antacids, vitamin C, boric acid, and milk/food samples.

CO2: Perform titrimetric and potentiometric analyses, including strong/weak acid-base determinations and saponification value.

CO3: Apply thin-layer chromatography (TLC) for separation, identification, and Rf value determination.

CO4: Study acid-base equilibria, dissociation constants, and buffer preparation.

CO5: Verify Lambert–Beer's law and measure pH of various solutions for analytical evaluation.

Practicals -

1. Determination of alkali content of an antacid tablet using HCL.
2. To determine the percentage of vitamin c in the given Vitamin C tablet
3. Thin-layer chromatography. Separation, identification and Determination of Rf values of Nitroanilines and phenols.
4. To determine the Saponification Value (Sap –value) of the given Oil.
5. To determine the normality of a strong acid by titrating it against a given strong alkali by the potentiometric method
6. To study the effect of the substituent on the dissociation constant of weak acid with respect to acetic acid and monochloroacetic acid (Cell constant to be given)
7. To verify Lambert-Beer's law by using a copper sulphate solution calorimetrically.
8. To determine the dissociation constant of monobasic acid (Acetic acid).
9. Determination of the percentage purity of boric acid using the supplied Sodium hydroxide.
10. Determination of titrable acidity in the given sample of 'milk' or 'Lassi' using supplied sodium hydroxide (Standard oxalic acid solution to be prepared to standardize the given sodium hydroxide solution).
11. Measurement of the pH of different solutions like aerated drinks, fruit juice, shampoos and soaps.
12. Preparation of acidic buffer and measurement of pH.

VSC III (2) (Major Specific) Practical

Course Outcomes (Cos): Students will be able to

CO1: Understand the working of cane preparation devices, mills, and mill rollers.
CO2: Explain the operation of rotary screens, juice heaters, and juice clarifiers.
CO3: Analyse evaporators, pan sections, crystallizers, and centrifugal machines.
CO4: Understand material handling equipment like hoppers, elevators, and graders in the sugar industry.
CO5: Apply practical knowledge of sugar processing machinery for industrial operations.

Practicals-

1) To study the working of Cane preparation devices in the sugar industry
2) To study the working of the mill in the sugar industry
3) To study the working of the mill roller in the sugar industry.
4) To study the working of the rotary screen in the sugar industry.
5) To study the working of the boiler in the sugar industry.
6) To study the working of the juice heater in the sugar industry.
7) To study the working of the juice clarifier in the sugar industry.
8) To study the working of the evaporator in the sugar industry.
9) To study the working of the pan section in the sugar industry.
10) To study the working of the Crystallizer section in the sugar industry.
11) To study the working of the centrifugal machine in the sugar industry.
12) To study the working of the hopper, elevator, and grader in the sugar industry.

SEC III (2) Practical

Course Outcomes (Cos): Students will be able to

CO1: Understand the working of pressure and vacuum measurement instruments.
CO2: Operate temperature, differential pressure, flow, and level transmitters.
CO3: Use pH meters for juice clarification and process monitoring.
CO4: Understand the application of PLCs in sugar mill automation.
CO5: Apply instrumentation knowledge for process control and industrial operations.

Practicals -

1. To study the Bourdon Tube Pressure Gauge
2. To study the Vacuum Gauge
3. To study Temperature Indicators (Thermocouple / RTD)
4. To study the Differential Pressure (DP) Transmitter
5. To study the Flow Transmitters (Ultrasonic / Magnetic / Rotameter)
6. To study Level Transmitters (Capacitance / Ultrasonic / Float type)
7. To study the pH Meters used in juice clarification
8. To study the PLC (Programmable Logic Controller) used in sugar mills

AEC IV (2)

English

IKS 2 (Major specific) (2)

FP (2)

The course will be run as per the guidelines of Shivaji University and the Government of Maharashtra. Under this course, students are required to enroll for on Field Project (FP) in the sugar Industry. This course is designed to offer students for gaining practical skills hands on experience that complements their academic learning and enhances their professional readiness.

To support students in this transition, the department needs to organise lectures, workshops, and seminars to mentor them with the necessary knowledge and skills. Most of our graduates are expected to seek employment in industries, pursue teaching careers or establish small enterprises after obtaining their B.Sc. Degree.

Note – Students have to spend a minimum of 60 hrs for FP

Report Submission and Evaluation

i) A student of the University Department is required to submit a hard copy of a detailed report of their FP to the department.
ii) Students from affiliated colleges must submit their detailed report of FP at their respective colleges for further evaluation.
iii) The FP will be evaluated as per the guidelines.

B.Sc. III (Sugar Technology) Syllabus (NEP-2.0)

To be implemented from June 2026 on wards

Semester V & VI

Nature of Question paper

Total Marks 40 Time: 1.5 Hours

Q.1Choose the correct alternative and rewrite the sentence again. 8 Marks

a)

b)

c)

d)

e)

f)

g)

h)

Q.2. Attempt any TWO of the following (Out of Three) 16 Marks

a)

b)

c)

Q.3. Answer any FOUR of the following (Out of SIX) 16 Marks

a)

b)

c)

d)

e)

f)

B.Sc. III (Sugar Technology) Syllabus (NEP-2.0)

To be implemented from June 2026 onwards

Semester V & VI

Outline of Internal Assessment

Time Duration: 1 Hour

Level	Semester	Activities Per Semester	Marks
5.5	V & VI	Case Study/ Field Work/Book Review/Poster Presentation/Mid Term	10