

**SU/BOS/Science/348**

**Date: 24/06/2024.**

**To,**

The Principal, All Concerned Affiliated Colleges/Institutions Shivaji University, Kolhapur	The Head/Co-ordinator/Director All Concerned Department (Science) Shivaji University, Kolhapur.
--	---

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

**Ref:** SU/BOS/Science/556 Date: 25/07/2023 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-I (Sem. I & II ) as per NEP-2020 (2.0) degree programme under the Faculty of Science and Technology.


<b>M.Sc.Part-I (Sem. I &amp; II) as per NEP-2020 (2.0)</b>			
1.	Chemistry	3.	Sugar Technology (Entire)
2.	Alcohol Technology (Entire)	4.	

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](http://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.)

**SHIVAJI UNIVERSITY, KOLHAPUR**



**Syllabus for**

**M.Sc. Part - I**

**Sugar Technology (Entire)**

**(Under Faculty of Science & Technology)**

**AS PER NEP – 2020**

**(To be implemented from Academic Year 2023-24)**

1. **Title:** M. Sc. in Sugar Technology, Shivaji University, Kolhapur, Syllabus as per NEP 2020.

2. **Faculty:** Faculty of Science and Technology

3. **Year of implementation:** For M. Sc. I (Semester I and Semester II): From **June 2023** and for M. Sc. II (Semester III and Semester IV): From **June 2024**.

**4. Vision:**

Leading edge Technology for the Sugar and allied industries.

**5. Mission:**

a) To emerge as one of the most preferred institutes by providing high technical knowledge of sugar and allied industries.

b) To impart quality education in the field of sugar and alcohol technology to achieve the needs of Sugar and allied industries.

c) To prepare young technocrats with sound footing of basic technical & managerial skills.

Research capabilities to lead and use technology for the progress of sugar and allied industries.

**6. Core Values:**

1. Quality Education    2. Social Service    3. Sound Character  
4. Global Competence    5. Scientific Temper    6. Environmental Consciousness

**7. Programme Outcomes:**

**Programme Outcomes- M. Sc. Sugar Technology**

After the completion of two-year post-graduation program students will be able to acquire the following attributes.

<b>PO 1</b>	<b>Domain Knowledge-</b> Acquire knowledge of fundamentals, models, basic scientific principles and methods in Sugar industry.
<b>PO 2</b>	<b>Application-</b> Able to apply fundamentals, techniques, skills and tools of sciences in new contexts sugar industry.
<b>PO 3</b>	<b>Analysis-</b> Able to analyses problems scientifically and find solutions sugar industry.
<b>PO 4</b>	<b>Project Management-</b> Able to undertake projects/tasks, plan and implement effectively sugar industry.
<b>PO 5</b>	<b>Individual and Team Work-</b> Able to work both as an individual and together with people of different socio-cultural backgrounds sugar industry.
<b>PO 6</b>	<b>Communication Skills-</b> Able to use proper communication skills for successful interaction in personal and public life sugar industry.
<b>PO 7</b>	<b>Social Awareness-</b> Able to undertake activities informed by social values (such as social equity), social issues and cultural diversity sugar industry.
<b>PO 8</b>	<b>Environment and Sustainability-</b> Develop consciousness to preserve the earth's finite resources and balance human needs and the environment sugar industry.

<b>PO 9</b>	<b>Ethics and Human Values-</b> Apply ethical principles and appreciate the importance of ethical practices in professional life and uphold human dignity sugar industry.
<b>PO 10</b>	<b>Lifelong Learning-</b> Able to acquire emerging knowledge and skills and adapt to the changing needs of the times sugar industry.

## 8. Programme Specific Outcomes:

After the completion of the two-year postgraduate programme in Sugar Technology students will be able to -----.

**PSO 1:** Learn about Sugar Production and Sugar Manufacturing and sugar structure, chemical names and physical and chemical properties.

**PSO 2:** Gain knowledge about soil formation, soil profile, soil properties and composition. Sugar properties.

**PSO 3:** Understand general characteristics, morphology and physiology microorganism, plant virus and viral diseases, disease management and control.

**PSO 4:** Acquire knowledge of production of Sugar and Sugar marketing and planning.

**PSO 5:** Understand the concept of ecology and interrelationship among.

## 9. The entire M. Sc Programme will be of four semesters spread over two years.

**10. Pattern of Examination:** Theory examination will be conducted Semester wise and Practical examination will be conducted annually.

**11. Fee Structure:** As per University rules and guidelines

### 12. Eligibility for admission:

Admission to the course for the candidate passing B. Sc. degree with Sugar technology/Physics/Chemistry/Mathematics/Agriculture, B.Tech. Food/Chemical Technology, B. E. Chemical Engineering/Instrumentation / Mechanical Engineering.

Candidate will be selected through entrance exam and fulfilling the conditions laid by as per the University rules. Merit list will be prepared based on the performance at entrance examination.

**13. Medium of Instruction:** English

### 14. Structure of course:

- Distribution of Marks – Internal evaluation: 20
- External evaluation: 80 (Semester exam)
- Total Marks for M.Sc. Degree
- Theory Papers: 1500
- Practical course: 700
- Total: 2200

➤ Total CGPA Credit: 88

### 15. Scheme of Teaching and Examination:

(Applicable to University Department and University affiliated colleges' centres).

- ❖ Each unit in theory course shall comprise 15 lectures, each of 60 minutes duration and there shall be four lectures per theory course per week.
- ❖ Entire course of M. Sc. Sugar Tech will be of 2200 marks.
- ❖ Examination of each theory course shall be of 100 marks (80 University Examination + 20 Internal Assessments). University examination of 80 marks (3 hours' duration) will be conducted at the end of each Semester. Internal assessment of 20 marks will be conducted before the semester examination during each semester.
- ❖ Examination of practical course shall be semester pattern and is of 300 marks.
- ❖ Question papers will be set in the view of the entire syllabus and preferably covering each unit of the syllabus.

### 16. Standard of Passing:

There will be separate passing for theory courses and practical courses. Minimum 40% marks will be required for passing separately for theory and practical courses.

### 17. Nature of Theory & practical question paper and scheme of marking:

#### Theory

Question No.	Type of Question	Total Marks (80)
Q.1.	Answer in one sentence (total 16 questions)	16
SECTION I		
Q.2.	Long answer type questions. Attempt any two out of three.	16
Q.3.		16
Q.4.		16
SECTION II		
Q.5.	Short answer type questions. Attempt any two out of three.	16
Q.6.		16
Q.7.		16

## **Practical**

Practical Examination will be semester pattern.

**M. Sc. I:** (MMSTP104Major) Practical I: Sugar Technology I – 100 marks

(MMSTP105Minor) Practical II: Sugar Technology II– 50 marks

(MMSTP204Major)Practical III: Sugar Technology III – 100 marks

(MMSTP205Minor) Practical IV: Sugar Technology IV – 50 marks

**MMSTP206 FP:** 100 marks.

**M. Sc. II:** (MMSTP305) Practical I: Sugar Technology V – 50 marks

(MMSTP306) Research Project – 100 marks

(RP 405 Major) Practical III: In plant Training – 150 marks

**M. Sc. Programme Structure of Sugar Technology**  
**NEP-2020 with Multiple Entry and Multiple Exit Option**

**M. Sc. Part I (Semester I & II)**  
**(Academic Year-2022-23)**

Year (2 Yrs. PG)	Level	Semester	Major		Research Methodology (RM) (04 Credits)	OJT/FP (04 Credits)	Research Project	Cumulative Credits	Degree
			Mandatory Degree (20 Credits)	Elective					
I	6.0	Sem I	MMST 101: (4 Credits) MMST 102: (4 Credits) PR-MMST 104: (4 Credits) PR-MMST 105: 2 Credits	E-ST 103: (4 Credit)	RMST 106: (4 Credits)	----	---	22	PG Diploma In Sugar Technology (After Three Year B.Sc. Degree) Note: All the Practical's/Pro ject will be discipline specific i.e. MMST oriented.
		Sem II	MMST 201: (4 Credits) MMST 202: (4 Credits) PR-MMST 204: (4 Credits) PR-MMST 205: (2 Credits)	E-ST 203: (4 Credits)	---	FP206: (4 Credits)	---	22	
Cumulative Credits for PG Diploma			28	08	04	04	---	44	Exit Option
Exit Option: PG Diploma (40-44) Credits) after three Year UG degree									

**Abbreviations:**

**PG:** Post Graduation, **Yrs.:** Years, **Sem.:** Semester, **MMST:**Major Mandatory Sugar Tech,

**MMSTP:**Major Mandatory Sugar Tech Practical, **MEST:**Major Elective Sugar Tech,

**RM:** Research Methodology, **OJT:** On Job Training, **FP:** Field Project.

## M. Sc. Programme Structure (NEP-2020) of Sugar Technology

### M. Sc. Part I (With effect from June 2023)

<b>Semester I (Duration – Six Month)</b>										
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	MMST 101: Sugar Processing – I	4	4	4	80	32	3	20	8	1
2	MMST 102: Sugar Engineering	4	4	4	80	32	3	20	8	1
3	E-MMST 103: Sugarcane Agriculture I <b>OR</b> E-MMST 103 : Sugar & Biochemistry	4	4	4	80	32	3	20	8	1
4	PR-MMST104: Sugar Technology I	---	8	4	100	40	6	---	---	---
5	PR-MMST105: Sugar Technology II	---	4	2	50	20	6	---	---	---
6	RM 106: Research Methodology	4	---	4	80	32	3	20	8	1
<b>TOTAL</b>		---	---	<b>22</b>	<b>470</b>	---	---	<b>80</b>	---	---

#### Abbreviations:

**PG:** Post Graduation, **Yrs.:** Years, **Sem.:** Semester, **MMST:** Major Mandatory Sugar Tech, **MMSTP:** Major Mandatory Sugar Tech Practical, **MEST:** Major Elective Sugar Tech, **RM:** Research Methodology, **OJT:** On Job Training, **FP:** Field Project.



## M. Sc. Programme Structure (NEP-2020) of Sugar Technology

### M. Sc. Part I (With effect from June 2023)

<b>Semester II (Duration – Six Month)</b>										
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	MMST 201: Sugar Processing – II	4	4	4	80	32	3	20	8	1
2	MMST202:Chemical Engineering	4	4	4	80	32	3	20	8	1
3	E-MST 203: Sugarcane Agriculture II <b>OR</b> E-MST 203: Organic & Physical Chemistry	4	4	4	80	32	3	20	8	1
4	PR-MMST204: Sugar Technology III	---	8	4	100	40	6	---	---	---
5	PR-MMST205: Sugar Technology IV	---	4	2	50	20	6	---	---	---
6	FP 206: Field Project	---	4	4	---	---	---	100	40	---
<b>TOTAL</b>		---	---	<b>22</b>	<b>390</b>	---	---	<b>160</b>	---	---

#### **Abbreviations:**

**PG:** Post Graduation, **Yrs.:** Years, **Sem.:** Semester, **MMST:** Major Sugar Tech,

**MMSTP:** Major Sugar Tech Practical, **MEST:** Major Elective Sugar Tech, **RM:** Research

Methodology, **OJT:** On Job Training, **FP:** Field Project.

## **M. Sc. Sugar Technology (Part-I) (Semester-I)**

**(Introduced from Academic Year 2023 – 24)**

**Title of Course: Sugar Processing-I (Clarification & Evaporation) (MMST101)**

**Total Credits: 04**

**Course Outcomes:** Upon successful completion of this course, the student will be able to

1. Acquire knowledge of Introduction of sugar industry & flow chart of sugar manufacturing process, Extraction of juice from cane, Maceration or imbibitions
2. Acquire knowledge of Composition of cane and juice, Principle of juice clarification, Influence of lime on different constituents of juice, Effects of pH on sucrose and reducing sugar, Action of heat on sucrose and reducing sugar, Different process of cane juice clarification, Defecation, Sulphitation and carbonation, Comparison between sulphation & carbonation.
3. Acquire knowledge Theory of evaporation – Introduction, quantity of water evaporated from juice, Heat transfer in evaporator, Boiling point of juice, Norbert Relux principle applicable to multiple effect evaporators.
4. Acquire knowledge of Operation of evaporator, Off season testing of evaporator, Starting of evaporator, Juice level in evaporator, Condensate and non- condensable gas removal, Flash recovery of condensate, Use Of condensate ,Stopping of evaporator.
5. Acquire knowledge of Treatment of syrup, Construction and working of syrup sulphitor, Scale formation and removal.

Unit	Syllabus	Lectures
I	<p>Introduction of sugar industry &amp; flow chart of sugar manufacturing process, Extraction of juice from cane, Maceration or imbibition's and their scheme Mill sanitation and type of biocides used, Effects of fine bagasillo on juice clarification &amp; its separation, Equipment's detail and operation of DSM screen &amp; Rotary screen, Weighing and metering of juice, Equipment detail and operation of Maxwell Boulogne scale and mass flow meter with calibration, Object of juice heating, Construction and working of vertical tubular juice heater, Removal of Condensate and non-condensable gas, Calculation of heating surface, Concept of vapor line and dynamic Juice Heater, Construction and working of DCH and PHE, Basic chemical required for clarification, their specification. Preparation of milk of lime (MOL) and its equipment details. Separation of grit from MOL, Production of SO<sub>2</sub> gas by furnace Quantity of air required for burning, Equipment detail and operation of continuous &amp; film type furnace, Roll of phosphate in juice clarification and its use.</p>	15
II	<p>Composition of cane and juice, Principle of juice clarification, Influence of lime on different constituents of juice, Effects of pH on sucrose and reducing sugar, Action of heat on sucrose and reducing sugar, Different process of cane juice clarification, Defecation, Sulphitation and carbonation, Comparison between sulphitation &amp; carbonation, Principle of subsidation, Factors affecting the subsidation, Speed of subsidation Construction and operation of DORR multi-feed clarifier, 444 Rapi clarifier, Importance of short ration clarifier, its construction and operation, Preparation of settling chemical and its use, juice and mud removal, Condition for good filtration, Preparation of mud, Construction and working of vacuum filter, Washing of cake, Mini condenser or vacuum pump, Quality of filtrate and its treatment, Decanter for muddy juice treatment, Advantages of decanter</p>	15
III	<p>Theory of evaporation – Introduction, quantity of water evaporated from juice, Heat transfer in evaporator, Boiling point of juice, Norbert Rolex principle applicable to multiple effect evaporators</p> <p>Construction of Robert type evaporator, Different types of evaporator body, Entrainment and entrainment separator Condenser and type of condenser, Quantity of water required for condention, Vapor velocity and vapor piping</p>	15

IV	<p>Operation of evaporator, off season testing of evaporator, Starting of evaporator, Juice level in evaporator, Condensate and non- condensable gas removal, Flash recovery of condensate, Use Of condensate, Stopping of evaporator ,Vapor bleeding and steam economy, Basic requirement of steam, Steam economy when vapor used for juice heating, Steam economy when vapor used for juice heating and pan boiling, Steam saving device</p> <p>Treatment of syrup, Construction and working of syrup sulphitor, Scale formation and removal</p>	15
----	--	----

**Reference books:**

- 1) Principle of sugar technology vol I P. Honig
- 2) Principle of sugar technology vol II P. Honig
- 3) Principle of sugar technology vol III P. Honig
- 4) Hand book of sugar refinery chung chi chou
- 5) Manufacturing and refining of raw sugar – Baikow
- 6) By product of cane sugar industries Paturau.
- 7) Cane sugar hand book R. B.L.Mathur

## M. Sc. Sugar Technology (Part-I) (Semester-I)

**Title of Course: Sugar Engineering- Milling, Boiler (MMST102)**

**Total Credits: 04**

**Course Outcomes:** Upon successful completion of this course, the student will be able to

1. Acquire knowledge of Cane weighbridges: types, capacity etc.
2. Acquire knowledge of Cane preparations Preparation of cane, various devices of cane preparation like kicker, chopper, leveler, cutter fibrizer and shredder.
3. Acquire knowledge of Boiler and Boiler accessories.
4. Acquire knowledge of steam & power generation.
5. Get knowledge about recent advances sugar technology.

Unit	Syllabus	Lectures
I	<p>Cane weighbridges: types, capacity etc.</p> <p>Cane handling and feeding Cane unloading - Bridge with trolley – having sling bar system – two motion/three motion, auto de-hooking system</p> <p>Feeder table – size, slope, chain, breaking strength, power consumption, drive etc</p> <p>Cane carrier – horizontal &amp; inclined carrier, feeding length, Width of carrier, Speed of carrier, capacity of carrier, power consumption of carrier, Types of carrier 1) single cane carrier 2) Split cane carrier.3) Rake cane carrier 4) Belt carrier, Tramp iron sepetor.</p> <p>Cane preparations Preparation of cane, various devices of cane preparation like kicker, chopper, leveler, cutter fiberize and shredder</p> <p>Measurement of preparation index by bulk density method, sieving method, leaching method.</p>	15

II	<p>Mills and mill components – Conventional three roller mill.</p> <p>Mill Headstocks, Mill rollers &amp; rollers grooving</p> <p>Grooving types – V-grooves, Messchaert grooves &amp; chevron grooves lotus roller, Mill hydraulic system, Mill bearings &amp; their types Mill roller pinions, Trash &amp; Scrapper plates.</p> <p>Mill drive types with merit and demerit, Mill power requirement, Mill gearing, Mill couplings and tail bars</p> <p><b>Mill setting</b> – Roller setting, pressure feeder setting, underfeed roller setting, Donnelley chute opening, trash plate setting, practical optimization of mill setting</p> <p>Checking of mill performance by Brix curve</p> <p><b>Imbibition's</b> – Objects of imbibition's, Types of imbibition's, Hot and cold water for imbibition's, Its Merit and demerit, Imbibition control system</p>	15
III	<p><b>Steam Generation: (Boiler)</b> - Properties of steam, Fuel (Bagasse), characteristics of Bagasse, combustion Bagasse, Furnaces (Spreader Stoker &amp; Travelling Grate),Boiler mountings:stop valve, Safety valve, blowdown valve water level gauge glass, Boiler accessories: Super heater, Economizer, Air preheater, Boiler feed water tank &amp; pump deration I.D, F.D.&amp;S.A f a n s, Chimney,electrostatic participator etc.</p> <p><b>Boiler Instrumentation &amp; Control</b> - Various flow meter to measure flows like steam, feed water, Level indicator for Drum water, Pressure indicator for steam pressure, Temperature indicator for various points,All these points to be connected to data logger for recording</p> <p><b>Boiler water treatment</b> - Use of condensate, Feed water specification and treatment (Internal &amp; External), DM &amp; RO Plants, analytical control.</p>	15
IV	<p><b>Power generation and Alternator</b></p> <p>a) Power generation – Classification, description &amp; working of extraction &amp; double extraction cum condensing and fully condensing type turbines, specific steam consumption.</p> <p>b) Alternator – sugar factory requirements, size, type, voltage, power factor &amp; efficiency, 3 phase AC generation, and power transmission system.</p>	15

**Reference Book.**

- 1] Hand book of cane sugar-E. Hugot
- 2] Cane sugar engineering-Peter Rain.
- 3] Machinery & equipments of sugar factory-L. A. Tromp
- 4] cane sugar hand book-R. B. L. Mathur
- 5] Modern milling of sugar cane:Maxwell
- 6] Standard fabrication practices of cane sugar mill-Delden.
- 7] The energy cane alternative-Alexander
- 8] Cane sugar manufacturing in India – D. P. Kulkarni

## M. Sc. Sugar Technology (Part-I) (Semester-I)

### Title of Course: Sugarcane Agriculture I (E-MST103)

Total Credits: 04

**Course Out Comes:** Upon successful completion of this course, the student will be able to

1. Origen of Cane, cultivation in India, varieties, climatic conditions, sugarcane agro climatic zones in India. Sugarcane pricing and payment.
2. **Soil:** Types, properties – Visual & morphological properties, analytical properties, fertility & soil problems, sustaining fertility, soil conservation practices.
3. **Planting:** Preparatory tillage, planting time, selection of seed cane, methods of planting -Flat, ridges & furrows, trench, IISR86206,ring, spaced Transplanting & poly bag seedling Transplanting method.
4. **Growth of Sugarcane:** Germination, development of shoot &root - factors affecting, tailoring, growth of leaves, internodes &stem, factors influencing cane growth,formation and storage of sugar in cane.
5. Get knowledge about recent advances in ethanol plantation

Unit	Syllabus	Lectures
I	<p><b>Introduction:</b> Origen of Cane, cultivation in India, varieties, climatic conditions, sugarcane agro climatic zones in India. Sugarcane pricing and payment,</p> <p><b>Soil:</b> Types, properties – Visual &amp; morphological properties, analytical properties, fertility &amp; soil problems, sustaining fertility, soil conservation practices,</p> <p><b>Planting:</b> Preparatory tillage, planting time, selection of seed cane, methods of planting -Flat, ridges &amp; furrows, trench, IISR 86206, ring, spaced Trans planting &amp; polybag seedling Transplanting method.</p> <p><b>Growth of Sugarcane:</b> Germination, development of shoot &amp; root - factors affecting, tailoring, growth of leaves, internodes &amp; stem, factors influencing cane growth, formation and storage of sugar in cane.</p>	15
II	<p><b>Irrigation:</b> Water requirement, scheduling, method of irrigation – surface, overhead or sprinkler, drip irrigation, water quality, water logging, drainage – side, main &amp; infield drains.</p> <p><b>Manu ring:</b> Cane nutrition, functions of macro &amp; micro (trace) nutrients, fertilizers – N, P, K, S, Ca &amp; Mg carriers,</p>	15



	<p>Mixed or compound fertilizers, biofertilizers, foliar applications, fertigation, organic &amp; green manuring, time &amp; method of application, visual symptoms of nutrient deficiencies and disorders.</p> <p><b>Weeds:</b> Common weeds, aquatic weeds, losses due to weeds, methods of weed control – mechanical, manual, chemical (time, method &amp; dosage), integrated weed management, measures to reduce the weeds.</p> <p><b>Pests:</b> Leaf eating &amp; sucking insects, stalk attacking insects, root attacking insects, soil insects &amp; Non insect species</p> <p><b>Diseases:</b> Major diseases (red rot, smut, pineapple, mosaic, wilt etc), period of occurrence, control measures (chemical &amp; biological), losses due to pests &amp; diseases, plant protection measures.</p>	
III	<p><b>Ripening:</b> Methods of judging ripeness or maturity, factors affecting ripening, accelerating ripening, chemical ripeness.</p> <p><b>Harvesting:</b> Manual &amp; mechanical harvesting of cane, transportation of cane, post-harvest deterioration of sugarcane – causes, effect &amp; losses, effect of extraneous</p> <p><b>Ratooning:</b> Definition, yield &amp; quality, number of ratoons, advantages and disadvantages, area and productivity, causes for low ratooning, tillering, varieties for good ratoons, removal of compaction, gap filling, fertilizer application, water requirement</p>	15

IV	<p>Breeding technique in sugarcane, Introduction, varieties, scope of varietal planting, cytology, raising of seed cane crop – Ideal seed cane, seed cane treatment, measures to obtain higher germination, transplanting technique and its advantages, Breeding Methods Introduction and germ plasma collection, Clonal Selection, Hybridization. Mutation breeding, Objectives of sugarcane breeding, Breeding for yield, lodging resistance, resistance to frost, resistance to drought, resistance to water logging, resistance to diseases, resistance to insect pests and quality.</p> <p>Sugarcane breeding institutes in India. Physiology of sugar cane under normal condition, Physiology of sugar cane under normal saline condition, Rapid screening parameters for salt stress, Agro-technology to improve germination under saline condition, Work on the physiology on various sugar cane clones.</p>	15
----	--	----

### Reference Books:

- 1) Hartmann and Kester's – Plant propagation – Principles and practices – Hudscan T. Hartmann, Dale E. Kester, Fred T. Davies, Jr. Robert L. Geneve.
- 2) Textbook of Plant Physiology – C. P. Malik.
- 3) Diseases of Crop Plants in India – G. Rangaswami and A. Mahadevan
- 4) 4)Plant Pathology – R. S. Mehrota
- 5) Practical cytology – Applied Genetics and Biostatistics – H. K. Goswami and Rajeev Goswami.
- 6) Recent Advances in Plant Diseases Vol – 1 to 5 – K. M. Chandaniwala.
- 7) Introduction to Principles of Plant Pathology – R. S. Singh.
- 8) An introduction to Plant Anatomy – Author R. Eames and Laurence H. Mac Deniels.
- 9) Genetics and Plant Breeding – E. B. Babcock.
- 10) Plant Taxonomy – O. P. Sharma.
- 11) Plant Breeding – Theory and Techniques – S. K. Gupta.
- 12) Breeding Asian Field Crops – John Milton Poehlman and DhirendranathBorthakur.
- 13) Crop Production and Field Experimentation – Dr. V.G. Vaidya, K. R. Sahastrabudhe, Dr.V. S. Khuspe.
- 14) Agricultural Problems of India – A. N. Agrwal and Kundam Lal.

## M. Sc. Sugar Technology (Part-I) (Semester-I)

### Title of Course: Sugar and Bio chemistry (E-MST103)

Total Credits: 04

**Course Out Comes:** Upon successful completion of this course, the Student will be able to

1. Understand chemical Properties **Carbohydrates**.
2. Acquire knowledge of **Proteins & Amino acids**—Learn alcohol structure chemical names and physical and chemical properties.
3. Acquire knowledge of **Sucrose** – formulations.
4. Acquire skill of using different devices **Sugar Derivatives & Sugar Alcohols**
5. Get knowledge about recent advances in ethanol plantation

#### UNIT:I - Carbohydrates:

[15]

- Introduction—Etymology, History: accent time, middle age & modern. Chemistry of sugar, Constituents of sugar, Natural polymers of sugars, Flammability of sugar. Types of sugar, Monosaccharide's – Glucose, Fructose, Disaccharides –sucrose, lactose & maltose.
- Forms of sugar and its use. Health effects of sugar- Blood glucose level – Obesity and Diabetics, Cardiovascular disease - Alzheimer's disease Tooth decays – Addiction forming Hyper activity-Measurement.
- Introduction and Classification of Carbohydrates with suitable examples.
- Reactions of Monosaccharide such as a) Mutal rotation b) Alkaline degradation c)Rearrangements d)Acidic degradation e) Polymerisation f) Caramelisation.
- Di & Polysaccharides: Structures and properties of sucrose, Maltose, Lactose, Starch & Cellulose (chain structures)

#### UNIT: II - Structure And Properties of Sugar

[15]

- Physical & Chemical properties of sugar.
- Physical properties of sucrose-structure of sucrose molecule, sucrose derivative, decomposition of sucrose.
- Chemical properties of sucrose, sucrose molecule, crystalline sucrose, amorphous sucrose, aqueous sucrose. Solution(solubility, density, viscosity, surface tension, boiling point, freezing point, rotation of polarized light)
- Physical properties of reducing sugar: Physical properties of reducing sugar (dextrose & laevulose) solubility, density, refractive index, optical rotation.
- Chemical properties of reducing sugar (dextrose & laevulose) with organic reagent Acetone, benzoic, carbonate, acetate. With inorganic reagent :Phosphate sodium, chloride salt, calcium levitates.
- Decomposition reaction with alkaline, solution & acid solution, oscillation reaction with iodine.

#### UNIT: III– Bio molecules

[15]

- Introduction to living cells, classifications of living cells, structure and function of cells, Structure and typical characteristics of DNA & RNA.
- Proteins: Characteristics and classifications of proteins, protein structure, proteins in sugarcane juice.
- Amino acids: Classifications and properties, Amino acids in

sugarcane juice and molasses.

**UNIT: IV - Carbohydrate Metabolism And Enzymology**

[15]

- Carbohydrate metabolism: Glycolysis, TriCarboxylic Acid (TCA) cycle, Pentose phosphate pathway, Glyoxylate cycle.
- Enzymes: Definition, classification, mechanism of enzyme action, factors affecting reactivity, industrial applications of enzyme

**Reference Books:**

1	Organic Chemistry	:	Hendrickson, Cram, Hammond
2	Organic Chemistry	:	Morrison & Boyd
3	Organic Chemistry	:	Volume I & III. L. Finar
4	Organic Chemistry	:	Pine
5	Advanced Organic Chemistry	:	Sachin kumar Ghosh
6	Advanced Organic Chemistry	:	B.S. Bahl & Arun Bahi
7	A guide book to Mechanism in Organic chemistry	:	Peter Sykes
8	Stereochemistry of organic Compounds	:	Kalsi
9	Stereochemistry of Carbon Compounds	:	Eliel
10	Text book of organic chemistry	:	P.L.Soni
11	Text book of practical organic Chemistry	:	A.I.Vogel
12	Advanced organic chemistry	:	Reactions, Mechanism & Structure Jerry March
13	Organic Chemistry	:	M.R.Jain
14	Organic Chemistry	:	J.M.Shaigel

## M. Sc. Sugar Technology (Part-I) (Semester-I)

**Title of Course: Sugar Technology-I (Routine analysis) (PR-MMST104)**

**Total Credits: 04**

### **SUGAR TECHNOLOGY- I**

- 1) Preparation of indicator solutions and test papers for pH determination of – Raw Juice (Methyl Orange) & Sulphite Juice (Bromothymol Blue)
- 2) Determination of pH of given sample by test paper and PH meter.
- 3) Determination of total dissolved solids (Brix) of given sample of juice by Hydrometer and hand refractor meter.
- 4) Determination of apparent Purity of given sample of juices.
- 5) To determine the purity of given sample of syrup and molasses.
- 6) To determine the purity of given sample of Masecuite
- 7) To determine purity of final molasses
- 8) To determine pol % and moist. % of Bagasse.
- 9) To determine pol % and moist. % of filter cake.
- 10) To determine sucrose of juice by –
  - a) double polarization method (Jackson & Gilis)
  - b) Fehling's method.
- 11) To determine reducing sugar of juice by
  - i) Eyon and lane method
  - ii) Luffs method
- 12) To determine sucrose of final molasses by
  - i) Double polarization method (Jackson & Gilis)
  - ii) Fehling's method.
- 13) To determine reducing sugar of final molasses by
  - a. Eyon and lane method
  - b. Luffs method
- 14) To determine total reducing sugar of final molasses.

**M. Sc. Sugar Technology (Part-I) (Semester-I)**

**Title of Course: Sugar Technology–II (Routine analysis) (PR-MMST105)**

**Total Credits: 02**

- 1) Analysis of white sugar for
  - a) Moisture (loss on drying)
  - b) Pol % by polarmeter
  - c) Sucrose by Jackson & Gillis
  - d) Reducing sugar by ofner method
  - e) Ash (sulphated & conductivity)
  - f) Grading of sugar in term of ISS
- 2) Analysis of raw sugar for
  - a) Moisture (loss on drying)
  - b) Pol % by Polari meter
  - c) Sucrose by Jackson & Gillis
  - d) Reducing sugar by Offer method
  - e) Ash (sulphated & conductivity)
  - f) Color in solution
  - g) Grain size by test sieve.
- 3) Analysis of Jaggery for
  - a) Moisture (loss on drying)
  - b) Pol % by polarimeter
  - c) Reducing sugar
  - d) Net Rendenment
- 4) Determination of melting point of sucrose and boiling point of Different concentration sugar solutions
- 5) The Determination of Insoluble Matter in White Sugar
- 6) The Determination of the Particle Size Distribution of White Sugar by sieve method
- 7) Analysis of raw and white sugar for colour by MOPS method.
- 8) To determine sulphur dioxide (so<sub>2</sub>) in sugar.

## **M. Sc. Sugar Technology (Part-I) (Semester-I)**

**Title of Course: Research Methodology (RM 106)**

**Total Credits: 04**

**Course Outcomes:** Upon successful completion of this course, the student will be able to

1. Acquire knowledge of Introduction to research methodology
2. Acquire knowledge of Sampling Techniques and Testing of Hypothesis.
3. Acquire knowledge of Computer Applications.
4. Acquire knowledge of Scientific Writing.
5. Get knowledge about Parts of Research report articles – introduction, review of literature, methodology, results & discussions and conclusions.

### **UNIT-I Research Methodology: [15]**

- Introduction to research methodology
- Formation of problems
- Formation of Hypothesis
- Research Design- Explorative, Descriptive, Diagnostic & Experimental
- Data Processing and classification
- Types of research

### **UNIT-II Sampling Techniques and Testing of Hypothesis [15]**

Concept of Data collection & Sampling, Methods of Sampling – Simple random sampling, stratified random sampling, cluster sampling. Advantages & limitations of sampling. Concept of testing of hypothesis

1. Testing of population mean and equality of two population means for large samples.
2. Testing of population proportion and equality of two population proportions.
3. Testing of population mean and equality of two population means for small samples.
4. Chi-square test for – i) testing independence of two attributes  
ii) testing variance

### **UNIT-III Computer Applications: [15]**

History and generations of computers; (I, II, III, IV and V), Hardware; CPU, input, output, storage devices, classifications of computers; analog computers, digital computers, mainframe computers, mainframes computers, microcomputers. Memory: Primary memory or main memory; magnetic core memory, RAM, ROM, Secondary memory or auxiliary memory. The students will learn how to operate a PC. Execution of linear regression, X-Y plot, statistical data interpretation.

#### **UNIT-IV Scientific Writing:**

**[15]**

Different forms of Scientific writing - Articles in Journals, Research notes, Review articles & Dissertations, Conference presentation, Bibliographies. Drafting titles, sub-titles and formatting tables. Use & guidelines of appendices. Parts of Research report articles – introduction, review of literature, methodology, results & discussions and conclusions.

#### **References:**

- 1) Research Methods and Techniques, C. R. Kothari (2019) New Age International Publishers.
- 2) Research Methodology – A Step by step Guide for Beginners 2nd edition Kumar Ranjit, Pearson Education, Singapore, 2005.
- 3) Introduction to Research and Research Methodology, M. S. Sridhar.
- 4) Practical Research Methods, Catherine Dawson, UBS Publishers Distribution, New Delhi 2002.
- 5) Computer Education by Prof. Lalini Varanasi, Prof. V. Sudhakar, and Dr. T. Mrunalini, Neelkamal Publications PVT. LTD.
- 6) Basic Computing Principles by B. West, BPB Publications, New Delhi
- 7) A Hand Book of Research Methodology, R. P. Devdas & K. Kulandaivel
- 8) Research Methods, S. P. Gupta
- 9) Methods of Research, C. V. Good & D. E. Scafes.



## M. Sc. Sugar Technology (Part-I) (Semester-II)

**Title of Course: Sugar Processing – II (Crystallization & Finishing) (MMST201)**

**Total Credits: 04**

**Course Out Comes:** Upon successful completion of this course, the student will be able to,

1. Theory of crystallization & its zones, Grain & graining methods, Principles & practices in graining process, Mechanism of pan boiling, Different Masecuite boiling scheme, Principles and practices in pan boiling.
2. Learn Construction of pan, Types of pan, Pan control & instrumentation, Cobenze's method for purity control, Calculations of masecuite % cane & molasses % cane by solid balance, Determination of crystal % masecuite, Determination of crystal size, volume and surface area, etermination of steam requirement.
3. Acquire knowledge of Centrifugal operations - Screen washing, Sugar washing, Masecuite charging, Separation of light and heavy molasses, Spinning and drying, Discharging Superheated wash water system.
4. Acquire skill of using Screen washing.
5. Get knowledge about recent advances in pest control.

Unit	Syllabus	Lectures
I	Theory of crystallization & its zones, Grain & graining methods, Principles & practices in graining process, Mechanism of pan boiling, Different masecuite boiling scheme, Principles and practices in pan boiling.	15
II	Construction of pan, Types of pan, Pan control & instrumentation, Cobenze's method for purity control, Calculations of masecuite % cane & molasses % cane by solid balance, Determination of crystal % masecuite, Determination of crystal size, volume and surface area, determination of steam requirement for masecuite boiling, Crystallization by cooling, Type of air and water cooled crystallizers, Various zones and their retention time in cooling process, Exhaustion of molasses its calculation & various factor affecting exhaustion	15
III	Centrifugal theories, Centrifugal forces, Mean equivalent radius, Gravity factory, Time cycle, Capacity of basket, Moment of inertia, Power requirement, Constructions of batch machine, types of drive and control, Constructions of continuous machine types of drive and control	15

IV	Centrifugal operations - Screen washing, Sugar washing, Masecuite charging, Separation of light and heavy molasses, Spinning and drying, Discharging Super-heated wash water system Sugar Melter capacity, control system for temperature & Brix Pug mill, magma & run off tank. Molasses weighing scale construction, operation Theory of drying & cooling Drying and cooling of sugar on hopper, fluidized bed drier, Rotary drier Grading of sugar, packing of sugar Stitching and weighing of sugar Keeping quality of sugar, storage of sugar Specification of sugar as per IS standard. Constriction of godown & storage of molasses Sugar handling & transporting system	15
----	---	----

**Reference Books:**

1. Principle of sugar technology, Vol I, P. Honig
2. Principle of sugar technology, Vol II, P. Honig
3. Principle of sugar technology, Vol III, P. Honig
4. Hand book of sugar refinery, Chung Chi Chou
5. Manufacturing and refining of raw sugar, Baikow
6. By product of cane sugar industries, Paturau
7. Cane sugar hand book, R. B. L. Mathur
8. Cane sugar manufacturing in India, D. P. Kulkarni

## M. Sc. Sugar Technology (Part-I) (Semester-II)

**Title of Course: Chemical Engineering (MMST202)**

**Total Credits: 04**

**Course Out Comes:** Upon successful completion of this course, the student will be able to

1. Understand Theory Heat transfer → Conduction- Mechanism of heat transfer by conduction in solids, Fourier's law of heat transfer, Thermal conductivity, and heat loss in conduction. Thermal insulation and optimum thickness for insulation.
2. Convection- Heat transfer by convection, forced and natural convection, individual and overall heat transfer coefficient. Fouling factor, overall resistance Effect of drop wise and film wise condensation, Effect of non condensable gases.
3. Acquire Heat Transfer Equipment: → Heater- multipass shell and tube type heat exchanger- shell, tubes, tube pitch ligaments' (clearance), tube passes, Baffles.
4. Acquire skill Fluid statics- Concept of momentum transfer, Nature of fluid and pressure concept, variation of pressure with height- hydrostatic equilibrium. Barometric equation, measurement of fluid pressure manometer.
5. Get knowledge about recent Chemical Engineering-(Heat & Momentum Transfer)

Unit	Syllabus	Lectures
I	<p><b>Heat Transfer:</b></p> <ul style="list-style-type: none"><li>• Conduction- Mechanism of heat transfer by conduction in solids, Fourier's law of heat transfer, Thermal conductivity, and heat loss in conduction. Thermal insulation and optimum thickness for insulation.</li><li>• Convection- Heat transfer by convection, forced and natural convection, individual and overall heat transfer coefficient. Fouling factor, overall resistance. Effect of drop wise and film wise condensation, Effect of non- condensable gases.</li><li>• Radiation -heat transfer by radiation. Kirchhoff's law, Stefan-Boltzmann law</li></ul> <p><b>Heat Transfer Equipment:</b></p> <ul style="list-style-type: none"><li>• Heater – multi-pass shell and tube type heat exchanger-shell, tubes, tube pitch ligaments' (clearance), tube passes, Baffles.</li><li>• Condenser - types of condenser co-current &amp; counter current. Derivation of overall heat transfer coefficient from hot fluid to cold fluid Through metal wall</li></ul>	15

II	<p><b>Fluid Transfer:</b></p> <ul style="list-style-type: none"> <li>• Fluid statics - Concept of momentum transfer, Nature of fluid and pressure concept, variation of pressure with height- hydrostatic equilibrium. Barometric equation, measurement of fluid pressure manometer</li> <li>• Fluid flow - Type of fluids, viscosity of gases and liquids, types of flow laminar &amp; turbulent, Reynolds number, basic equation of fluid flow, Average velocity, and mass velocity, continuity equation, flow of incompressible fluids. Laminar flow through circular conduit, turbulent flow through pipes, friction factor</li> </ul> <p><b>Fluid transfer Equipment:</b></p> <ul style="list-style-type: none"> <li>• <b>Pumps</b> – positive displacement and centrifugal pumps, Fans, compressor &amp; blower, Metering of fluids Pipes, Fitting and valves, measurement of liquid and gas flow rates by orifice meter, venturi meter, rotameter and pilot tube</li> </ul>	15
III	<p><b>Size reduction:</b></p> <ul style="list-style-type: none"> <li>• Necessity &amp; mechanism, Ritting's law, Kick's law, Bond's law, method of operating crusher, Size reduction in sugar industries,</li> </ul> <p><b>Screening:</b></p> <ul style="list-style-type: none"> <li>• Standard screens, capacity of screen &amp; efficiency, Ideal and actual screen, screen analysis, equipment for industrial screening, sieve test of sugar.</li> </ul> <p><b>Leaching &amp; Extraction:</b></p> <ul style="list-style-type: none"> <li>• Leaching techniques, percolation through solids bed, stationary bed &amp; moving bed, Counter-current leaching, theory of diffusion, Theory of extraction of juice from cane</li> </ul> <p><b>Sedimentation:</b></p> <ul style="list-style-type: none"> <li>• Law of settling, Stokes law, Batch settling test, Design feature of continuous thickeners, Determination of thickeners area, factors affecting the settling rates, Different type of settling equipment, equipment in sugar industries.</li> </ul>	15
IV	<p><b>Evaporation:</b></p> <ul style="list-style-type: none"> <li>• Theory of evaporation, construction and operation of evaporator bodies.</li> </ul> <p><b>Mixing &amp; Agitation:</b></p> <ul style="list-style-type: none"> <li>• Introduction, classification of mixing equipment and its application. Mixers</li> </ul>	15

	<p>for mixing the material. (Solid-solid &amp; solid –liquid)</p> <p><b>Filtration:</b></p> <ul style="list-style-type: none"> <li>Theory, factors affecting filtration and remedies, filter aid and their use, equipment used in sugar factory (Rotary vacuum filter)</li> </ul> <p><b>Centrifugation:</b></p> <ul style="list-style-type: none"> <li>Theory, different types of centrifugal machines –Batch &amp; continuous, their performance study.</li> </ul>	
--	---	--

**Reference Books:**

- 1) Introduction of Chemical Engineering by Badger and Baneo
- 2) Introduction of Chemical Engineering by Ghosal and Sanyal
- 3) Stoichiometry by Bhatt and Vohra

**M. Sc. Sugar Technology (Part-I) (Semester-II)**

**Title of Course: Sugar Agriculture II (E-MST203)**

**Total Credits: 04**

**Course Out Comes:** Upon successful completion of this course, the student will be able to

**Introduction:**

1. Understand Farm Implements and Machinery In Sugarcane Cultivation, Strategies for Transfer of Technology in Sugarcane Agriculture, The different operations carried out during sugarcane planting.
2. Learn Flame Photometer.
3. Acquire Agricultural economics: Farm management, scope, importance and characteristics.
4. Acquire skill of using Agriculture technology.
5. Get knowledge about recent advances in Ethanol production.

**UNIT:I**

**[15]**

Farm Implements and Machinery In Sugarcane Cultivation, Strategies for Transfer of Technology in Sugarcane Agriculture, The different operations carried out during sugarcane planting are

- Making of furrow or trench.
- Sett cutting.
- Placement of setts in furrows.
- Fertilizer application in bands Scientific Sugarcane Cultivation 114.
- on either side of setts.
- Application of fungicidal, anti-termites and anti-insecticide solution.
- Covering and pressing of sets.

- Harvesting technology.
- Intercultural operations-Mulching, Hoeing and earthing-up.
- Tying of cane.
- Harvesting and yield-Assessing the maturity of the cane crop.
- Harvesting system and harvesting unit.

**UNIT:II - Agricultural economics:**

**[15]**

- Farm management, scope, importance and characteristics, farmplanning.
- Optimum resource use and budgeting.
- Economics of different types of farming systems.
- Marketing management – strategies for development, market intelligence.
- Price fluctuations and their cost; role of co-operatives in
- agricultural economy
- Types and systems of farming and factors affecting them.
- Agricultural price policy.
- Crop Insurance

**Agriculture technology -**

- conservation agriculture, principles of conservation agriculture,
- conservation agriculture different from sustainable intensification,
- benefits and challenges of conservation agriculture conservation
- agriculture originate.

**UNIT:III-Agronomy:**

**[15]**

- Cropping patterns in different agro-climatic zones of the country
- Impact of high yielding and short-duration varieties on shifts in
- cropping patterns
- Concepts of various cropping and farming systems.
- Organic and Precision farming
- Package of practices for production of important cereals, pulses,
- oil seeds, fibers, sugar, commercial and fodder crops

**Weed science**

- Weeds – characteristics
- Dissemination and association with various crops; their
- multiplications

- Cultural, biological, and chemical control of weeds
- Seed production and technology
- Seed production and processing technologies
- Seed certification, seed testing and storage.
- DNA finger printing and seed registration.
- Role of public and private sectors in seed production and marketing.
- Intellectual Property Rights (IPR) issues, WTO issues and its impact on Agriculture.

#### **UNIT:IV-Plant Physiology:**

**[15]**

- Principles of Plant Physiology with reference to plant nutrition, absorption, translocation and metabolism of nutrients.
- Soil – water- plant relationship.
- Enzymes and plant pigments;
- Photosynthesis- modern concepts and factors affecting.
- C3, C4 and CAM mechanisms.
- Factors affecting aerobic and anaerobic respiration
- Carbohydrate, Protein and fat metabolism.
- Growth and development; photo periodism and vernalization.
- Plant growth substances and their role in crop production.
- Physiology of seed development and germination; dormancy.
- Stress physiology – drought, salt and water stress.

#### **Reference Books:**

- 1) Hartmann and Kester's – Plant propagation – Principles and practices – Hudson T. Hartmann, Dale E. Kester, Fred T. Davies, Jr. Robert L. Geneve.
- 2) Textbook of Plant Physiology – C. P. Malik.
- 3) Diseases of Crop Plants in India – G. Rangaswami and A. Mahadevan  
Plant Pathology – R. S. Mehrotra
- 4) Practical cytology – Applied Genetics and Biostatistics – H. K. Goswami and Rajeev Goswami.
- 5) Recent Advances in Plant Diseases Vol – 1 to 5 – K. M. Chandaniwala.
- 6) Introduction to Principles of Plant Pathology – R. S. Singh.
- 7) An introduction to Plant Anatomy – Author R. Eames and Laurence H. Mac Deniels.
- 8) Genetics and Plant Breeding – E. B. Babcock.
- 9) Plant Taxonomy – O. P. Sharma.

- 10) Plant Breeding – Theory and Techniques – S. K. Gupta.
- 11) Breeding Asian Field Crops – John Milton Poehlman and  
Dhirendranath Bor thakur.
- 12) Crop Production and Field Experimentation – Dr. V.G. Vaidya, K. R.  
Sahastrabudhe, Dr.V. S. Khuspe.
- 13) Agricultural Problems of India – A. N. Agrwal and Kundam Lal.



## M. Sc. Sugar Technology (Part-I) (Semester-II)

**Title of Course: Organic & Physical Chemistry(E-MST203)**

**Total Credits: 04**

**Course Out Comes:** Upon successful completion of this course, the student will be able to

1. Understand **Introduction:** Sugar and Polysaccharides:
2. Learn Organic acids & Polyphones.
3. Acquire knowledge of **Solution & Strength of Solution:** Definitions of the terms: Solute, solvent.
4. Acquire skill of using Distribution Law.
5. Get knowledge about **Analytical Chemistry and Chromatography.**

Unit	Syllabus
I	<p><b>Sugar and Polysaccharides:</b></p> <ul style="list-style-type: none"> <li>• Introduction to Di and Polysaccharides</li> <li>• Stereochemistry and cyclic forms and Sugar derivatives</li> <li>• Glycoside bonds &amp; cyclic forms</li> <li>• Polysaccharides–amyl aseamyl pectin &amp; cellulose</li> <li>• Glycosamino glycans and proteoglycans</li> <li>• Oligo saccharides of glycol proteins and glycol lipids and Lectins</li> </ul> <p><b>Classification of carbohydrates and Fermentation</b></p> <ul style="list-style-type: none"> <li>• A) Mono saccharides– classification of Mono saccharides</li> </ul> <p>-Ring straight chain isomerism -Use of monosaccharide in living organisms</p> <ul style="list-style-type: none"> <li>• B) Disaccharides – Introduction – nutrition – classification</li> </ul> <p>- Metabolism Catabolism–carbohydrates–chemistry</p> <ul style="list-style-type: none"> <li>• C) Fermentation–Introduction, Definition, Examples, chemistry, ethanol, fermentation, Lactic acid fermentation, Hetero lactic fermentation, Methane gas production in fermentation</li> </ul>
II	<p><b>Organic acids &amp; Polyphones</b></p> <ul style="list-style-type: none"> <li>• Organic acids &amp; Polyphones in cane juice &amp; their characters.</li> <li>• Organic acids &amp; their effects on the processing of sugar house products.</li> <li>• Polyphones and their effects on the processing of sugar house products.</li> </ul> <p><b>Non sugars in sugar cane juice</b></p> <ul style="list-style-type: none"> <li>• Acids in cane juice- aconite acid, mallic acid, oxalic acid, citric acid, Amino acids &amp; proteins in cane juice.</li> <li>• Organic non sugar of high molecular weight in cane juice –c ellulose, hemicelluloses,</li> <li>• lignin,pectin,starch.</li> <li>• Colored non sugar originally present in cane juice: chlorophyll, xanthophyll,carotene, Anthocyan in. Colored non sugar from sugar decomposition</li> </ul>

	<p>product–</p> <p>a) caramel b) sugar decomposition product c) in version of sucrose.</p>
III	<p><b>Distribution Law:</b></p> <ul style="list-style-type: none"> <li>Nernst distribution law: Its limitations, and modification With reference to association and dissociation of solute in One of the solvents.</li> <li>Application of Distribution law in i) Process of extraction (derivation expected)</li> </ul> <p>ii) Determination of solubility iii) Distribution of indicators iv) Determination of molecular weight.</p> <p><b>Colloidal State:</b></p> <ul style="list-style-type: none"> <li>Definition of colloids</li> <li>Types of colloidal systems.</li> <li>Solids in liquids (sols): i) Preparation of sols: Dispersion and Aggregation methods</li> </ul> <p>ii) Purification of Sols: Dialysis, Electro dialysis and Ultra -filtration. iii) Properties of sols: Colour, optical, kinetic and electrical properties. iv) Stability of sols, protective action, Hardy – Schulze law, gold number</p> <ul style="list-style-type: none"> <li>Liquids in liquids (emulsions): Types of emulsions, preparation, Emulsifier.</li> <li>Liquids in solids (gels): Classification, preparation and properties, inhibition.</li> <li>General applications of colloids.</li> </ul>
IV	<p><b>Analytical Chemistry and Chromatography</b></p> <p>Basic concept, errors, types of errors, Accuracy precision, statistical Representation of analytical data.</p> <ul style="list-style-type: none"> <li>Chromatography–Introduction, Classification of chromatographic methods, introduction of the terms used in chromatography.</li> <li>Thin Layer chromatography: Introduction of basic concept of the technique, methodology, applications.</li> <li>Gas chromatography : General introduction to the terminology used, stationary phases, support used in making GLC columns.</li> </ul>

**Reference Books:**

- 1) Organic Chemistry: Hendrickson, Cram, Hammond
- 2) Organic Chemistry: Morrison & Boyd
- 3) Organic Chemistry: Volume I & III. L. Finar
- 4) Organic Chemistry: Pine
- 5) Advanced Organic Chemistry: Sachin Kumar Ghosh
- 6) Advanced Organic Chemistry: B.S. Bahl & Arun Bahi
- 7) A guide book to Mechanism inorganic chemistry: Peter Sykes

- 8) Stereochemistry of organic compounds: Kalsi
- 9) Stereochemistry of Carbon compounds: Eliel
- 10) Text book of organic chemistry: P.L.Soni

## **M. Sc. Sugar Technology (Part-I) (Semester-II)**

**Title of Course: Sugar Technology III (Special Analysis) (PR-MMST204)**

**Total Credits: 04**

- 1) To determine pol % cane by direct.
- 2) To determine pol % cane by indirect method
- 3) To determine fiber % cane by direct
- 4) To determine fiber % cane by direct and indirect method.
- 5) To determine of recovery % cane by lab crusher method.
- 6) To determine preparatory index of prepared cane.
- 7) To determine mill performance by Brix curve method.
- 8) To determine mud volume of juice by heating, liming & addition of flocculants.
- 9) To determine optimum pH of shock liming for good clarification.
- 10) To determine SO<sub>2</sub> contend in syrup.
- 11) To determine size of crystal in slurry/seed/massecuite. By microscope.
- 12) To determine crystal% massecuite by purity and lab centrifugal machine.

## **M. Sc. Sugar Technology (Part-I) (Semester-II)**

**Title of Course: Sugar Technology IV (Special Analysis) (PR-MMST205)**

**Total Credits: 04**

- 1) To determine phosphate content of juice by Ammonium molybdate method.
- 2) To determine phosphate content of juice by Uranium acetate method.
- 3) To determine CaO content of juice by EDTA method
- 4) To determine CaO content of juice by Ammonium oxalate method.
- 5) To determine sulphated Ash of juice.
- 6) Analysis of boiler water for
  - a) TDS
  - b) Hardness
- 7) Analysis of boiler water for
  - a) Alkalinity.
  - b) Dissolve oxygen.
  - c) Chlorine.
- 8) Analysis of effluent for
  - a) Total solids
  - b) Total suspended solids
- 9) Analysis of effluent for
  - a) Total dissolved solids
  - b) Bio chemical oxygen demand
  - c) Chemical oxygen demand

**M. Sc. Sugar Technology (Part-I) (Semester-II)**

**Title of Course: Field Project (Visit) (FP206)**

**Total Credits: 04**

**Students can do the field visits near sugarcane area/Sugar factory/Distillery unit make the survey of any required/observed issues also finding the solutions on them and submit the detail report to college.**