FACULTY OF SCIENCES

SYLLABUS

FOR

B. TECH. (SUGAR & ALCOHOL TECHNOLOGY)

(Under Credit Based Continuous Evaluation Grading System)

(Semester: I-VIII)

Session: 2013-14

GURU NANAK DEV UNIVERSITY AMRITSAR

B.TECH. (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER SYSTEM
(Under Credit Based Continuous Evaluation Grading System)

FIRST SEMESTER:

Course No.	C/E/I	Course Title	Credits			Total Credits
			L	T	P	
STL-101	**C**	Computer Applications	3	1	-	4
STL-102	**C**	Manufacturing Processes	3	1	-	4
ECL-210	**C**	Basic Electrical & Electronics Engineering	3	1	-	4
PBL-121 PBL-122	**C**	Punjabi Compulsory-I OR Basic Punjabi-I (*Mudhli* Punjabi)	2	-	-	2
ENL-101	**C**	Communicative English	2	-	-	2
CYL-197	**C**	Organic Chemistry	3	1	-	4
STP-101	**C**	Computer Applications Lab	-	-	3	3
STP-102	**C**	Manufacturing Processes Workshop	-	-	2	2
CYP-198	**C**	Organic Chemistry Lab	-	-	3	3
Total Credits			**16**	**4**	**8**	**28**

For elective courses: The students can opt for **any two** combinations from the following:

Combination 1: STL-307 + STP-306 (6^{th} Sem) (Industrial Fermentation & Alcohol Tech)
Combination 2: STL-401 + STP-401 (7^{th} Sem) (Confectionery Technology)
Combination 3: STL-402 + STP-402 (7^{th} Sem) (Technology of Malting and Brewing)

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SECOND SEMESTER:

Course No.	C/E/I	Course Title	Credits			Total Credits
			L	T	P	
STL 103	**C**	Physical Chemistry	3	1	-	4
STL 104	**C**	Chemical Engineering-I	3	1	-	4
STL 105	**C**	Sugar Cane Agriculture	3	1	-	4
PBL-131 PBL-132	**C**	Punjabi Compulsory-II OR Basic Punjabi-II *Mudhli* Punjabi)	2	-	-	2
ENL-151	**C**	Communicative English	2	-	-	2
MTL -122	**C**	Applied Maths	3	1	-	4
STP 103	**C**	Instrumentation Lab	-	-	3	3
STP 104	**C**	Drawing and Design Lab-I	-	-	2	2
STP 105	**C**	Sugar Chemical Testing Lab	-	-	3	3
ID-1	**I**	Interdisciplinary (ID) course	-	-	-	-
Total Credits			**16**	**4**	**8**	**28+ID**

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THIRD SEMESTER:

Course No.	C/E/ I	Course Title	Credits			Total Credits
			L	T	P	
STL-201	**C**	Sugar Tech.Manufacturing-I	3	1	-	4
STL-203	**C**	Sugar Tech.Manufacturing-II	3	1	-	4
STL-204	**C**	Analytical Chemistry	3	1	-	4
STL-205	**C**	Chemical Engineering-II	3	1	-	4
*ESL-220	**A**	Environmental Studies (Compulsory)	3	-	-	3
STP-201	**C**	Sugar Technology Lab-I	-	-	3	3
STP-202	**C**	Analytical Chem. Lab.	-	-	3	3
STP-203	**A**	In-season in Plant Training 2 Weeks (Dec / Jan)	-	-	2	2
STP-204	**C**	Chemical Engineering Lab	-	-	2	2
Total Credits			**15**	**4**	**10**	**29**

Last date for submission of

i) Training Report (in season): Within 2 weeks after coming from training.

* Note: Credits will be included in the Grand Credits

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FOURTH SEMESTER:

Course No.	C/E/I	Course Title	Credits			Total Credits
			L	T	P	
MTL-222	C	Applied Stat. & Stat. Control	3	1	-	4
STL-202	C	Sugar Engineering-I	3	1	-	4
STL-206	C	Sugar Tech. Manuf.-III	3	1	-	4
STL-207	C	Sugar Technology (Chem. Control)	3	1	-	4
STL-208	C	Plant Utilities	3	1	-	4
STP-205	C	Sugar Technology Lab-II	-	-	3	3
ID-2	I	Interdisciplinary (ID) course	-	-	-	-
Total Credits			**15**	**5**	**3**	**23+ID**

Last date for submission of

i) Training Report (off season): Within 2 weeks after coming from training.

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FIFTH SEMESTER:

Course No.	C/E/I	Course Title	Credits			Total Credits
			L	T	P	
STL-301	**C**	Refinery (Raw Sugar Manuf. & Refining)	3	1	-	4
STL-302	**C**	Sugar Industry By Products	3	1	-	4
STL-303	**C**	Process Control & Instrumentation	3	1	-	4
STL-304	**C**	Industrial Microbiology	3	-	-	3
STP-301	**C**	Industrial Microbiology Lab	-	-	2	2
STP-302	**C**	Sugar Tech. Lab. III	-	-	3	3
STP-303	**C**	Drawing & Design Lab-II	-	-	2	2
STP-304	**C**	Process control & Instrumentation Lab	-	-	2	2
ID-3	**I**	Interdisciplinary (ID) Course	-	-	-	-
Total Credits			**12**	**3**	**9**	**24+ID**

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SIXTH SEMESTER:

Course No.	C/E/I	Course Title	Credits			Total Credits
			L	T	P	
STL-306	**C**	Sugar Engineering-II	3	1	-	4
STL-307	**E**	Industrial Fermentation	3	1	-	4
STL-308	**C**	Sugar Technology (Capacity)	3	1	-	4
STL-309	**C**	Business & Financial Management	3	1	-	4
STL-310	**C**	Industrial Biochemistry	3	-	-	3
STP-306	**E**	Industrial Fermentation	-	-	2	2
STP-307	**C**	Industrial Biochemistry Lab	-	-	2	2
STP-308	**A**	Industrial/Educational Tour 10 to 20 days (Dec / Jan)	-	-	3	3
STP-206	A	Off Season in Plant Training (1^{st}-30^{th} June) 4 weeks	-	-	4	4
Total Credits			**15**	**4**	**11**	**30**

Last date for submission of:

i) Tour Report: Within 2 weeks after coming from tour.

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SEVENTH SEMESTER:

Course No.	C/E/I	Course Title	Credits			Total Credits
			L	T	P	
STL-401	**E**	Confectionery Technology	3	1	-	4
STL-402	**E**	Technology of Malting and Brewing	3	-	-	3
STL-403	**C**	Environmental Pollution and Management	3	1	-	4
STP-401	**E**	Confectionery Technology	-	-	2	2
STP-402	**E**	Technology of Malting and Brewing	-	-	2	2
STP-403	**C**	Seminar	-	-	2	2
STL-406	**C**	Alcohol Technology	3	1	-	4
ID-4	**I**	Interdisciplinary (ID) Course	-	-	-	-
ID-5	**I**	Interdisciplinary (ID) Course	-	-	-	-
Total Credits			**12**	**3**	**06**	**21 + IDs**

EIGHTH SEMESTER:

Course No.	C/E/I	Course Title	Credits			Total Credits
			L	T	P	
STP-404	**A**	Industrial Training (4 Months i.e. Jan-April) (Sugar/Alcohol)	-	-	16	16
STP-405	**A**	Research Project	-	-	4	4
Total Credits			-	-	**20**	**20**

Last date for submission of:

i) Training Report: Within two weeks after coming from training
ii) Research Project to be submitted by 15th June
iii) Defence of the Project Report: 30th June

B.TECH. (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – I
(Under Credit Based Continuous Evaluation Grading System)

STL-101: COMPUTER APPLICATIONS

Credits: 3-1-0
Note: Students can use the Non-Programmable scientific calculator.

UNIT-I

Introduction to Computers: History of computers; Block diagram of a computer and its essential units; Memories – RAM, ROM, Secondary storage devices; Compilers and interpreters. **Number Systems:** Decimal, Binary, Octal and Hexadecimal systems. Integer and real number representation.

UNIT-II

Microsoft Office: MS word, Introduction to windows; Purpose and characteristics of documents (text, fonts, size and styles); Paragraphs, searching and replacing; Page layout; Alignments and justification; Spell check; MS Excel; graphs, charts, Labels. MS power point.

UNIT-III

C Language: Flow charts; Various data types; Operators; Input and output statements; Control statements – for, while, do while, if then, switch and case statements; Functions, pointers, call by value and reference, recursion; Arrays one and two dimensions; Strings and string functions.
Introduction to Information Technology & its Potential: Definition of networks, Concept of Web page, Elderman idea of web searching, intranet, e-mail and its attachments.

Texts:

1. Introduction to Computers by Peter Norton (Tata McGraw-Hill).
2. Schaum's Outline Programming with C by Gottfried and Byron (Tata McGraw-Hill).
3. Let Us C by Kanetkar (Tata McGraw-Hill).
4. Working with MS Office 2000 (Tata McGraw-Hill).
5. Window based computer course, Gurvinder Singh & Rachhpal Singh, Kalyani Publishers.
6. Programming in C by K.S. Kahlon, Gurvinder Singh & Rachhpal Singh, Kalyani Publishers.
7. Robert Lafore: Object Oriented Programming in Turbo C++, Galgotia Publications Pvt. Ltd.
8. Yashwant Kanetkar Let us C, BPB Publications, New Delhi.
9. R.S.Salaria Application Programming in C, Khanna Book Publishing, Delhi.

B.TECH. (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – I
(Under Credit Based Continuous Evaluation Grading System)

STL-102: MANUFACTURING PROCESSES

Credits: 3-1-0
Note: Students can use the Non-Programmable scientific calculator.

UNIT-I

1. **Plastics and their Processing:** Introduction, Types of Plastics, Thermo-plastics, Materials for processing plastics, Moulding processes compression moulding, Transfer Moulding, Injection moulding, Extrusion, Calendering, Thermo forming, Blow moulding, Casting, Laminating & Reinforcing, foamed plastics, Fastening & machine plastics.

2. **Ferrous Metal & Alloys:** Introduction, Pig iron, cast iron, wrought iron, carbon steel, alloy steel, blast furnace, modern development, electric furnace process, classification of steel, unalloyed steels and alloy steels.

3. **Non-Ferrous Metals & Alloys:** Introduction, Aluminum & its alloys, copper and its alloys, lead and its alloys, phosphors Bronze gun metal.

4. **Joint Processes:** Introduction, weldability, types of welding, welding processes, use of electricity in welding, formation & characteristics of electric Arc, Four positions of Arc, welding, types of joints and types of applicable welds, Arc. Welding machine. TIG welding MIG welding, submerged welding, laser welding, spot welding etc. gas welding, Oxyacetylene welding, types of gas flame welding equipments, relative merits of AC & DC welding, welding defects, soldering and Brazing. Welding technique for Pipes.

UNIT-II

5. **Carpentry:** Introduction, structure of wood, grain in wood, seasoning of wood, classification of wood, common varieties of Indian timber, carpentry tools, marking and measuring tools, cutting tools, boring tools, striking tools, holding tools, miscellaneous tools, carpentry processes marking, sawing, planning, chiseling, boring, grooving, rebating, moulding, carpentry joints, wood working lathe, circular saw, band saw, wood planer, joint, mortiser.

6. **Foundry:** Introduction, pattern making pattern materials, types of pattern, solid pattern, split pattern, match plate pattern, three piece split pattern, etc. Pattern making allowances moulding tools and equipments. Moulding sand, types of moulding sands, properties of moulding sand casting defects.

7. **Mechanical Working of Metals (Metal Forming) :** Introduction, hot working, rolling, forgoing, piercing, Drawing, Spinning, extruding, cold working, metallurgical advantages of hot working over cold working processes.

UNIT-III

8. **Machine Process:** Introduction, function of the lathe, types of lathe, speed lathe, engine lathe, bench lathe, tool room lathe, capstan and turret lathe, special purpose lathe, automatic lathe, size of lathe, list of lathe operations. Difference between Capstan & Turret & an Engine lathe.

9. **Drilling Machine:** Introduction, types of drilling machine, work holding devices, list of drilling machine operation, twist drill nomenclature.

10. **Shaper and Planning Machines:** Introduction, types of shaper and planner, list of shaper and planer operations, Planner vs shaper machine.

11. **Grinding Machines :** Introduction, kinds of grinding, types of grinding machines, rough grinding and precision grinding, potable and flexible shaft grinders, swing frame grinders, surface grinders etc. size and capacities of the grinder.

Texts:

(1) Workshop technology by Hazra Chaudhary, Latest Edition, Volumes I, II.

(2) Workshop Technology by W.A.J. Chapman, Part I & II.

B.TECH. (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – I
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ECL-210: BASIC ELECTRICAL & ELECTRONICS ENGINEERING

Credits: 3-1-0
Note: Students can use the Non-Programmable scientific calculator.

UNIT-I

1. **Electric Current and Ohm's Law:** Ohm's Law, Resistance in Series, Resistance in Parallel, Division of current in Parallel circuits, Equivalent Resistance, Numericals.

2. **Network Theorems:** Kirchhof's laws, Thevenin Theorem, Work, Power & Energy effect of electric current, Joule's law of Electric beating Numericals.

3. **Electromagnetic Induction & A.C. Fundamentals:** Faraday's law of Electromagnetic Induction, Generation of Alternating voltage, current, simple wave form, cycle Time period, frequency, Amplitude, phase, phase difference.

4. **Transformer:** Working principle of a Transformer construction, Elementary Theory of an ideal Transformer E.M.F. Equation of a Transformer Voltage Transformation Ratio Efficiency of a Transformer, Three phase – Transformer.

UNIT-II

5. **Induction motor:** Classification of A.C. Motors General Principle, construction, Relation between Torque & Slip, control of A.C. motors.

6. **D.C. Generators & D.C. Motors:** Generator Principle, Construction & working of Generator, Motor Principle, Comparison of Generator & Motor action, comparison of shunt, series Motors, losses & Efficiency Powerstages, Speed control of D.C. Motors.

UNIT-III

7. **Electronic Devices:** Semiconductors, Bipolar Junction Transistor, transistor circuit configuration transistor characteristics. Field Effect Transistor.

8. Amplifiers, Classification, Configuration, Concept of feedback amplifiers.

9. Special Diodes, Zener Diode, Voltage, Regulation.

10. Cathode Ray oscilliscope (CRO) Introduction – Analog & Digital Instruments function of Instruments. Electronic versue Electrical Instruments.

Text:

1. Principle of Electrical Engg. by Vincent Del Tora.
2. Basic Electronics by G.K. Mittal, 2003.
3. Electronic Principles by A.P. Malvino, 1999.

B.TECH. (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – I
(Under Credit Based Continuous Evaluation Grading System)

PBL121: pj`bl l`zml – I

p`T-km Eq| p`T-psqk~

Credits: 2–0–0

(I) 1. **E`qm En`qm** (sp. virE`m isG sD Eq f`. sih rblr isG! "r n`nk v #nlvris$l! Eimqsr% iv') hT il* kh`+lk`r ,
(-% "rm* isG ms`i.r , **"$`r**
(E% sj`n isG , **pT`+ l Dl**
(/% krq`r isG "l , **-l'l Elfl v`ll "lr"`bl**
(kh`+l-s`r! iv0`-vsq! kh`+l-kl`! kh`+lk`r%

1. "rm*l Er3"r`.l l j"q! (p)ql5 mh`rnl5 ib l! i$pl q EDk%5 ivr`m i'n! 0b j7 (0D-E0D%

(II) 1. **E`qm En`qm** (sp. virE`m isG sD Eq f`. sih rblr isG! "r n`nk v #nlvris$l! Eimqsr% iv') hT il* kh`+lk`r ,
(-% sq* isG Dlr , **s~8l kD**
(E% klvq isG ivrk , **-j`7**
(/% mih r isG srn` , **j3| `r mkl isG**
(kh`+l-s`r! iv0`-vsq! kh`+l-kl`! kh`+lk`r%

1. l* r'n` (jlvnl-prk! sm`jk Eq 'lq ivi0E~ -q%,
9: l* il*v`-+ (kl`s iv' Eq Gr l/l Ei;E`s%

(III) 1. **E`qm En`qm** (sp. virE`m isG sD Eq f`. sih rblr isG! "r n`nk v #nlvris$l! Eimqsr% iv') hT il* kh`+lk`r ,
(-% pm pk`0 , **m`7`bl `**
(E% "lz`r isG sD , **kll<+|**
(/% mhn ;f`rl , **G|$+`**
(s% virE`m isG sD , **l l**
(kh`+l-s`r! iv0`-vsq! kh`+l-kl`! kh`+lk`r%

1. pr` p7 k p0n~ -qr +`
(**E`qm En`qm** psqk kh`+l ;`" iv') 9= pirE~ Ei;E`s krv`-+%

B.TECH. (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – I
(Under Credit Based Continuous Evaluation Grading System)

PBL-122: ਮੁੱਢਲੀ ਪੰਜਾਬੀ

(In lieu of Punjabi Compulsory)

2–0–0

ਪਾਠ–ਕ੍ਰਮ

1. ਪੰਜਾਬੀ ਭਾਸ਼ਾ,
   ਗੁਰਮੁਖੀ ਲਿਪੀ
   ਗੁਰਮੁਖੀ ਲਿਪੀ : ਬਣਤਰ ਅਤੇ ਤਰਤੀਬ

2. ਗੁਰਮੁਖੀ ਆਰਥੋਗ੍ਰਾਫੀ
   ਸੁਰ ਬਣਤਰ ਅਤੇ ਉਚਾਰਨ
   ਵਿਅੰਜਨ ਬਣਤਰ ਅਤੇ ਉਚਾਰਨ

3. ਪੰਜਾਬੀ ਸ਼ਬਦ ਬਣਤਰ
   ਸਾਧਾਰਨ ਸ਼ਬਦ
   ਇਕ ਉਚਾਰਖੰਡੀ ਸ਼ਬਦ

ਯੂਨਿਟ ਅਤੇ ਥੀਮ

1. ਪੰਜਾਬੀ ਭਾਸ਼ਾ : ਨਾਮਕਰਣ ਅਤੇ ਸੰਖੇਪ ਜਾਣ ਪਛਾਣ, ਗੁਰਮੁਖੀ ਲਿਪੀ : ਨਾਮਕਰਣ, ਗੁਰਮੁਖੀ ਵਰਣਮਾਲਾ; ਪੈਂਤੀ ਅੱਖਰੀ, ਅੱਖਰ ਕ੍ਰਮ, ਸੁਰ ਵਾਹਕ (ੳ ਅ ੲ), ਲਗਾਂ ਮਾਤਰਾਂ, ਪੈਰ ਵਿਚ ਬਿੰਦੀ ਵਾਲੇ ਵਰਣ, ਪੈਰ ਵਿਚ ਪੈਣ ਵਾਲੇ ਵਰਣ, ਬਿੰਦੀ, ਟਿੱਪੀ, ਅੱਧਕ।

2. ਗੁਰਮੁਖੀ ਆਰਥੋਗ੍ਰਾਫੀ ਅਤੇ ਉਚਾਰਨ; ਸੁਰਾਂ ਦੀ ਬਣਤਰ ਅਤੇ ਉਚਾਰਨ (ਲਘੂ–ਦੀਰਘ ਸੁਰ); ਸੁਰ ਅਤੇ ਲਗਾਂ ਮਾਤਰਾਂ; ਵਿਅੰਜਨਾਂ ਦੀ ਬਣਤਰ ਅਤੇ ਉਚਾਰਨ; ਪੈਰ ਵਿਚ ਪੈਣ ਵਾਲੇ ਵਰਣਾਂ (ਹ, ਰ, ਵ) ਦਾ ਉਚਾਰਨ ; ਲ ਅਤੇ ਲ਼ ਦਾ ਉਚਾਰਨ; ਭ, ਧ, ਢ, ਝ, ਘ ਦਾ ਉਚਾਰਨ; ਪੈਰ ਵਿਚ ਬਿੰਦੀ ਵਾਲੇ ਵਰਣਾਂ ਦਾ ਉਚਾਰਨ।

3. ਪੰਜਾਬੀ ਸ਼ਬਦ–ਬਣਤਰ : ਸਾਧਾਰਨ ਸ਼ਬਦ; ਇਕੱਲਾ ਸੁਰ (ਜਿਵੇਂ ਆ); ਸੁਰ ਅਤੇ ਵਿਅੰਜਨ (ਜਿਵੇਂ ਆਰ); ਵਿਅੰਜਨ ਅਤੇ ਸੁਰ (ਜਿਵੇਂ ਪਾ); ਵਿਅੰਜਨ ਸੁਰ ਵਿਅੰਜਨ (ਜਿਵੇਂ ਪਾਰ); ਕੋਸ਼ਗਤ ਸ਼ਬਦ (ਜਿਵੇਂ ਘਰ, ਪੀ); ਵਿਆਕਰਣਕ ਸ਼ਬਦ (ਜਿਵੇਂ ਨੂੰ, ਨੇ); ਪੰਜਾਬੀ ਸ਼ਬਦ ਰਚਨਾ–1; ਲਿੰਗ–ਪੁਲਿੰਗ, ਇਕ ਵਚਨ–ਬਹੁ ਵਚਨ; ਨਿੱਤ ਵਰਤੋਂ ਦੀ ਪੰਜਾਬੀ ਸ਼ਬਦਾਵਲੀ–1: ਖਾਣ–ਪੀਣ, ਸਾਕਾਦਾਰੀ, ਰੁੱਤਾਂ, ਮਹੀਨਿਆਂ, ਗਿਣਤੀ, ਮੌਸਮ ਆਦਿ ਨਾਲ ਸੰਬੰਧਿਤ।

B.TECH. (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – I
(Under Credit Based Continuous Evaluation Grading System)

Subject Code: ENL–101 Duration of Examination: 3 Hrs
Course Title: **Communicative English** Credits: 02 (L=2,T=0,U=0)

Objectives: To Introduce students in a graded manner to the communication skills of Reading and Writing in English. At the end of semester I, the students should be able to demonstrate adequate competence in comprehending the prescribed text and performing the given writing tasks.

Reading:

a) Developing Habits of Independent and Fast Reading.
Students will be required to read a prescribed prose anthology titled *Selections from Modern English Prose* (Ed. Haladhar Panda published by University Press, Hyderabad). The essays in the anthology will be read by students at home with the help of glossary given in the book. Progressing from one lesson to another, they should learn to read fast.
Students are supposed to keep a record of their reading in the form of notes, difficulties, summaries, outlines and reading time for each essay. Class teacher may use this record for award of internal assessment (if any).

b) Developing Comprehension Skills
Teacher will provide guided comprehension of the prescribed texts in the class and help students in answering the questions given at the end of each lesson. Teacher can construct more questions of factual and inferential nature to enhance the comprehension skills of the students. The teacher shall also guide students to do the grammar exercises given at the end of each lesson.

Writing:

a) Developing Skills in Personal Writing
Students will be required to learn short personal write–ups involving skills of description and narration. The types of composition task may include personal letter writing, telegram writing, notice writing, diary writing etc. Teacher shall instruct the students about the appropriate format and usual conventions followed in such writings. The teacher may also prescribe composition/writing book if so required.

b) Developing Writing Skills based on Guided Composition
The students will be required to write a longish composition on a question from the essays on *Selections from Modern English Prose*. The composition will require presentation of ideas beyond the prescribed essays. Sample composition topics are given at the end of each lesson.

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Question Paper: The following format is suggested for a 3–hour test.

(Appropriate choices may be given where possible)

1. Short–answer comprehension questions (at least 5) based on the lessons included in S*election from Modern English Prose* **App. weighting 30%**
2. Questions on grammar and vocabulary (words, phrases, proverbs) **App. weighting 20%**
3. Two short writing tasks of app. 100 words. One a personal letter involving narration of a personal experience or description of objects, persons, places of events. The second may be a telegram or public notice or a diary entry about a personal or family achievement, loss or celebration. **App. weighting 30%**
4. One long composition of about 300 words on one of the topics discussed in Selections from Modern English Prose. Due consideration be given to the organization of details and coherence in writing. **App. weighting 20%**

Internal Assessment: The teacher may consider the following for award of internal assessment, if any.

1. Evidence of independent reading as given above. Teacher may suggest some special tasks to suit the needs of their students.
2. Students may be asked to keep diary of their daily or specific routines.
3. Students may be asked to write a certain number of compositions on selected topics during the semester.

The division of the syllabus and the paper pattern for Minor and Major tests may be as follows:-

Minor-I

The syllabus to be covered; the essay from Sr. No. 1 to Sr. No. 6 from the prescribed book and personal letter.
Paper pattern: The following format is suggested for a test of 20 marks.

1. Personal letter (1 out of 2)
2. Short answer type question from the essay (2 out of 4).
3. Questions on Grammar and Vocabulary.

Minor-II

The syllabus to be covered; the essay from Sr. No. 7 to Sr. No. 13 from the prescribed book and personal letter.

Paper pattern: The following format is suggested for a test of 20 marks.

1. Personal letter (1 out of 2)
2. Short answer type question from the essay (2 out of 4).
3. Questions on Grammar and Vocabulary.

Major Test

The syllabus to be covered; the essay from Sr. No. 14 to Sr. No. 20 from the prescribed book telegram and diary entry.

The format for 3 hour major test will be mentioned in the syllabus. This test will also include the syllabus covered in Minor-I and Minor-II.

B.TECH. (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – I
(Under Credit Based Continuous Evaluation Grading System)

CYL-197: ORGANIC CHEMISTRY

Credits: 3-1-0
Note: Students can use the Non-Programmable scientific calculator.

UNIT-I

1. **Alcohols:** Classification, nomenclature, physical properties:- Different methods of their preparation. Oxymercuration-demercuration, hydrobration, oxidation, Grignand`s, Synthesis and its limitations in alcohol preparations, industrial source (fermentation of carbohydrates) and their reactions (including oxidation, diols, triols.)
2. **Aldehydes & Ketones:** Preparations with mechanistic details of reactions involved. Discussion of chemical reactions of aldehydes and ketones with mechanisms involved. Analysis of aldehydes and ketones.

UNIT-II

3. **Estimation of reducing sugars:** Lane & Eynon and Luff & Schoore methods for determinations of reducing sugars: determination of sucrose by titration method and after destruction of reducing sugar.
4. **Carbohydrates:** Classification, stereoisomers of Fructose, glucose, sucrose, Oxidation, affect of alkali, osazone formation, epimers, Kiliani-Fischer synthesis, Ruff's degradation, conversion of an aldose into its epimer, Disaccharides, maltose, cellobiose, lactose, sucrose, polysaccharides, starch, structure of amylase, and group analysis, structure of amylopectin, structure of cellulose, reactions of cellulose, rayon cellophane, natural glycosides.

UNIT-III

5. **Amino acids and proteins:** structure of amino acids, iso-electric point, configuration, preparation, reactions, peptides, determination structure of peptides, classification and function of proteins, denaturation, structure, isoelectric point, electrophoresis, effect of amino acids and proteins on the manufacture of sugar.
6. **Non-nitrogenous organic acids in sugarcane juice**, their effect, in the process of sugar manufacture, isolation and industrial uses of aconitic acid.
7. **General study of anthocyanins,** colouring matter present in sugarcane juice and its elimination, development of colour during processing and its effect on the processing.

Texts:

1. Organic Chemistry by R.T.Morrison & R.N.Boyd, (2008) 6th Edition, Published by Allyn & Bacon Inc., Boston, London.
2. Organic Chemistry by I.L.Finar, Vol.II, 7th Edition, Reprint (2009), ELBS.
3. Cane Sugar Handbook by J.C.P.Chen,(1985) IInd Edition, Published by A.Wiley Inter Science Publication, New York.
4. Biochemistry by Lubert Stryer, (1995) 4th Edition, W.H.Freeman & Company, Sanfrancisco, New York.
5. Review of Physiologycal Chemistry by Harold A.Harper, Victor W.Rodwell & Peter A.Mayes,Maruzan Aushian Edition (1997), Kothari Book Depot, Acharya Donde Marg,Parel, Bombay-12.

B.TECH. (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – I
(Under Credit Based Continuous Evaluation Grading System)

STP-101: COMPUTER APPLICATIONS (LAB)

Credits: 0-0-3
Note: Students can use the Non-Programmable scientific calculator.

Use of MS Word,

Use of MS Excel,

Use of MS Power point for making presentations

Use of Internet.

Programming in C: About 25 programs on different applications of C including operators, expressions, functions, arrays, pointers, strings and files.

Texts:

1. Working with MS Office 2000. Tata McGraw Hill.
2. Norton, P. “Introduction to computers”, Tata McGraw Hill.
3. Window based computer course, Gurvinder Singh and Rachhpal Singh, Kalayani Publishers.
4. Let us C by Yashwant Kanetkar.

B.TECH. (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – I
(Under Credit Based Continuous Evaluation Grading System)

STP-102: MANUFACTURING PROCESSES WORKSHOP

Credits: 0-0-2
Note: Students can use the Non-Programmable scientific calculator.

MACHINE SHOP:
Machine shop practice on Lathe, Milling Machine and shaper simple jobs.

CARPENTRY SHOP:
Simple jobs on sawing, ripping, planning and chiseling, wood turning practice in carpentry shop.

FITTING SHOP:
Simple jobs on fitting, sawing, tapping and dieing practice in fitting shop.

SHEET METAL SHOP:
Cutting and joining of sheet metal jobs, simple cylindrical jobs. Practice in sheet metal shop.

SMITHY SHOP:
Simple jobs practice in smithy shop.

WELDING SHOP:
Fillet joint welding and corner point welding practice in welding shop.

ELECTRICAL SHOP:
Single switch wiring for household and winding of coils practice in electrical shop.

Texts:

1. Workshop Technology by Hazra Chaudhary, Latest Edition, Volumes I & II.
2. Workshop Technology by Chapnum.

B.TECH. (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – I
(Under Credit Based Continuous Evaluation Grading System)

CYP-198: ORGANIC CHEMISTRY (LAB)

Credits: 0-0-3
Note: Students can use the Non-Programmable scientific calculator.

1. QUALITATIVE ANALYSIS:

a) Separation purification and identification of the components of mixture of three organic compounds (three liquids-three solids, one liquid-two solids) using chemical analysis and IR and PMR spectral data.

b) Analysis of sugar (Mono and di-saccharides)

2. QUANTITATIVE ANALYSIS:

c) Estimation of phenolaniline using bromate bromide solution/acetyalation methods.

d) To estimate nitrogen in the given sample by Kjeldahl's method.

e) To estimate sulphur in the given sample by the Na_2KNO_3 fusion method/Messenger's method.

f) To determine the percentage or number of hydroxyl groups in the given sample by the acetylation method.

g) To estimate a halogen in the given sample by the alkaline reduction method (Modified Stepanow method).

3. PREPARATIONS:

h) Preparation of crystalline derivatives of sugars.

i) Preparation of acetanilide and glucose penta acetates.

B.TECH. (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – II
(Under Credit Based Continuous Evaluation Grading System)

STL-103: PHYSICAL CHEMISTRY

Credits: 3-1-0
Note: Students can use the Non-Programmable scientific calculator.

1. Kinetic theory of gases-Equipartioning of Energy Theory-Distribution of molecular velocities in three dimensional spheres-Derivation of Root Mean Square Velocity, average velocity and most probable velocity. Applications of kinetic Molecular theory.

   i) Collision frequency on a plan surface and derivation of Graham law.
   ii) Bimolecular collision frequency and meen free path.
   iii) Vapour pressure of solids.

2. Laws of Diffusion-Diffusion rate- Diffusion through cane milling process.

3. Laws of Evaporation-Rillieux's Principles Multiple Effect Evaporator-Clausius Clapyeron equation. Heat Balance in evaporation.

4. Chemical Kinetics- Order and Molecularity of a reaction-Mechanism of Chemical reactions and determination of order- activation energy-Collision theory of bimolecular reactions, Consecutive and steady state reactions. Inversion of Sucrose- Role of Inversion of Sucrose in Sugar Industry, Mutarotation of Sugar.

5. Electrochemistry - Conductance measurements- Theory of ionization- Solubility product-Precipitation reaction in clarification process in sugar manufacture - Relation of conductivity of sugars to their ash content-cuitometer.

6. EMF measurement- Reversible cells- Chemical & concentration cells, Liquid Junction potential- pH measurement using Hydrogen electroide-quinhydrone electrode-glass electrode applications-Calorimetric measurements.

7. Ion Exchange Resins- Their use in Sugar Industry.

8. Colloid-Preparation and properties- isoelectric point-zetapotential-colloids in cane juice-elimination of colloids clarification process.

9. Adsorption: Different adsorption isotherms- Adsorption of colouring matter- Use of active carbons in Refineries. Regeneration.

10. Electronic Absorption Spectroscopy:
    Basic principles: Vibrational and electronic energy levels in a diatomic molecule, relationship of potential energy curve, electronic spectra, frank condon principle, different type of electronic transitions in molecules symbols enteria to aid in band assignment, spin orbit coupling and higher state mixing, the intensity of electronic transitions, charge transfer transition. Application with respect to Sugar industry.

11. Vibrational Spectroscopy:
    Theory of infrared absorption: Harmonic and anharmonic vibrations, quantum treatment of vibrations, selection rules, force constants, number of normal modes in poly atomic molecules, energy regions, types of relations, fermi resonance, group vibrations.

Texts:

1. Principles of Physical Chemistry by S.H.Marm and Cart F Prutton, published by Amerind Publishing Co. Pvt. Ltd.
2. Cane Sugar Handbook by James C.P. Chen XIth Edition.
3. Physical Methods in chemistry by R.S. Drago, .Published by W.B.Sounders Company, London 1977.
4. Modern Optical methods of analysis by E.D.Olsen Published by McGraw Hill, New York 1975.
5. Principles of Instrumental Analysis by D.A. Skoog. Published by Saunders College Publishing, Tokyo, 1985.
6. A textbook of Physical Chemistry by A.W. Adamson, IIIrd Edition, Published by Academic Press College Division.

B.TECH. (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – II
(Under Credit Based Continuous Evaluation Grading System)

STL-104: CHEMICAL ENGINEERING-I

Credits: 3-1-0
Note: Students can use the Non-Programmable scientific calculator.

UNIT-I

1. **Material and Energy Balance:**
   Dimensions and units: Basic chemical calculations of atomic weight, molecular weight, Dimensions equivalent weight, mole. Composition of liquid mixture and gaseous mixture.
   Material balance without chemical reactions: Flow diagram for material balance, simple material balance with or without recycle or bypass for chemical engineering operations such as distillation, absorption, crystallization, extraction etc.
   Material balance involving chemical reactions: Concept of limiting reactant, conversion, yield, liquid phase reaction, gas phase reaction with or without recycle or bypass.
   Energy balance: Heat capacity of pure gases and gaseous mixtures at constant pressure. Sensible heat changes in liquids, enthalpy changes.

2. **Mixing & Agitation:** Objects and requirement, types of mixing equipment, calculations, power consumptions of agitators, calculation, calculations of power consumption based dimensional analysis, power correlation's for specific impellers.

UNIT-II

3. **Fluid Flow:** Flow rate, concept of viscosity, kinematic viscosity, Newtonian and non-Newtonian fluids, types of pressure, energy balance, (Bernoulli's equation), mechanical energy balance, friction losses in pipes and fittings, due to sudden contraction and sudden expansion, calculations.

4. **Transportation and Metering of Fluids:**
   Pumps and Compressors: Different types of pumps and their construction, centrifugal pump characteristics and operation, NPSH, Cavitation, pump selection, Blowers and compressors. Valves: Cocks, globe valves, gate valves, quick opening valves, butterfly valves. Pressure rating of fittings, pipe joints and fittings. Flow meters: Venturi meter, orifice meter, rotameters, turbine meters, magnetic meters. Vortex shedding meters.

UNIT-III

5. **Heat Transfer:** Mechanism of heat transfer by conduction and radiation, thermal resistance, heat loses in furnace by conduction through series of layers of different material under steady state conditions, heat transfer by convection, fluid film concept, dimensionless groups, equation for fluids by forced convection in tubes, natural convection on horizontal surfaces and vertical surfaces, simplified equation for natural convection to air, laws of radiation, black body, Stefan boltzman law, numerical problems.

6. **Heat Transfer Equipment:** Shell & tube heat exchanger, design features, heat load, log mean temperature drop in single pass and multiple pass heat exchangers, special equipments, plate type, spiral type, finned type, cooling coils heat exchangers, their construction, numerical problems.

Texts:

1. Chemical Engineers Handbook (5th Edition) R.H. Parry & C.H. Chlton, McGraw Hill Book Company.
2. Badger, W.L. “Introduction to Chemical Engineering”.
3. McCabe, W.L., Smith J.C. and Harriot P. “Unit operations of chemical Engg” McGraw Hill, 5th edition-1993.
4. Kerns, D.Q. “Process Heat Transfer” 2nd edition, McGraw Hill-1965.
5. Foust, A.S., Wenzel, L.A., Clump, C.W. Maus, L. and Andersen, L.B. “Principles of Unit Operations” 2nd edition, John W. Leey & Sons.

B.TECH. (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – II
(Under Credit Based Continuous Evaluation Grading System)

STL-105: SUGAR CANE AGRICULTURE

Credits: 3-1-0
Note: Students can use the Non-Programmable scientific calculator.

UNIT-I

1. Sugar producing plants.
2. History, Origin and distribution of sugarcane. Major sugar producing countries in the world. Area under sugarcane in different states of India.
3. Definition, composition and function of soils, different types of soils in India.
4. Cultivation of sugarcane : Soil types, preparation of land, periods of sowing, cane seed, seed treatment, types of planting, seed rate and row spacing, growth phases of sugarcane plant i.e. germination, tillering, grand growth period, maturity. Different inter cultural operation i.e. hoeing, weeding, earthing up, tying, wrapping and mulching.
5. Nutrition of sugarcane- Nitrogen, phosphorus and potash: Effect of each element on tonnage and sugar content. The role of micronutrients in sugarcane crop. Recommended fertilizer schedule for different sugarcane growing states of India.

UNIT-II

6. Major diseases of sugarcane plant, their symptoms, period of occurrence, control measures and effect on yield and sugar content.
7. Major pests of sugarcane plant, their symptoms, period of occurrence, control measures and effect on yield and sugar content.
8. Irrigation of sugarcane crop, concept of drip irrigation and its advantages.
9. Harvesting and transport management: Method for testing maturity of sugarcane. Advantage of harvesting sugarcane on the basis of pre-harvest maturity test.
10. Sugarcane varieties and breeding objectives.

UNIT-III

11. Deterioration of Sugarcane: Factors affecting deterioration and control measures, effect of deterioration on cane weight and sugar content.
12. Burnt Cane: effect on weight and sugar content.
13. Sugar Beet, Requirement of the crop and potentialities for growing in India.
14. Cultivation of sugar beet, methods and period of sowing fertilization and maturity
15. Comparison of sugarcane & Sugar beet for producing sugar in India.
16. Formation and accumulation of sugar in sugarcane.
17. Factors affecting cane quality and its effect on processing parameters and sugar recovery.
18. Concept of intercropping with sugarcane crop and its advantages.

Texts:

1) Sugarcane by C.N. Babu, (1990 IInd Edition), Allied Publishers Ltd.
2) The sugar beet crop by D.A.Cooke and R.K.Scott, (1993, Ist Edition)
3) Sugarcane pest management by Dr. R. S. Brar, (1998 Ist edition), G.K.Publication, Ludhiana.
4) Diseases of sugarcane & sugar beet by V.P.Agnihotri, (1990, Revised Ist Edition), Oxford & IBH Publicating Company.
5) Hand book of cane sugar technology by R.B.L. Mathur, (1986 IInd Edition), Oxford & IBH Publishing Company.

B.TECH. (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – II
(Under Credit Based Continuous Evaluation Grading System)

PBL-131: ਪੰਜਾਬੀ ਲਾਜ਼ਮੀ-II

p`T-km Eq| p`T psqk~

Credits: 2-0-0

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(II) 9. **E`qm En`qm** (sp. virE`m isG sD Eq f`. sih rblr isG! "r n`nk v #nlvris$l!
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(III) 9. **E`qm En`qm** (sp. virE`m isG sD Eq f`. sih rblr isG! "r n`nk v #nlvris$l!
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B.TECH. (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – II
(Under Credit Based Continuous Evaluation Grading System)

PBL-132: ਮੁੱਢਲੀ ਪੰਜਾਬੀ

(In lieu of Punjabi Compulsory)

2–0–0

ਪਾਠ–ਕ੍ਰਮ

1. ਪੰਜਾਬੀ ਸ਼ਬਦ–ਬਣਤਰ
   ਸੰਯੁਕਤ ਅਤੇ ਮਿਸ਼ਰਤ ਸ਼ਬਦ
   ਬਹੁ–ਉਚਾਰਖੰਡੀ ਸ਼ਬਦ

2. ਪੰਜਾਬੀ ਵਾਕ–ਬਣਤਰ
   ਸਾਧਾਰਨ–ਵਾਕ : ਕਿਸਮਾਂ
   ਸੰਯੁਕਤ–ਵਾਕ : ਕਿਸਮਾਂ
   ਮਿਸ਼ਰਤ–ਵਾਕ : ਕਿਸਮਾਂ

3. ਪ੍ਰਕਾਰਜੀ ਪੰਜਾਬੀ
   ਚਿੱਠੀ ਪੱਤਰ
   ਪੈਰ੍ਹਾ ਰਚਨਾ
   ਸੰਖੇਪ ਰਚਨਾ
   ਅਖਾਣ ਅਤੇ ਮੁਹਾਵਰੇ

ਯੂਨਿਟ ਅਤੇ ਥੀਮ

1. ਪੰਜਾਬੀ ਸ਼ਬਦ-ਬਣਤਰ : ਸੰਯੁਕਤ ਸ਼ਬਦ; ਸਮਾਸੀ ਸ਼ਬਦ (ਜਿਵੇਂ ਲੋਕ ਸਭਾ); ਦੋਜਾਤੀ ਸ਼ਬਦ (ਜਿਵੇਂ ਕਾਲਾ ਸਿਆਹ); ਦੋਹਰੇ ਸ਼ਬਦ/ਦੁਹਰੁਕਤੀ (ਜਿਵੇਂ ਧੂੜ੍ਹ ਧਾੜ੍ਹ/ਭਰ ਭਰ), ਮਿਸ਼ਰਤ ਸ਼ਬਦਾਂ ਦੀ ਬਣਤਰ/ਸਿਰਜਨਾ; ਅਗੇਤਰਾਂ ਰਾਹੀਂ (ਜਿਵੇਂ ਉਪ ਭਾਸ਼ਾ), ਪਿਛੇਤਰਾਂ ਰਾਹੀਂ (ਜਿਵੇਂ ਰੰਗਲਾ), ਪੰਜਾਬੀ ਸ਼ਬਦ ਰਚਨਾ–2: ਪੜਨਾਵੀਂ ਰੂਪ, ਕਿਰਿਆ/ਸਹਾਇਕ ਕਿਰਿਆ ਦੇ ਰੂਪ; ਨਿੱਤ ਵਰਤੋਂ ਦੀ ਪੰਜਾਬੀ ਸ਼ਬਦਾਵਲੀ–2: ਮਾਰਕੀਟ/ਬਾਜ਼ਾਰ, ਵਪਾਰ, ਧੰਦਿਆਂ ਨਾਲ ਸੰਬੰਧਿਤ।

2. ਪੰਜਾਬੀ ਵਾਕ-ਬਣਤਰ : ਕਰਤਾ ਕਰਮ ਕਿਰਿਆ; ਸਾਧਾਰਨ ਵਾਕ, ਬਿਆਨੀਆ, ਪ੍ਰਸ਼ਨਵਾਚਕ, ਆਗਿਆਵਾਚਕ, ਸੰਯੁਕਤ ਅਤੇ ਮਿਸ਼ਰਤ ਵਾਕਾਂ ਦੀਆਂ ਕਿਸਮਾਂ; ਸੁਤੰਤਰ ਅਤੇ ਅਧੀਨ ਉਪਵਾਕ; ਸਮਾਨ (ਤੇ/ਅਤੇ) ਅਤੇ ਅਧੀਨ (ਜੋ/ਕਿ) ਯੋਜਕਾਂ ਦੀ ਵਰਤੋਂ; ਪੰਜਾਬੀ ਵਾਕਾਂ ਦੀ ਵਰਤੋਂ : ਵਿਭਿੰਨ ਸਮਾਜਕ/ਸਭਿਆਚਾਰਕ ਪ੍ਰਸਥਿਤੀਆਂ ਦੇ ਅੰਤਰਗਤ; ਘਰ ਵਿਚ, ਬਾਜ਼ਾਰ ਵਿਚ, ਮੇਲੇ ਵਿਚ, ਸ਼ੌਪਿੰਗ ਮਾਲ/ਸਿਨਮੇ ਵਿਚ, ਵਿਆਹ ਵਿਚ, ਧਾਰਮਿਕ ਸਥਾਨਾਂ ਵਿਚ, ਦੋਸਤਾਂ ਨਾਲ ਆਦਿ।

3. ਇਸ ਯੂਨਿਟ ਵਿਚ ਚਿੱਠੀ ਪੱਤਰ (ਨਿੱਜੀ/ਦਫ਼ਤਰੀ/ਵਪਾਰਕ), ਪੈਰਾ ਰਚਨਾਂ, ਸੰਖੇਪ ਰਚਨਾ ਅਤੇ ਅਖਾਣ ਮੁਹਾਵਰਿਆਂ ਦੀ ਵਰਤੋਂ ਰਾਹੀਂ ਵਿਦਿਆਰਥੀ ਦੀ ਭਾਸ਼ਾਈ ਯੋਗਤਾ ਨੂੰ ਪਰਖਿਆ ਜਾਵੇਗਾ।

B.TECH. (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – II
(Under Credit Based Continuous Evaluation Grading System)

Subject Code: ENL–151 Duration of Examination : 3 Hrs
Course Title: **Communicative English** Credits : 02 (L=2,T=0,U=0)

Objectives: To Introduce students in a graded manner to the communication skills of Reading and Writing in English. At the end of semester II, the students should be able to demonstrate adequate competence in comprehending an unseen passage and performing the prescribed communication/writing tasks.

Prescribed Book: Vandana R. Singh, The Written Word, Oxford University Press, New Delhi (Selected Chapters).

Reading:

a) Developing Comprehension Skills

Students will be required to read sample comprehension passage as given in Chapter *Critical Reading and Comprehension* of the prescribed book. The teacher will help students in handling text and answering questions given at the end of each passage.

Teacher can bring in more texts and construct questions of factual and inferential nature to enhance the comprehension skills of the students.

b) Developing Habits of Additional Reading

The students will be required to show evidence of additional independent reading. They will maintain a scrapbook consisting of such readings as clippings from newspapers and magazines, short articles, stories etc. The minimum quantum of such additional reading will be decided by the class teacher, who will also test students individually on their additional reading (and appropriately award internal assessment, if required.

Writing:

a) Developing Vocabulary and using it in the Right Context

Students will be required to pay special attention to build up their vocabulary. They should master the contents of the chapter on *Vocabulary* in the prescribed book. Teacher will help the students learn the correct and appropriate use of the given set of words/phrases/expressions.

b) Developing Skills in Formal Writing

Students will be required to do write–ups involving skills of making formal complaints, requests, orders etc., reporting, note taking, summarizing and transcoding. The types of composition task may include business and public interest letters, news/features writing, speeches, minutes, instructions, summary reports etc. Teacher shall instruct the students about the appropriate format and usual conventions followed in such writings. The following chapters in the prescribed book may be consulted for exercise materials on these tasks:

1. Paragraph and essay writing
2. Report Writing
3. Letter Writig
4. Note Making and Summarizing
5. Transcoding

Recommended Books:

1. A Course in Grammar and Composition by Geeta Nagaraj, Foundation Book, 2006.
2. Oxford Guide to Effective Writing and Speaking by John Seely.

B.TECH. (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – II
(Under Credit Based Continuous Evaluation Grading System)

MTL -122: APPLIED MATHS

Credits: 3-1-0
Note: Students can use the Non-Programmable scientific calculator.

UNIT-I

Differential Calculus: Partial derivatives, Euler's theorem for homogeneous functions, total derivative, change of variables, Maxima and minima of functions of two variables, Lagrange's methods of undetermined multipliers.

Complex Numbers: De moivre's theorem and its applications, Exponential, Logarithmic, Circular and Hyperbolic functions of complex variables inverse functions and their real and imaginary parts. Summation of series.

UNIT-II

Differential Equations: Formation of differential equations, solutions of first order and first degree differential equations, Exact differential equations, integrating factors, Linear differential equations, Cauchy's form, Legendre linear equations, simultaneous linear equations with constant coefficients, Total differential equations.

Matrices: Linear dependence, Rank of a matrix, applications to solution of system of linear equations, linear transformations, Orthogonal, Unitary and Hermitian matrices, Eigen values and Eigen Vectors, Reduction of diagonal form. Caylay-Hamilton theory, Bilinear and Quadratic forms.

UNIT-III

Double & Triple Integration: Evaluation of double and triple integrals, interchange of order of integration, Areas by double integration. Evaluation of volumes of solids.

Fourier Series: Euler's formula, Fourier expansion, Change of interval, Expansions of odd and even periodic functions, Half range series, Harmonic analysis.

Text:

1. N.P. Bali: A text book of Engineering Mathematics.
2. B.S.Grewal: Higher Engineering Mathematics
3. Kreyszig Erwin: Advanced Engineering Mathematics

B.TECH. (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – II
(Under Credit Based Continuous Evaluation Grading System)

STP-103: INSTRUMENTATION (LAB)

Credits: 0-0-3
Note: Students can use the Non-Programmable scientific calculator.

1. Study of inversion of cane sugar by hydrolysis with 4N HCl with the help of polarimeter.
2. Determination of specific rotation of sucrose employing polarimeteric method.
3. Determine the relative strength of two acids of the same normally using a polarimeter.
4. Determine the total sugar present in cane-juice from calibration graph between various percentages of sugar and refractive index using refractometer.
5. Study of adsorption of sugar by AL_2O_3. SIO_2 or activated charcoal kieselgurh employing polarimeteric method.
6. Study of adsorption of colouring matter on activated charcoal and determination of the amount absorbed from the natural juice of the cane sugar spectrophotometrically.
7. Determination of Fe(III) in ppm present in cane juice by reaction with potassium ferrocynide/spectrophotometrically.
8. Determination of the total Ca-present in ppm present in cane sugar juice with the help of flame photometer. First drawn calibration curve between various amount of Ca present in 5% sugar solution vs. Unit of flame photometer.
9. Determination of the ash content of cane juice by Spencer Sattler and Zerban conductivity method.
10. Study of the deduction of excess acidity based upon the scale of 2.5-4.8ml of O.1N NaOH required to raise 10ml of juice to a pH metric method.
11. Study of mutarotation of glucose from the pure sample of glucose.
12. Determination of PO_4 present in cane juice by turbidometric method. Phosphate content.
13. Study of effect of heat on the colouring matter of cane juice.
14. Determination of viscosity of the following: cane juice, massecuite, molasses by procuring the samples from the mills.
15. Determination of the concentration of an unknown sucrose solution with the help of viscometer.

Texts:

1. Principles of Instrumental Analysis by Skoog & West. Published by Holt Rineharts Winston Inc.
2. Advanced Practical Physical Chemistry by J.B. Yadav. Published by Goel Publishing House.

B.TECH. (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – II
(Under Credit Based Continuous Evaluation Grading System)

STP-104: DRAWING & DESIGN LAB–I

Credits: 0-0-2
Note: Students can use the Non-Programmable scientific calculator.

Drawing: Sketch on the following:

1. Types of Rivets.
2. a) Single riveted Lap Joint
   b) Double riveted Lap joint (Zig-zag riveting and Chain riveting)
3. Types of the welded joints.
4. Thread terms and nomenclature.
5. Types of V/thread forms for fastening.
6. Types of square thread family.
7. Drawing of Hexagonal nut.
8. Hexagonal heated bolt and hexagonal nut assembly.
9. Square headed bolt and square nut assembly.
10. Machine Screws.
11. Types of keys.
12. Pin type flexible coupling.
13. Dimensioning*:* Dimensioning terms and notations important dimensioning rules, dimensioning common features.
14. Orthographic projections Projection terms first angle and third angle orthographic projection method of obtaining orthographic projections in third angle. View analysis. Comparison of first & third angle projections.

Text:

Machine Drawing by P.S.Gill, Latest Edition, B.D.Kataria & Sons, Opp.Clock Tower.

B.TECH. (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – II
(Under Credit Based Continuous Evaluation Grading System)

STP-105: SUGAR CHEMICAL TESTING (LAB)

Credits: 0-0-3
Note: Students can use the Non-Programmable scientific calculator.

1. Analysis of lime for available CaO by
   a) Phenol Method b) Sucrose Method.

2. Analysis of lime for slakability test.

3. Analysis of sulphur for
   a) Sulphur% b) Moisture%
   c) Ash% d) Combustibility
   e) Arsenic

4. Analysis of lime for
   a) Matter insoluble in HCl b) Silica
   c) Fe_2O_3 and Al_2O_3 d) MgO

5. Analysis of limestone for
   a) Moisture% b) Silica%
   c) Fe_2O_3 and $Al_2O_{3\%}$ d) MgO%
   e) Sulphates%

6. Analysis of Commercial Phosphoric acid.
7. Analysis of Blankit (Sodiuim Hydrosulphite)
8 Analysis of Electrolytic Chlorine
9. Analysis of Ammonium bifluoride
10 Analysis of Commercial formalin
11. Analysis of Coke for
    a. Moisture%
    b. Ash%
    c. Sulphur%
12. Analysis of evaporator scale for
    a. Insoluble silica b. Soluble silica
    c. Ferric Oxide and Alumina d. Ca and Mg
    e. So4 f. Oxalate
    g. Phosphate h. Aconitic acid

Text: Textbook of Quantitative Chemical Analysis by Vogel, 5th Ed. (1994) ELBS.

B.TECH. (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – III
(Under Credit Based Continuous Evaluation Grading System)

STL-201: SUGAR TECH. MANUFACTURING-I

Credits: 3-1-0
Note: Students can use the Non-Programmable scientific calculator.

UNIT-I

1. Juice extraction from cane, maceration and imbibition use of cold and hot water, maceration schemes and mill sanitation.
2. Measurement and weighment of Juice, measuring tanks, level meters, counter weighing machines hand operated, semi automatic and automatic systems-equipment details and operation.
3. Sulphur burning for production of SO_2 (sulphur-di-oxide) different types of sulphur furnaces, batch type, continuous type, their construction and operation, gas scrubbers, cooling of gas, composition of sulphur, different arrangements of melting and addition, air compressors of different types.
4. Lime kilns-batch type and continuous type, milk of lime preparations, slakers and grit removal, CO_2, production, CO_2 scrubbers and cooling of gas.
5. Color & coloured non-sugars, colour originally present, developed during process & from sugar decomposition products, removal of color by precipitates and adsorbents.

UNIT-II

6. Composition of cane & beet juice- their differences, principle of acane juice clarification, influence of lime, different constitutent of juice, effect of heating, different processes of cane juice clarification, simple clarification, compound clarification process, sulphitation, carbonation single and double De Haaus process, comparison of different clarification methods, modern techniques, middle juice carbonation, DM Process.
7. Sulphitation process: Origin and development precipitation of non sugars at the liming or sulphuring of cane juice. Titration curves of cane juices, effect of purification,Technology of sulphitation.

8. Practical effect of clarification: separation of settlings, clarity, purity, colour & general consideration.
9. Juice & syrup sulphitation, design parameters, working problems of juice & syrup sulphiter, melt clarification.
10. Ion exchange process, theory of Ion exchange, Roles of Ion exchange, resins, Application of Ion exchange, different techniques of Ion exchange , regeneration of resins, plant requirement-operation and economics, Treatment of effluent, Ion exchange for recovery of minerals.

UNIT-III

11. Settling tank, system of draining clear juice and dirty juice, continuous subsiders, 'Dorr, Graver, Bach, Trayless and other types of clarifier.
12. Plate and frame type filter presses, continuous filter, oliver filter KOP filters, pressure filters, different desweetening systems.
13. Juice heaters, heat exchangers, use of vapours and steam economy.
14. Evaporation-study of different types of evaporators multiple effect, vapour cell/pre-evaporators- Vapour bleeding systems, condenser barometric, multijet, in-built condensers, catchalls, scale formation and their removal, factors affecting efficiency of evaporation, methods of removal of condensate and incondensable gases, brix test devices, automatic juice level regulator.

Texts:

1) Manufacture and refining of raw cane sugar by Baikow, V.E., (1982- IInd Edition), Elsevier Publishing Co.
2) Handbook of cane sugar technology by Mathur, R.B.L, (1986- IInd Edition), Oxford & IBH Publishing Co.
3) Unit operations in cane sugar production by Payne, J.H, (1988- IInd Edition) Elsevier Publishing Co.
4) Cane Sugar Handbook by Chen, J.C.P., (1985-11th Edition), Wiley Inter science
5) Principles of Sugar Technology Vol. I by Pieter Honig, (1953-Ist Edition), Elsevier Publishing Co.
6) Principles of sugar technology Vol. II by Pieter Honig, (1959-Ist Edition), Elsevier Publishing Co.
7) Handbook of Cane Sugar Engineering by E.Hugot. (1986-IIIrd Edition), Elsevier Science Publishers.

B.TECH. (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – III
(Under Credit Based Continuous Evaluation Grading System)

STL-203: SUGAR TECH. MANUFACTURING-II (PAN BOILING)

Credits: 3-1-0
Note: Students can use the Non-Programmable scientific calculator.

UNIT-I

I. Syrup

a) Syrup brix and pH & their role in pan boiling.
b) Syrup sulphitation- batch type & continuous vessels.
c) Syrup settling & filtration and other new techniques for the treatment/clarification of syrup.

II. Pan boiling

a) Saturated solution, super saturated solution and coefficient of super saturation and its measurement.
b) Classien's theory of pan boiling.
c) Pan its description, heating surface, working volume, and hydrostatic head of pan & its importance.
d) Techniques of pan boiling old methods and new methods, different methods of graining i.e., waiting, shock seeding & true pan seeding, calculation for seed requirement for true pan seeding, seed magma, dry seed.
e) Concept or Massecuite boiling, different types of massecuite boiling i.e., 2M/C boiling, 3M/C boiling, 4 M/C boiling. Ideas of purities of different intermediate massecuite and molasses.
f) Types of pans- coil & calandria, central flow, peripheral and side flow. Different types of calandria and their advantages & disadvantages. Concept of low head pan & its advantages.
g) Intermediate molasses formed during pan boiling and their storage and conditioning.
h) False grain and conglomerates formation and their removal.
i) Circulation in pans- natural & mechanical its importance on rate of crystallization.
j) Control on different intermediate molasses purities. Steps to reduce the final molasses purity.
k) Brief idea of pan instruments i.e., crystal scope, viscometer, cuitometer, pan refractometer & automatic control of pan.
l) Brief concept of steam consumption during massecuite boiling, steam consumption for massecuite % cane.

UNIT-II

III. Solid Balance

Detailed solid balance calculation, different types of numericals based upon solid balance used during the pan boiling.

IV. Crystallization in motion

a) Concept of crystallization of sugar in crystallizer, factors affecting the rate of crystallization.

b) Air cooled & water cooled crystallizers.

c) Types of crystallizers- kopke, Lafeuille, workspoor, continuous crystallizers, vertical continuous crystallizers.

d) Concept of cooling and reheating of massecuite, different methods of heating i.e. by stationary & moving coils.

e) Molasses exhaustion, step to reduce the final molasses purity, saturation temperature.

V. Centrifugals.

a) Theory of centrifugals, different types of drive, gravity factor numerical based upon G.F.

b) Batch type & continuous type centrifugals, their advantages and disadvantages brief idea about semi & fully automatic centrifugal machines.

c) Centrifugal basket, inter liners and mesh arrangements.

d) Washing of sugar-use of water, steam & superheated water.

e) Pugmills, magma mixers and disposal of molasses during centrifugalling.

f) Sugar Melter.

UNIT-III

VI. Sugar Driers

a) Types of sugar driers.
b) Grass hopper type drier its working, drying & cooling of sugar.
c) Grading of sugar,. different sizes of mesh used for grading of sugar.

VII. Storage of Sugar

a) Temperature of bagging, keeping quality of sugar.

b) Construction of sugar godowns its site, type of flouring & roofing, moisture content/R.H. of air and their control in godowns, use of hygrometer.

VIII. Quality of Sugar

a) Role of pan boiling on sugar quality.

b) Quality parameters of sugar i.e. ICUMSA colour, moisture %, SO_2 content, starch contents etc. Effect of R.H., temperature & moisture content on sugar quality.

c) Standards quality parameters limits for raw, white plantation & refined sugar.

IX. Storage of Molasses

Molasses tanks, storage pits and their requirements, precaution to be taken during storage.

Texts:

1. Handbook of Cane Technology–R.B.L. Mathur (1986 2nd Edition), Oxford & IBM Publishing Company.
2. Principle of Sugar Technology, Vol. II, III, Ist Edition, Pieter Honnig, Elesvier Publishers.
3. Handbook of Cane Sugar Engineering E. Hugot, 3rd Editon, 1986. Elesvier Publishers.
4. Cane Sugar Handbook–Meade & Chen.

B.TECH. (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – III
(Under Credit Based Continuous Evaluation Grading System)

STL-204: ANALYTICAL CHEMISTRY

Credits: 3-1-0
Note: Students can use the Non-Programmable scientific calculator.

UNIT-I

1. Sampling techniques for soil sugarcane, bagasse, juices, press cake, molasses, sugar and other sugar house products.
2. Moisture determination in soil, sugarcane leaves, bagasse molasses, sugar and other sugar house products.
3. Different types of solids and inorganic non-sugars present in cane juice.
4. Boiler feed water, various sources, chemical compositions, methods of analysis, various processes for making water fit for feed and the specifications of feed and the specifications of feed water for different pressure boilers.

UNIT-II

5. Optical methods sugar analysis- Principles of polarimetry polarized light : specific rotation of sugars & various factors affecting specific rotation; polarization by Nicol prism principles of polarimeters and saccharimeters; Sugar scales and normal weight, methods of simple polarization, ICUMSA method of polarization of raw sugars, juices, syrups, molasses, massecuites etc. Error due to use of lead subacerare and method for its elimination: methods of double or invert polarization and its principle, clerget constant and factors affecting of double it: invert polarization of impure solutions such as molasses, syrups, massecuites etc.
6. Colorimetry and turbimetry principles and applications in sugar industry

UNIT-III

7. Chromatography: Theories of Elution Chromatography w.r.t column, plate theory, kinetic theory and band broadening, thermodynamic factors affecting band separation, Optimization of column performance, quality and quantitative analysis. High pressure Liquid Chromatography and Gas Chromatography: Scope column efficiency and brief description of instrumentation and detectors, Mobile phases and their properties, partition selection and applications, absorption selection and applications.
8. Chemistry of colored non-sugars in cane. Chemical reactions of colored decomposition products. Removal of color by precipitates and adsorbents. ICUMSA Color determination. Additive and subtractive mixing of colour laws, Attributes of color, CIE System, Metamerism, Munshell system.

Texts:

1. Engineering Chemistry by Jain, (1994-10th Edition), Published by Dhanpat Rai & Sons, New Delhi.
2. System of Technical Control for cane sugar factories in India by N.C.Verma, Published by The Sugar Technologists of India, Kanpur.
3. Principles of instrumental methods of Analysis (3rd Edition) by D.S.Skoog.
4. Sugar Analysis Browne & Zerban IIIrd Edition, Published by John Wiley & Sons.
5. Water treatment for Industrial and other uses Nordell E. IInd Edition, Published by Van Nostrand Reinhold Company, Published by Holt Rinehart and Winston In….

B.TECH. (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – III
(Under Credit Based Continuous Evaluation Grading System)

STL-205: CHEMICAL ENGINEERING-II

Credits: 3-1-0
Note: Students can use the Non-Programmable scientific calculator.

UNIT-I

1. **Gas Absorption:** Theory of gas absorption, gas absorption, in sulphitation and carbonation process, design of packed towers.

2. **Sedimentation:** General laws of settling, Newtons's law, Stokes equation, hindered settling, Equipment for Sedimentation: Thickeners, cyclones, hydrocyclones, centrifugal decanters.

3. **Filtration:** Theory of filtration, kozeny's equation in general at constant rate filtration, at constant pressure and continuous filtration, principles of Cake filtration, clarifying filters. The filter aids, filtration equipments, selection, plate and frame type filter press, leaf filters, continuous filters.

UNIT-II

4. **Distillation**: Vapour-liquid equilibrium, Batch distillation, flash distillation, distillation with reflux. McCabe-Thiele method, types of plates – sieve plate, bubble cap plates, valve plate, plate efficiency, azeotropic distillation.

5. **Crystallization:** Solution, solubility, saturation, supersaturation, nucleation, crystallization mechanism, crystal growth, agglomeration and breakage, yield, purity of products, false grain and their formation, caking of crystals, fractional crystallisation equipment, vacuum crystallizers, draft tube-baffle crystallizers, application of principles to design.

UNIT-III

6. **Drying:** Theory of drying, Temperature pattern in dryers, phase equilibria, drying principles for porous & non-porous solids, rate of drying, tray dryer, rotary dryer, drum dryer, spray dryer, fluidized bed dryer.

7. **Size Reduction:** Crushing and grinding, objectives, stages of reduction, laws of size reduction, coarse, intermediate and fine grinders, open and closed circuit grinding, fuel control, mill discharges, energy consumption, removal and supply of heat, size enlargement.

Books Recommended:

1. Chemical Engineers Handbook by R.H. Parry and C.H. Chilton, McGraw Hill Book Company.
2. Introduction to Chemical Engineering by W.L. Badger and J.T. Bunchero, McGraw Hill Book Company.
3. Unit Operations of Chemical Engineering by W.L. McCabe, J.C. Smith and P. Harriot McGraw Hill International Edition.
4. Principles of Unit Operations by A.S. Foust, L.A. Wenzel, C.W. Clump, L. Maus and L.B. Andersen, John Wiley & Sons.
5. Transfer Processes and Separation Process Principles by C.J. Geankoplis, Prentice –Hall of India Pvt. Ltd, New Delhi.
6. Food Powders Physical Properties, Processing, and Functionality by G.V. Barbosa-Canovas, E. Ortega-Rivas, P. Juliano and H. Yan, Kluwer Academic/Plenum Publishers.

B.TECH. (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – III
(Under Credit Based Continuous Evaluation Grading System)

ESL220: Environmental Studies (Compulsory)

Credit 3-0-0

1. **The multidisciplinary nature of environmental studies:** Definition, scope & its importance, Need for public awareness.

2. **Natural resources**: Natural resources and associated problems.

   a) **Forest resources**: Use of over exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.

   b) **Water resources**: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

   c) **Mineral resources**: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

   d) **Food resources**: World food problems, change caused by agriculture and overgrazing, effects or modern agriculture, fertilizer-pesticide problem, salinity, case studies.

   e) **Energy resources**: Growing of energy needs, renewable and non-renewable energy resources, use of alternate energy sources, case studies.

   f) **Land recourses**: Land as a resource, land degradation, soil erosion and desertification.

   g) Role of an individual in conservation of natural resources, Equitable use of resources for sustainable lifestyles.

3. **Ecosystem:**
   Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids.
   Introduction, types, characteristic features, structure and function of the following ecosystems:
   a. Forest ecosystem
   b. Grassland ecosystem
   c. Desert ecosystem
   d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

4. Biodiversity and its Conservation:

Definition: Genetic, species and ecosystem diversity, Biogeographical classification of India.

Value of Biodiversity: Consumptive use; productive use, social, ethical, aesthetic and option values.

Biodiversity of global, National and local levels, India as mega-diversity nation "Hot-spots of biodiversity.

Threats to Biodiversity: Habitat loss, poaching of wild life, man wildlife conflicts Endangered and endemic species of India.

Conservation of Biodiversity: In situ and Ex-situ conservation of biodiversity.

5. Environmental Pollution:

Definition, Causes, effects and control measures of:

a) Air Pollution
b) Water Pollution
c) Soil Pollution
d) Marine Pollution
e) Noise Pollution
f) Thermal Pollution
g) Nuclear Hazards

Solid Waste Management: Causes, effects and control measures of urban and industrial wastes.

Role of an individual in prevention of pollution.

Pollution case studies Disaster Management: Floods, Earthquake, Cyclone and Landslides

6. Social Issues and Environment:

* From unsustainable to sustainable development
* Urban problems related to energy
* Water conservation, rain water harvesting, watershed management
* Resettlement and rehabilitation of people; its problems and concerns. Case studies
* Environmental ethics: Issues and possible solutions.
* Climate change, global warning, acid rain, ozone layer depletion, nuclear accidents and holocause. Case studies.
* Wasteland reclamation
* Consumerism and waste products
* Environmental Protection Act
* Air (prevention and Control of Pollution) Act
* Water (prevention and Control of Pollution) Act
* Wildlife Protection Act
* Forest Conservation Act
* Issues involved in enforcement o£. environmental legislation
* Public awareness

7. Human population and the environment

* Population growth, variation among nations
* Population explosion-Family welfare programme
* Environment and human health
* Human rights
* Value education
* HIV / AIDS
* Women and child welfare
* Role of information technology in environment :and human health
* Case studies

*** Road Safety Rules & Regulations:** Use of Safety Devices while Driving, Do's and Don'ts while Driving, Role of Citizens or Public Participation, Responsibilities of Public under Motor Vehicle Act, 1988, General Traffic Signs

*** Accident & First Aid:** First Aid to Road Accident Victims, Calling Patrolling Police & Ambulance

8. Field Work: Visit to a local area to document environmental assets–river / forest / grassland / hill / mountain. Visit to a local polluted site–Urban / Rural / Industrial / Agricultural. Study of common plants, insects, birds. Study of simple ecosystems–pond, river, hill slopes, etc. (Field work equal to 5 lecture hours)

References:

1. Agarwal, K. C. 2001. Environmental Biology, Nidhi Publications Ltd. Bikaner.
2. Bharucha, E. 2005. Textbook of Environmental Studies, Universities Press, Hyderabad.
3. Bharucha, E. 2004. The Biodiversity of India, Mapin Publishing Pvt. Ltd. Ahmedabad.
4. Brunner, R. C. 1989. Hazardous Waste Incineration, McGraw Hill Inc. New York.
5. Clark, R. S. 2000. Marine Pollution, Clanderson Press Oxford.
6. Cunningham, W. P., Cooper, T. H., Gorhani, E. & Hepworth, M. T. 2001. Environmental Encyclopedia, Jaico Publications House, Mumbai.
7. De, A. K. 1989. Environmental Chemistry, Wiley Eastern Ltd.
8. Down to Earth, Centre for Science and Environment, New Delhi.
9. Hawkins, R. E. 2000. Encyclopedia of Indian Natural History, Bombay Natural History Society.

10. Heywood, V. H & Waston, R. T. 1995. Global Biodiversity Assessment, Cambridge House, Delhi.
11. Jadhav, H. & Bhosale, V. M. 1995. Environmental Protection and Laws. Himalaya Pub.
12. Joseph, K. and Nagendran, R. 2004. Essentials of Environmental Studies, Pearson Education (Singapore) Pte. Ltd., Delhi.
13. Kaushik, A. & Kaushik, C. P. 2004. Perspective in Environmental Studies, New Age International (P) Ltd, New Delhi.
14. Miller, T. G. Jr. 2000. Environmental Science, Wadsworth Publishing Co.
15. Odum, E. P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA.
16. Rajagopalan, R. 2005. Environmental Studies from Crisis to Cure. Oxford University Press, New Delhi.
17. Sharma, B. K. 2001. Environmental Chemistry. Geol Publishing House, Meerut.
18. Sharma, J. P. 2004. Comprehensive Environmental Studies, Laxmi Publications (P) Ltd, New Delhi.
19. Sharma, P. D. 2005. Ecology and Environment, Rastogi Publications, Meerut.
20. Subramanian, V. 2002. A Text Book in Environmental Sciences, Narosa Publishing House, New Delhi.
21. Survey of the Environment. 2005. The Hindu.
22. Tiwari, S. C. 2003. Concepts of Modern Ecology, Bishen Singh Mahendra Pal Singh, Dehra Dun.
23. Townsend, C., Harper, J. and Michael, B. 2001. Essentials of Ecology, Blackwell Science.
24. Booklet on Safe Driving. Sukhmani Society (Suvidha Centre), District Court Complex, Amritsar.

B.TECH. (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – III
(Under Credit Based Continuous Evaluation Grading System)

STP-201: SUGAR TECHNOLOGY LAB-I

Credits: 0-0-3
Note: Students can use the Non-Programmable scientific calculator.

1. Preparation of reagents for clarification:
   a) Basic Lead Acetate.
   b) Alumina Cream
   c) Deleading solution.
2. Determination of total soluble solids by:
   a) Refractometer.
   b) Brix Spindle
   c) Drying Method.
3. Determination of Pol and calculation of purities juices, syrup, massecuites and other boiling house products.
4. Preparation of indicator solution and test papers for pH determination of:
   a) Raw Juice (Methyl orange)
   b) Sulphited Juice (BTB) Solution and papers
   c) Carbonated Juice (Dupont paper and B paper)
   d) Water (Phenophthalein papers)
   e) Syrup (Indicator Solution and papers)
5. Determination of pH of various cane sugar product by different methods:
   a) Hellige Comparator
   b) Test Papers
   c) pH meter
6. Preparation of acidic and alkaline solutions of different strength.
7. Determination of SO_2 content in juices and syrup.
8. Preparation of solutions and detection of sugar traces in condensate, condensor and boiler feed water by:
   a) Naphthol Test.
   b) Concentration Procedure.

9. Water analysis for its major constituents including dissolved oxygen content e.g.
   a) Temporary Hardness.
   b) Permanent Hardness
   c) P-alkalinity.
   d) Mo-alkalinity.
   e) TDS
   f) PO_4 content
   g) Chloride content
10. Determination of ash% in juices, syrup, massecuites, molasses etc.
   a) Carbonated Ash.
   b) Sulphated Ash.

Recommended Books:

1) Sugar Analysis by Zerban & Brown, IIIrd Edition, Published by John Wiley & Sons.

2) System of Tech.Control for Cane Sugar Factories in India, 1988 Edition, Published by STAI, New Delhi.

B.TECH. (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – III
(Under Credit Based Continuous Evaluation Grading System)

STP-202: ANALYTICAL CHEM. (LAB)

Credits: 0-0-3
Note: Students can use the Non-Programmable scientific calculator.

Separation of liquids by gas Chromatograph
Separating of liquid by paper chromatograph
Quantitative analysis of Beer by NMR

A. Determination of Iron Spectrophotometrically.
Determination of Phosphate Spectrophotometrically.
Determination of Calcium using Flame PhotometerB.

B. Volumetric Analysis

a) $KMnO_4$ Titrations
Determination of Fe(II)
Determination of Mn^2.
Determination of Ca^{2-} in calcium oxalate.
Determination of H_2O_2.

b) Iodometry
Standardization of hypo with KIO3.
Determination of Cu (II).
Determination of H_2O_2.
Determination of available chlorine in bleaching powder.

c) Complexion: EDTA Titratrions
Standardization by Mg(II)/Zn (II).
Determination of Mg^2.
Determination of Ni^2.
Determination of total hardness of water.
(Permanent or Temporary).

Recommended Book:
Vogel' Text book of Quantitative Inorganic Analysis by J.Basselt, R.C.Denney, G.H.Jeffany & J.Mendhan, published by Longman Group Limited.

B.TECH. (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – III
(Under Credit Based Continuous Evaluation Grading System)

STP-203: IN-SEASON IN PLANT TRAINING (2 Weeks)
(Dec/Jan)

Credits: 0-0-2

B.TECH. (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – III
(Under Credit Based Continuous Evaluation Grading System)

STP-204: CHEMICAL ENGINEERING (LAB.)

Credits: 0-0-2
Note: Students can use the Non-Programmable scientific calculator.

1. Determination of Reynolds number for a flowing liquid and there by the nature of flow.
2. Determination energy losses in pipe bends, elbows, the sudden contraction and sudden
    a. expansion of various Reynolds numbers.
3. Determination of friction factor for the given pipe for various Reynolds numbers.
4. Determination of efficient discharge for (a) Orifice meter (b) weirmeter (c) V notch
    a. (angle 60^0, angle 90^0).
5. Determination of thermal conductivity of metal rod.
6. Determination of thermal resistance of a powder.
7. Determination of heat transfer co-efficient for heated vertical cylinder in natural convection.
8. Determination of heat transfer co-efficient in forced convection of air in a tube.
9. Determination of settling rate of a slurry of sedimentation.
10. Determination of mass and volumetric flow rate of the fluid flowing in a tank.
11. Determination of mass and volumetric flow rate with (a) Orifice meter (b) V notch.

B.TECH. (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – IV
(Under Credit Based Continuous Evaluation Grading System)

MTL-222: APPLIED STAT AND STAT. CONTROL

Credits: 3-1-0
Note: Students can use the Non-Programmable scientific calculator.

UNIT-I

A general introduction about the role of statistics in science and technology, Classification and tabulation of frequency distribution, Diagrametic and graphical representation of frequency distribution data, Measures of central tendency, dispersion, skewness and kurtosis. Correlation and regression analysis for bivariate data, partial and multiple correlations (for three variables only).

UNIT-II

An introduction to probablility and random variables, Binomial, Poisson and Normal probability distributions, their definitions & important applications in the industry, Tests of hypothesis and level of significance, Random sample. Chi^2, t and Z tests: their applications in industry.

UNIT-III

Fitting of polynomials and growth curves (excluded derivations), growth rate, An introduction to control charts, 3σ control limits, Control charts for mean, proportion defective and number of defects per unit. (excluded derivations)

Recommended Books:

1. Fundamentals of Statistics by S.C. Gupta, Himalaya Publishing House.
2. Statistical Methods: An Introductory text, by I. Medhi, New Age International Pvt. Ltd.
3. Fundamentals of Applied Statistics by S.C. Gupta & V.K. Kapoor, Sultan Chand & Sons Publishers.
4. Theory and Problems of Elements of Statistics, Vol I, by Stephen Bernstein and Ruth Bernstein.
5. Mathematical Statistics with Application by Irwin Miller Marryless Miller, Pearson Education Publishers.

B.TECH. (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – IV
(Under Credit Based Continuous Evaluation Grading System)

STL-202: SUGAR ENGINEERING – I

Credits: 3-1-0
Note: Students can use the Non-Programmable scientific calculator.

UNIT-I

1. Cane Handling, unloading of Cane, different systems and equipment used, guyed crane, self supporting crane, overhead traveling crane, grab and sling system, rakes, cane tumblers & tipping trucks, lateral feeder table, auxiliary carrier dimension, speed and power.

2. **Cane Carrier:** Determination of slope, length, speed, width and power consumption, different methods of drives, cane carrier controls, equalizer (speed & power)

3. **Cane Preparation :** Principle, design and types of knives, chopper leveler and cutter, methods of drives, hydraulic drive, stem turbines and electric motors, flexible coupling, speed of rotation and power requirements, reversed running of knives: shredder-principle, different types, method of drives, speeds and power requirement, merits of different types of cane preparatory device, assessment of cane preparation-bulk density preparation index.

4. Feeding of mills and conveying of bagasse Principal types of intermediate carriers, location and arrangement, belt type carrier, high speed carriers, location of feeding roller with open & Donnelly chute, Effect of imbibition on mill feeding, mechanical feeding devices, Rotary feeders, continuous pressure feeders, bagasse conveyors.

5. **Roller Grooving:** Function, types-circumferential grooves, messchaert grooves, dimension of messachaerts, chevrons grooves, differential angle and differential and equal pitch grooves, how to increase the juice drainage (Lotus roller, etc).

6. **Pressure in Milling:** Hydraulic pressure, accumulators, Reabsorption factor, fibre index. Compression ratio, filling ratio, fibre loading, specific fibre loading, hydraulic pressure, specific hydraulic pressure, Resolution of pressure in a mill, influence of the trash plate, pressure regulating appliances- hydraulic accumulators(dead weight, and air-oil type), calculation of hydraulic pressure, sequence of hydraulic pressure in the milling tendem, mashing of the three roller pinion reaction and measures to control.

UNIT-II

7. **Mill Speed:** Selection of speed and sequence of speeds along the tandom, Relation between the two speeds, linear speed and speed of rotation.

8. **Mill Capacity:** Factors effecting mill capacity and general formula.

9. **Mill Setting:** Calculation of mill settings by different methods, mill ratio, roller lift, setting at rest, effect of fibre loading & preparation on mill setting.
10. **Power Requirement of Mills:** Power absorbed by compression, friction between (Journal and bearings bagasse bed trash plate, scrappers and rollers), intermediate carriers, gearing, general formula, factors effecting power consumption in a mill.
11. **Mill Drives :** Hydraulic drive, steam turbines and electric motors, their merits and demerits, combined and individual drives.
12. **Mill Gearing:** Speed reduction, gearing arrangement, types of gears used, construction of gearing, roller pinions.

UNIT-III

13. **Construction of Mills:** Functions, different types of housing-standard inclined housing, self setting mill, trash plate and its function; trash turner, mill rollers, bearings pinion roller scrappers, flanges.
14. Imbibition Principle, different systems of imbibition in methods of application of imbibition, hot and cold imbibition, optimum imbibition.
15. Extraction Measure of efficiency of milling work, sucrose percent bagasse, lost undiluted juice percent fibre, length of tandom, rollers speeds, specific fibre loading, imbibition, milling loss, extraction, reduced extraction, extraction ratio, factors in efficiency of mills, sanitation at the mills.
16. **Milling Control:** Extraction of primary juice, brix graphs, how to check the milling performance by brix curves.
17. **Fine Bagasse Separators:** Juice trays, screens area, screen plates, chains, precautions, application, secondary screening, oliver D.S.M. screen, vibrating screen.
18. **Diffusion:** Laws of diffusion, diffusion and lixivation cane diffusion and bagasse diffusion.

    Diffusers : Types of diffusers, D.D.S. diffuser, Desmet Diffuser, B.M.A. diffuser etc. their description, retention time, power and steam requirement, capacity, automatic controls, treatment of their juices, their merits and demerits.

19. New trends in the sugar industry world wide.

Texts:

1. Handbook of cane sugar engineering by E.Hugot (3rd Edition-1986), Elesvier Publishers.
2. Standard Fabrication Practices for cane sugar mills by Delden, (1981), Elesvier Publishers.
3. Unit operation in cane sugar production by Payne, (1988), Elesvier Publishers.

B.TECH. (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – IV
(Under Credit Based Continuous Evaluation Grading System)

STL-206: SUGAR TECH. MANUFACTURING-III

Credits: 3-1-0
Note: Students can use the Non-Programmable scientific calculator.

UNIT-I

1. **Sugar Beet:** Botany & Growth characteristics of sugar beet, cultivation of sugar beet. Preparation of seed bed, planting, fertilization, chemical & mechanical control of weeds & pests. Agro climatic conditions for beet. Beet harvesting & its supply to sugar mills. Distribution of sugar in the beet root. Chemical composition of sugar beet and beet juice.

2. **Beet Storage:** Beet silos or piles, equipment used, type of pile covering, factors affecting piling losses, reclaiming, fluming operation.

3. **Primary Operation & Equipment Used**: Beet silos, flumming channel, Beet feeder or finger gate, stone catcher, leaf & weed catcher. Beet washer, clean beet conveying, beet slicing, cossette weighing, beet pulp press for dewatering pulp.

UNIT-II

4. **Diffusion:** Definition & explanation, theory of diffusion, factor affecting diffusion, difference between diffusion & lixivation. Sugar cane & sugar beet diffusion, cane diffusion & Bagasse diffusion, batch & continuous diffusion.

5. Continous diffuser based on a) percolation_BMA diffuser (b) Maceration
   (c) Maceration cum squeezing. Detail feature of following cane beet diffuser.
   (a) Desmet (b) Saturne (c) D.D.S.
   Dewatering devices i.e. French screw press & three roller mills.

UNIT-III

6. Carbonation process in beet sugar manufacturing. An integrated juice purification system. Ion exchange process in beet sugar manufacturing.

7. Treatment & Diposal of effluents of sugar beet factory. Ion exchange for Desugarging of molasses & Byproduct Isolation.

8. Ultrafiltration used in to produce high fructose syrup from different raw materials, Utilization of Fiber & other Non sugar products from sugarbeet.

9. Open Pan boiling : Khandsari & Gur processing, extraction of juice clarification techniques. Application of electric power to small scale plants . Sugar balance Advantages & disadvantage of khandsari sugar. Fuel consumption.

10. Methods of Gur refining as practised in Indian refineries quality of Gur & Recovery.

Texts:

1. Beet Sugar Technology, Manufacture of Raw & Refined Sugar, MccGinnes Baikow.
2. Chemistry & Processing of Sugar Beet & Sugar Cane by M.A. Clarke & M.A.Godshall.
3. Sugar Beet Crop. By D.A. Cooke & R.K. Scott.

B.TECH. (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – IV
(Under Credit Based Continuous Evaluation Grading System)

STL –207: Sugar Technology (Chem. Control)

Credits: 3-1-0
Note: Students can use the Non-Programmable scientific calculator.

UNIT-I

A. Milling Control

1. Technical definitions, fundamental formula for cane, added water mixed juice and bagasse, calculations of a) Weight of M.J., b) weight of added water, calculation of brix percent bagasse, fibre percent bagasse, undiluted juice lost in bagasse percent fibre, added water in mixed juice percent added water in cane.
2. Methods of control-differential and inferential methods, primary extraction, secondary extraction using simple and compound imbibition scheme.
3. Ideal extraction, mill extraction, brix curves, brix free cane water, lost juice percent fibre, reduced mill extraction, Jawa system of chemical control, steurwald formula, E.R.Q.V., Inferential methods for calculation of bagasse percent cane, mixed juice percent cane, brix percent cane, undiluted juice percent cane, undiluted juice in mixed juice percent cane, added water percent cane and added water per unit cane,indirect method of calculating cane weight.
4. Methods of comparison of milling efficiency of factories.

UNIT-II

B. Boiling House Control:

1. S.J.M.formula and its postulates, winter Carp's formulas, relation between S.J.M. and winter's formulas.
2. Differences between commercial sugar, standard granulated and equivalent standard Granulated (E.S.G.), difference between E.S.G. and Jawa Crystal, calculation of E.S.G., Calculation of clarification factor, actual molasses percent theoretical molasses and non-sugar in molasses percent non-sugar in mixed juice.Calculation of boiling house recovery, basic boiling house recovery, boiling house performance and boiling house recovery (E.S.G.)
3. Comparison of boiling house recovery of different factories, virtual purity of waste molasses, reduced boiling house, recovery.

B.TECH. (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – IV
(Under Credit Based Continuous Evaluation Grading System)

UNIT-III

C. Stock taking:

4. Stock taking, preparation of various balance viz., Pol balance, brix balances and unknown non sugar lases.
5. Time account, capacity utilization, crushing rate/22 hours operation and crushing rate/22 hours operation excluding cane shortage and holidays only)

D. System of recording & reporting control data

1) Daily Manufacturing report
2) Weekly report
3) Monthly report
4) Seasonal report

E. Norms of efficiency

Recommended Books:

1. System of Technology Control for Cane Sugar Factories in India, Ist edition, N.C.Varma.
2. Sugar Analysis by Zerban & Brown IIIrd edition published by John Wiley & Sons.
3. Handbook of Cane Sugar Technology, IInd edition, R.B.L. Mathur.

B.TECH. (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – IV
(Under Credit Based Continuous Evaluation Grading System)

STL-208: PLANT UTILITIES

Credits: 3-1-0
Note: Students can use the Non-Programmable scientific calculator.

UNIT-I

1. **Properties of Steam**: Generation of Steam, Wet steam, Dryness fraction enthaply, specific volume work done during vaporisation, internal energy, Super heated steam, entropy of water, saturated steam and superheated steam, constant volumes process, adiabatic process, Steams tables, experimental method of determining the dryness of fraction of steam-numericals.

2. **Steam Generators:** Introduction, essential of a good stream boiler, selection of steam boiler. Classification of boilers, fire and water tube type, Vertical tubular boilers, high Pressure boilers, typical high pressure boilers, comparison between water tube and fire tube boilers, mounting and accessories.

3. **Performance of Steam Generator:** Evaporation rate, Performance, boiler efficiency, factors influencing boiler efficiency problems.

4. **Draught:** Introduction, types of draught, classification of draught, natural and available draught, aritificial draught, manometer draught gauge, comparison between forced draught and induced draught, power required for draught fan and problems.

UNIT-II

5. **Fuels & Combustion**: Introduction, solid liquid and gaseous fuel, merits and demerits of liquid fuel over solid fuel and gaseous fuel, requirement of a good fuel, calorific values of fuel. GCV and NCV fuel gas analysis by volume orsat apparatus, dulong formula, determination of the weight of dry flue gases per Kg. of fuel, minimum air required per Kg. of fuel, excess air, problem.

6. **Condensers**: The function of a condenser in a steam power plant, vacuum, Classification & comparison of jet and surface condensers, advantages and disadvantages air removal. Edward's air Pump, ejector, Vacuum efficiency. Mass of circulating water required in a condenser, problems.

7. **Belts, Ropes & Chains**: Introduction, selection of belt drive, types of flexible connector, belts & ropes, types of belt, material of belt, strength of belt material, types of flat belt drive, open and crossed belt drives etc., intermediate a counter shaft pulley, velocity ratio (V.R.). slip, V-belt advantages of v-belt over flat belt. Angle of contract, creep, chain drive: Difference between Rope & Chain drives, advantages and disadvantages of chain drive over belt and rope, classification of chains problems.

8. **Corrosion**: Corrosion and its control, General corrosion, localized corrosion, pitting corrosion etc. Factors influencing corrosion, combating corrosion, method of protecting metal, factor influence corrosion, types of coating for the protection.

UNIT-III

9. **Reciprocating Air Compressors**: Mechanical details single stagecompressor, equation for shaft work, clearance volume, volumetric efficiency, classification of air compressor, comparison of reciprocating and rotary air compressor, power of compressor, introduction to the multistage reciprocating compressors, control of compressor- Numericals.

10. **Lubrication**: Physical and chemical test of lubricants, methods of applying lubrication, hand oiling, drop feed cup, ring type of lubrication, needle lubrication etc., forced feed lubrication and grease lubrication etc.

11. **Gears:** Introduction, Classification of gears, parallel shafts, spur gears spur rack and opinion, helical gears, intersecting shafts, straight bevel gears, spiral bevel gears, skew shafts, crossed helical gears, worm gears, hypoid gears, gear terminology, pitch circle, dia, pitch, circular pitch, diameteral pitch, module, gear ration, velocity ratio. pitch point. Addendum, Dedendum, etc.

12. **Friction**: Introduction, kinds of friction, laws of friction, coeff. of friction, friction clutches, disc clutches, Single and multiple clutches, cone clutch, centrifugal clutch.

Recommended Books:

1. Thermal Engineering by P.L. Ballaney (2000 Ed.): Khanna Publishers, Delhi-6.
2. Theory of Machine by Dr. J. Lal and Prof. J.M. Shah: Publishers- Metropolitan Book & Co. Pvt. Ltd., Delhi-6.
3. Theory of Machine by S.S. Rattan, Tata Mc. Graw Hill Publishing Co. Ltd., New Delhi.
4. Frozen Food Technology by C.P. Mallet: Blackie Academic and Professional and Imprint of Chapman and Hall

B.TECH. (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – IV
(Under Credit Based Continuous Evaluation Grading System)

STP-205: SUGAR TECHNOLOGY (LAB-II)

Credits: 0-0-3
Note: Students can use the Non-Programmable scientific calculator.

A. Determination of sucrose and gravity purity of juice, syrup massecuites and other boiling house products by double polarization using:

1. Jackson and Gill's method
2. Steurward's cold inversion method
3. Walker's inversion method
4. Fehling's solution method

B. Determination of reducing sugar in Juices, syrups, massecuites, molasses, etc. by:

5. Eynon and Lane method
6. Potasium Ferricyanide method
7. Gravimetric method
8. Luff's method : For white Sugar only

C. Determination of phosphate content in juice by:

9. Uranium Acetate method
10. Ammonium Molybdate method

D. Determination of CaO content Juice of Syrup, molasses etc., by:

11. EDTA-method
12. Ammonium Oxalate method

Recommended Books:

1. System of Technology Control for Cane Sugar Factories in India, Ist edition, N.C.Varma.
2. Sugar Analysis by Zerban & Brown IIIrd edition published by John Wiley & Sons.
3. Handbook of Cane Sugar Technology, IInd edition, R.B.L. Mathur.

B.TECH (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – V
(Under Credit Based Continuous Evaluation Grading System)

STL-301: Refinery (Raw Sugar Manuf. & Refining)

Credits: 3-1-0
Note: Students can use the Non-Programmable scientific calculator.

UNIT-I

1. **Introduction to Sugar Refining:** Glossary of terms and definitions, sugar refining processes and equipment, automation in a raw cane sugar factory, raw sugar storage and handling.
2. **Refining Process and Operations:** Affination, phosphatation for turbidity and color removal, carbonation for turbidity and color removal, granular carbon decolorisation system, pulsed-bed moving-granular activated carbon system, ion-exchange resin processes for color and ash removal, filtration processes.

UNIT-II

3. **Refinery Boiling:** White sugar boiling and crystallization, refined sugar drying, conditioning and storage, packaging, warehousing and shipping of refined products, remelt and recovery house operations, application of membrane technology in sugar manufacturing.
4. **Refinery Design and Process Control:** Refining design criteria, process selection, integration of raw and refined sugar operations, off-crop sugar refining for a back-end refinery, energy conservation for sugar refining, microbiological control in sugar manufacturing and refining.

UNIT-III

5. **Specialty Sugar Products:** Brown or soft sugar, areado soft sugar process, liquid sugar production, microcrystalline sugar.
6. **Chemistry of Sugar Refining:** Refining quality of raw sugar, non-sugars and sugar refining.

References:

1. Handbook of Sugar Refining by Chung Chi Chou.
2. Manufacturing and Refining of Raw Cane Sugar by V.E. Baikow.

B.TECH (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – V
(Under Credit Based Continuous Evaluation Grading System)

STL-302: SUGAR INDUSTRY BY PRODUCTS

Credits: 3-1-0
Note: Students can use the Non-Programmable scientific calculator.

UNIT-I

General Introduction: Co-product of cane sugar & Beet sugar industry.

Bagasse: 1. Physical & Chemical characters fuel value of bagasse.

2. Ways & means of sparing Bagasse.
3. Handling & Storage of Bagasse

4. Manufacture of pulp & paper from Bagasse

5. Manufacture of particle board, fibre board & corrugated. board

6. Use of bagasse as a fuel, production of bagasse production gas.

7. Miscellaneous products from Bagasse.
   (a) Furfural (b) Cellulose (c) Xylitol (d) Poultry Litter (e) Soil Conditions
   (f) Plastics (g) Cattle Feeds (h) Charcoal and Activated Carbon.

UNIT-II

Molasses

1. Characteristics of molasses, different types of molasses and their comparison in production and composition.
2. Desugarzation of molasses
3. Molasses for products of ethyl alcohol
4. Recovery of CO2 in distilleries.
5. Molasses for production of:

(a) Yeast (b) Monosodium Glutamate (c) Lysine (d) Citric acid (e) Tartaric Acid

(f) Oxalic Acid (g) Aconitc Acid (h) Acetone Butanol Ethanol ABS

6. Use of molasses in live stock feeds
7. Molasses as fuel, fertilizer in briquetting.

UNIT-III

Filter Mud

1. Characteristics, different types & their comparison
2. Use of filter Mud as
   a) fertilizer
   b) fuel
   c) cattle feed
3. Filter Mud for manufacture of
   a) Cane wax
   b) Biogas
   c) Cement

Sugar cane green top: Composition & utilization.

Sucrose derivatives: Brief introduction.

Book Recommended:

Industrial Utilization of Sugarcane & its Co-Product - P.J. Manohar Rao.

B.TECH (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – V
(Under Credit Based Continuous Evaluation Grading System)

STL-303: PROCESS CONTROL & INSTRUMENTATION

Credits: 3-1-0
Note: Students can use the Non-Programmable scientific calculator.

UNIT-I

1. **Instrumentation Terminology and Performance:** Definition of terms: Accuracy, precision, reliability, repetability, reproductivity, standards and calibrations, types of errors, transducers.
2. **Pressure Measurement:** Bourdon type pressure sensors: spiral element, helical type, diaphragm type pressure sensors: standard diaphragm element, multiple capsule element, nested diaphragm type. Electro-mechanical instrument (for indicating and recording). Resistive transducer, LVDT, capacitive transducer, photoelectric transducer. Measurement of vacuum, mechanical vacuum gauges, Mcleod vacuum gauges, resistance wire vacuum gauges.
3. **Temperature Measurement:** Application and selection, bimetallic thermometer. Filled thermal elements: liquid filled systems, vapour filled, gas filled systems, mercury filled system. Glass stem thermometer, liquid in glass thermometer, resistance thermometers. Thermisters: thermocouples: Thermocouple terminology, The law of intermediate temp. and metals. Advantages and disadvantages of thermocouples

UNIT-II

4. **Flow Measurement:** Meter selection, differential pressure: orifice plates, venturi tubes, pitot tube, positive displacement liquid meters: oval gear type, helical rotor type, turbine flow type. Electromagnetic flow meters, variable area flow meters. Rotameter, mass flow meters: impeller-turbine, twin-turbine, ultrasonic meter: Doppler flow meter, two transducer type. Metering pumps: Peristaltic pump (rollers and cam operated), piston pump, Solids flowmeters and feeders: basic belt feeder type, rotary valve volumetric feeder, screw feeder, vibratory feeder, shaker feeder.
5. **Level Measurement:** Selection, application, atmospheric vessel, pressurized vessels, liquid manometer, glass tube manometer, float liquid manometers. Measurement of clean liquid level in atmospheric and pressurized tank by d/p instruments. Float level devices: atmospheric tanks, pressurized tank. Optical level switches: non contacting level sensor, laser used to detect level. Type level device: surface sensor for solids and liquids, thermal level sensors: low level thermal conductivity switch. Ultrasonic level detectors: continuous ultrasonic level detectors

6. **Measurement of Viscosity:** Viscometer selection, laboratory viscometer; rotational, coaxial cylinder viscometer, cone and plate type, industrial viscometer: differential pressure continuous capillary viscometer, float type viscometer: single float, two float, by pass installation of concentric viscometer.

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UNIT-III

7. **Measurement of Density:** Hydrometer, in line hydrometer indicator, liquid density capacitance type, liquid density radiation type.

8. **Measurement of pH:** pH glass membrane electrode, reference electrode, typical installation for pH measuring under pressure in pipe line, preamplifier, amplifier, high temp. and low temp. pH control and recorder.
9. **Measurement of Humidity:** Wet and dry bulb hygrometers, absolute humidity relative humidity, resistive hygrometer etc.

10. **Final Control:** Introduction, final control operations, signal conversions, analog electrical signals, relay, amplifiers, motor control, digital electrical signals, on/off switch, DAC, Pneumatic signals, amplification, nozzle/flapper system, current to pressure converters, actuators, electrical actuators, solenoid, electrical motors, DC and AC motors, stepping motors, pneumatic actuators, hydraulic actuators, hydraulic servos.

11. **Display, Recording, Alarm:** Introduction, display methods, pointer scale system, illumination display, the CRO, recorders of galvanometric and oscillographic recording. Circular chart recorder, recording part, chart and its drive, alarm annunciation. Data logger.

Reference Books:

1. Instrument engineers handbook (process measurement) by Bela G. Liptak, Kriszta Venceal, Chilon Book Company, Pennysylvania.
2. Process instruments and controls handbook – Considine.
3. Process control instrumentation technology - Curtis Johnson, Prentice Hall.
4. Principles of Industrial Instrumentation - D. Patranabis , 2nd edition (McGraw Hill).
5. Electrical and electronic measurement and instrumentation - A.K. Sawhney, Dhanpat Rai & Co.

B.TECH (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – V
(Under Credit Based Continuous Evaluation Grading System)

STL-304: INDUSTRIAL MICROBIOLOGY

Credits: 3-0-0
Note: Students can use the Non-Programmable scientific calculator.

UNIT-I

1. **Introduction:** Kinds of microorganisms, Historical developments in microbiology. General account of bacteria, yeasts and fungi.

2. **Microbiological Techniques:** Isolation of pure culture, pour plating, spreading, streaking, serial dilutions methods of sterilization, media preparation, types of media (synthetic natural, enrichment, selective). Identification & maintenance of cultures.

3. **Control of Microorganisms:** Physical methods: heat sterilization, filtration, irradiation etc., chemical methods: antimicrobial agents, germicides, antibiotics etc.

UNIT-II

4. **Cultivation of Microorganisms:** Natural & laboratory environment, growth media, factors affecting growth, determination of cell mass and cell number, phases of microbial growth, mean generation time, cell division and reproduction, bacterial sporulation and germination, occurrence of heat resistance in bacterial endospores.

5. **Microbial Nutrition:** Bacterial classification on the basis of their nutritional requirements, aerobic, anaerobic and microaerophilic microorganisms. Autotrophic, heterotrophic and photosynthetic organisms.

UNIT-III

6. **Microbial Genetics:** Bacterial transformation, conjugation, transudation and lysogeny, mutagenesis and mutagens, selection and screening of mutants, development of genetically improved strains.

Recommended Books:

1. Pelczar, M.J., Chan, E.C.S. and Crieg, N.R. (21986). Microbiology Vth Ed., McGraw Hills Publishers.
2. Principles of Fermentation Technology. Stanbury and Whitaker, Pergamon Press.
3. Stanier, R.Y., Ingrgham, J.L, Wheelis, M.L. and Painter, P.R. (1987). General Microbiology, Vth ed., McGraw Press Ltd., U.K.

B.TECH (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – V
(Under Credit Based Continuous Evaluation Grading System)

STP-301: INDUSTRIAL MICROBIOLOGY LAB

Credits: 0-0-2
Note: Students can use the Non-Programmable scientific calculator.

1. Handling and use of microscope.
2. Microscope examination of microorganisms like bacteria, yeast, fungi etc.
3. Preparation and sterilization of culture media like nutrient agar media, malt extract media, molasses agar media etc., preparation of slants and stabs.
4. Aquaintance with different microbiological techniques like inoculation, streaking, plating, stabing etc., aseptic handling of culture media and pure cultures.
5. Isolation and development of a pure yeast culture.
6. Preparation of bacterial culture slides and staining by simple and Gram stains.
7. Dilution and plating of culture for total viable cell count.
8. Direct microscopic counting of the no. of cells in a culture suspension.
9. Differential counting of living and dead yeast cells by direct microscopic examination.

Book:

1. Benson, H.J. (1960), Microbiological Applications. A Laboratory Manual in General Microbiology, Vth edition, WM C. Brown Publishers.

B.TECH (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – V
(Under Credit Based Continuous Evaluation Grading System)

STP- 302: SUGAR TECH. LAB-III

Credits: 0-0-3
Note: Students can use the Non-Programmable scientific calculator.

1. Analysis of Sugarcane for:
   a) Pol %
   b) Fibre %

2. Analysis of Bagasse for:
   a) Pol %
   b) Moisture %

3. Analysis of Press Mud for:
   a) Pol %
   b) Moisture %

4. Determination of crystal % in Massecuite by a) Non-Sugar method
   b) Labortary centrifuge method

5. Analysis of Gur for:
   a) Bx % Pol % & Purity b) Ash %
   c) Reducing sugar %

6. Determination of turbidity of Juice using Nephlometer

7. Seiving & Grading of Sugar.

8. Determination of Crystal size using travelling microscope of:
   a) Seed slurry b) Massecuite.

9. Preparation of seed slurry by:
   a) Precipitation method b) Grinding method.

10. Colour measurement using spectrophotometer by ICUMSA method in a) White sugar & Raw sugar
    b) Clear Juice & Syrup
    c) A light molasses & Melt.

11. Determination of available sugar factor for:
    a) Cane Juice & Syrup
    b) Massecuites & Molasses

Texts:

1. System of Technology Control for Cane Sugar Factories in India, Ist edition, N.C.Varma.
2. Sugar Analysis by Zerban & Brown IIIrd edition published by John Wiley & Sons.

B.TECH (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – V
(Under Credit Based Continuous Evaluation Grading System)

STP-303: DRAWING & DESIGN LAB- II

Credits: 0-0-2
Note: Students can use the Non-Programmable scientific calculator.

DESIGN

1. **Juice Heaters:** To find out the heating surface area, number of tubes, dia, thickness of heaters, shell thickness with respect to hydraulic test pressures.

2. **Evaporator:** With a given heating surface area, to find out the number of tubes, downtake dia, tube plate design, dimension, vapour body thickness under external pressure (Vacuum conditions and calendria design).

3. **Pans:** With given capacities to find the heating surface, down take dimension, shell dimensions with standard tubes, tube plate thickness with heat exchange principle.

4. **Crystallizers:** To find the dimension parameter of crystallizers taking considerations of the volume of massecuites discharged into crystallizers, cooling temp. at different time intervals.

5. **Condenser:** Design the multi jet condenser, calculate the height of the condenser, cross-section of the condenser, condenser volume size of vapour pipe, diameter of cooling water piper, wt. of cooling water required.

6. **Storages Vessels:** Molasses tank for different crushing capacities, so find the thickness of various courses of steel tank, dia and height of steel tank.

Books Recommended

1. Hand book of Sugar Engineering by E. Hugot.
2. Engineering Drawing by P.S. Gill.

STP-304: PROCESS CONTROL & INSTRUMENTATION (LAB)

Credits: 0-0-2
Note: Students can use the Non-Programmable scientific calculator.

Use of transducers and measurement of pressure, vacuum of temperature, humidity, pH Theological parameters, and study of different types of temperature and pressure controllers study of instruments used for measurement of solar energy instruments and controls used in various food processes/Food equipments.

B.TECH (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – VI
(Under Credit Based Continuous Evaluation Grading System)

STL-306: SUGAR ENGINEERING-II

Credits: 3-1-0
Note: Students can use the Non-Programmable scientific calculator.

UNIT-I

1. **Combustion of Fuel**: Chemical composition of bagasse & air, reaction of combustion, calorific value of bagasse, gross calorific value & net calorific value, heat loss, excess air & optimum proportion CO_2, loss in efficiency due to CO, measurement of furnace temperature, heat loss in fuel gases, calculation of heat loss & quantity of steam obtainable overall efficiency, fuel other than bagasse.

2. **Furnaces:** Different types of furnaces for bagasse, fuel feeding devices, bagasse furnaces step grate, horse shoe, ward, spreader stoker, water cooled furnaces- fixed grate, moving grate, and mechanical stokers, their description, designing of furnaces with dimensions of the furnace, length of the flame, width of the boiler, grate area, combustion chamber volume and application of secondary air. Performance of different types of furnances -capacity for burning of fuel per unit grate area. Limitation of these furnaces and their relative merits and demerits. Oil firing equipments- atomization of furnace oil, air and steam atomizers, pressure jet atomizers mechanical atomizers heating coils for oil. Oil burners-air control, oil firing combustion calculations, storage of furnance oil.

3 **Boiler Heat Balance:** Boiler efficiency, condensation loss, sensible heat loss, unburnt and unknown losses. Estimated quantity of steam of obtainable, weight of steam per unit weight of fuel of typical examples, observations and analysis for determination of boiler efficiency. Methods for improving the boiler efficiency.

4. **Super Heaters:** Different types of super heaters-convection and radiation, their location in the fuel path ,calculation of heating surface, degree of super heat. Contribution of superheaters in boiler heat balance, maintenance.

5. **Economisers:** Different types of economizer general and individual economizer merit and demerits, role and limitations in improving boiler plant efficiency, assessment of determination of heating surface and checking the performance of a existing installation.

UNIT-II

6. **Air Heater**: Different types of air heaters-Tubular and plate types, limitations of those air heaters. Determination of heating surface, checking of the performance of an existing installation, fuel gas recirculation, comparison between air heater and economizer possibilities of installation of air heaters and economizers in a boiler plant air heaters maintenance.

7. **Draught:** Natural and artificial draught, balanced draught, chimney Location, cross section of the chimney, height of the chimney, practical formula for power, fly ash removal, mechanical dust removal, removal by water and their merit and demerits.
8. **Feed Water**: Use of condensates, make up water, temporary and permanent hardness, Method of treatment, Internal treatment, external treatment-water softner.
9. **Feed Water Systems**: Capacity of feed water tank, feed water pumps, feed water pipes, reaction of the feed water and different condensate collection systems, automatic feed water controls.
10. **Steam Accumulators**: Principle, calculation for a steam accumulator.
11. **Steam Reducing :** Valve and desuper heaters, different types of steam reducing valves, their description and working, merits and demerits typical layout of steam reducing valves and precaution for their smooth operation.

UNIT-III

12. **Process Steam consumption**: Estimation of steam requirement at juice heaters evaporators and pans circulators, turbocompressors and thermocompressors, Economy obtained due to thermocompressors. Steam balance of sugar factory-calculations. General steam distribution system in sugar factory.
13. **Conservation of Heat**: Fourier law of heat conduction, conduction through hollow cylinder, composite cylinder, lagging, heat loss from bare surface, properties and choice of lagging materials, saving due to lagging.
14. **Steam Turbines:** Fundamental equation, shape & out put of the nozzle, Blading, impulse turbine & reaction turbines, steam consumption.
15. **Pumps:** Centrifugal pumps, multistage pumps, rota-type pump, rotary pump, screw pumps in the sugar industry.
16. **Centrifugal Separation**: Object, batch centrifugal, basket, gauges, dimensions of centrifugals, speed of centrifugals, capacity, power, coupling, motors for centrifugal drive, operating conditions of centrifugal motors, choice of electric motor. Continuous centrifugals, high gravity factor machine, comparison of old & modern centrifugals.

Texts:

1. Hand book of Cane Sugar Engineering, E. Hugot.
2. Standard Fabrication Practice for Cane Sugar Mills-Delden.
3. Unit Operation in Cane Sugar Production-Payne.
4. Thermal Engg.-Ballaney.

B.TECH (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – VI
(Under Credit Based Continuous Evaluation Grading System)

STL .307 INDUSTRIAL FERMENTATION

Credits: 3-1-0
Note: Students can use the Non-Programmable scientific calculator.

Unit – I

1. Raw Materials

(a) **Molasses:** Composition, storage, grades and classification of molasses, clarification of molasses.
(b) Other saccharine Materials: Cane juice, beet juice, fruits juices, etc.
(c) Starchy and Cellulosic Materials.

2. Introduction to fermentation technology, interaction between chemical engineering. Microbiology and Biochemistry. History of Fermentation.
3. Introduction to fermentation processes. Microbial culture selection for fermentation processes, media formulation and process optimization.

Unit – II

4. Fermentation Classification, design and operation of fermenters, basic concepts for selection of a reactor, packed bed reactor, fluidized bed reactor, trickle bed reactor, bubble column reactor.
5. Product synthesis kinetics, growth and non-growth synthesis, open and closed system of fermentation, plug flow reactor and its kinetics, continuous stirred tank reactor (CSTR). Steady state model for CSTR, rate of biomass production in a chemostat.

Unit – III

6. Down steam processing, recovery of particulates, product isolation, distillation, centrifugation, whole broth processing, super critical fluid extraction, aqueous two phase separation, solvent extraction, chromatography and electrophoresis.
7. Production of industrial and power alcohol.
8. Production of wine and distilled alcoholic beverages.

Texts:

1. Baiy, J.E. and Ollis D.F. Bio Chemical Engineering Fundamentals (1986) McGraw Hills.
2. Rehrn H.J. and Reed G. (Ed). Biotechnology, Vol. 1-2. Verlag-Chemie.

B.TECH (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – VI
(Under Credit Based Continuous Evaluation Grading System)

STL-308: SUGAR TECHNOLOGY (CAPACITY)

Credits: 3-1-0
Note: Students can use the Non-Programmable scientific calculator.

UNIT-I

1. Brief idea about the units used in capacity calculation / sugar industry.
2. Selection of site, types of plant i.e. gravity & non-gravity, types of layout. sequences of different section.
3. Cane yard, weight bridge, lateral / feeder table. mechanical grab system (cane unloading).
4. Cane Carrier -length of horizontal and inclined portion, slope, speed capacity of carrier, power absorbed.
5. Cane knives- pitch, nos. of blades, clearance & power requirement (factor only). preparatory index, shredder & fibrizer.
6. Brief about intermediate carrier, bagasse carrier -speed factor power factor.
7. Mill capacity -various formula (Noel Deer's, K.S. Arnold, Tromp, N.S.I. & Hugot). Mill speed, factor for power requirement for milling tandem.
8. Capacity will screen area, juice pumps, imbibition water pump, mixed juice / water weighing scale, juice receiving tanks, M.J. Pump.

UNIT-II

9. Juice heaters, Heating surface, size of juice vapour pipe inlet, size condensate, numerical based upon juice heaters with bleeding.
10. Sulphur furnace -combustion consumption tempr, of SO_2, tray Ara of furnace, capacity of air temp.
11. Lime Kiln-capacity factor, capacity of CO_2 pump, lime slaker size, miller of lime preparation tanks & pumps.
12. Juice sulphitation-capacity of bath & continuous juice sulphiter.
13. Capacity of clarifies.
14. Capacity of filter presses & rotary vacuum filters.
15. Evaporators-Calculation of H.S, (taking different cases e.g. simple quad, D.E.P.E. etc.), dia of inter connecting vapour pipes, combine numerical problems of evaporators and juice heaters with different bleeding.
16. Condensers-water requirement, height, cross-section, volume, size of vapour pipe, air pump.
17. Capacity of injection pump.
18. Spray pond -depth, area, spray pumps, spray nozzles, forced draught cooling towers.
19. Capacity of syrup sulphitor, syrup pumps.

UNIT-III

20. Capacity of pans in terms of tons, detailed calculations based upon solid balance & calculations of AM/C BM/C, CM/C and other intermediate molasses capacity of syrup & molasses storage tanks.
21. Capacity of crystallizers, cooling time for different mechanical, nos of crystal required quality of water required for cooling the mechanical calculation of cooling surface of work poor crystallizer, capacity vertical crystallizers, brief idea about its design.
22. Centifugal -capacity of batch type & continuous centrifugal machines, nos. of machines required for a sugar factory.
23. Capacity of sugar conveyers, elevators, grades.
24. Storage of sugar & molasses-goodness & F. Molasses tanks.
25. N.C.V. & G.C.V. of bagasse, calculation of steam balance, calculation of heating surface of boilers.

Texts:

1. Cane Sugar Handbook: Chen & Moode.
2. Standard Fabrication Practice for Cane Sugar Mills Dolden.
3. Handbook of Cane Sugar Engineering. E. Hugot.
4. Machinery & Equipment of Cane Sugar Factory: L.A. Tromp.
5. Handbook of Cane Sugar Tech.: R.B.L. Mathur.

B.TECH (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – VI
(Under Credit Based Continuous Evaluation Grading System)

STL-309: BUSINESS AND FINANCIAL MANAGEMENT

Credits: 3-1-0
Note: Students can use the Non-Programmable scientific calculator.

UNIT-I

1. Definition and Scope of Management: Fundamental principals, concept and philosophy of management, its use in major and small scale industries, types of organisation, elements of management. Characteristics and classification of wants. Law of demand, elasticity of demand and supply, market competition, monopoly and monopolicity competition, price determination under competition and monopoly.
2. Plant Layout: Location of factory, layout of plant, building equipment, factors important in decision making about the location of an industry.
3. Management Policy: Concept of scientific management in industry. General understanding of functions of management like decision making, planning, organising, directing and control. Practice of management control and delegation of authority, division into various departments, office management, joint stock companies, cooperative societies, board of directors, managing director, division into various sections.

UNIT-II

4. Production Management and Control: Main considerations, factors influencing production control, Product design & development.
5. Personnel Administration: Personnel department, its organisation and function. Management of human resources, selection and training of employees, their welfare and safety, labour incentives/wages and renumeration. Absenteesm and its control. Factory Acts effecting industrial undertaking and workers in the factory.
6. TQM and ISO Quality Management systems.
7. Role of Sugar Industry in Promoting Economic Growth Through Social Good.
   a) Microeconomics:- Monoplistic and oligoplistic market, optimisation of production
   b) Microeconomics:- Concept of excise Modvat, VAT, CT-3, Stock Exchange
   c) Sugar economy of India and world. Its impact due to GATT agreement.

PART- III

8. Objectives and Functions of Financial Management: General understanding of marketing management, concept of market and marketing management, pricing policy, marketing media. Factors involved in project estimation, methods employed for the estimation of capital investment. Capital formation.Capital Structure: different sources of finance,types of capital and its cost determination. Capital budgeting decisions, method of appraising investment decision.Depreciation. Methods of determining depreciation, taxes. Optimum batch sizes, production scheduling .
9. Capital Budgeting Decisions: Method of appraising investment decisions.
10. Costing and Cost Control: Elements of cost, cost factors, budgetry control, forms of budget and their integration,variation f cost with capacity, Break Even point.
11. Inventry Management: Purchase, organisation and control. General understanding of the concept of material management.

Texts:

1. Cost Accounting by Jain & Narang. Kalyani Publishers.
2. Financial Management by Khan & Jain. Tata McGraw Hills.
3. Principal & Practice of Management by T. N. Chabra. Dhanpat Rai & Sons, Delhi.
4. Fundamentals of Book keeping & Accountancy by Sharma, Chug & Katyal.
   S. Dinesh & Comp., Jalandhar.
5. Production and Operation Management by B. S. Goel. Pragti Prakashan, Meerut.

B.TECH (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – VI
(Under Credit Based Continuous Evaluation Grading System)

STL-310: INDUSTRIAL BIOCHEMISTRY

Credits: 3-0-0
Note: Students can use the Non-Programmable scientific calculator.

UNIT-I

Biophysics: Concepts of pH and buffers, acid base equilibrium.
Cell: Morphology, structure, cell membrance, Nucleus, chromatin, Mitochondria, Endoplasmic Reticulum, Ribosomes.
Vitamins: Classification, fat soluble vitamins, A, D, E. & K, water soluble vitamins B complex and C, Daily requirements, Physiological functions and diseases of Vitamin deficiency.

UNIT-II

Carbohydrates: Definition, functions, sources, classifications, Monosaccharides, Disaccharides, Polysaccharides, mucopolysaccharide and its importance, glycolysis, Pentose phosphate pathway, TCA cycle, glycogenesis, glycogenolysis, Gluconeogenesis, interconversions of different sugars.

Lipids: Definition, functions, sources, classification, simple lipid, compound lipid, derived lipid, unsaturated and saturated fatty acids. Essential fatty acids and their importance, cholesterol and its importance. Fatty acid oxidation and fatty acid synthesis.

UNIT-III

Proteins: Definition, classification, amino acids, simple proteins and conjugated proteins and varieties of proteins transamination, deamination, fate of ammonia, urea cycle.

Nucleic acid: Structure and function of DNA and RNA. Nucleosides, nucleotides, Genetic code. Biologically important nucleotides.

Enzymes: Definitions, classification, mode of action, factor affecting enzyme action.

Books:

1. Nelson, D.L., Cox, M.M. (2001): Lehninger Principles of Biochemistry, Macmillan worth Publishers.
2. Chatterjee, M.N. Textbook of Biochemistry: Jaypee Brothers.
3. D.M. Vasudevan, Shreekumar's Textbook of Biochemistry, Latest Edition, Jaypee Brothers, Medical Publishers Pvt. Ltd., New Delhi.
4. J.L. Jain, Sunjay Jain, Nitin Jain, Fundamentals of Biochemistry. S. Chand & Company, Ram Nagar, New Delhi.

STP-306: INDUSTRIAL FERMENTATION

Credits: 0-0-2

Note: Students can use the Non-Programmable scientific calculator.

1. Handling and use of Microscope.
2. Microscopic examination of microorganisms like bacterial, yeast, fungi etc.
3. Preparation and sterilization of culture media like nutrient agar media, malt extract, media, molasses agar media etc., preparation of slants and stabs..
4. Acquaintance with different microbiological techniques like inoculation, streaking, plating, stabing etc., aseptic handling of culture media and pure cultures.
5. Isolation and development of a pure yeast culture.
6. Preparation of bacterial culture slides and staining by simple and Gram stains.
7. Dilution and plating of culture for total viable cell count.
8. Direct microscopic counting of the no. of cells in a culture suspension.
9. Differential counting of living and dead yeast cells by direct microscopic examination.

Book Recommended:

1. Benson, H.J. (1969). Microbiological Applications. A Laboratory Manual in General Microbiology, Vth Edition, Won C. Brown, Publishers.

B.TECH (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – VI
(Under Credit Based Continuous Evaluation Grading System)

STP-307: INDUSTRIAL BIO-CHEMISTRY (LAB)

Credits: 0-0-2
Note: Students can use the Non-Programmable scientific calculator.

1. Preparation of a buffer.
2. Absorption maxima of bromophenol blue dye.
3. Demonstration of Beer-Lambert's law.
4. Estimation of Carbohydrates by Anthrone method.
5. Determination of total Reducing Sugars in molasses by different colorimetric methods including ICUMSA method.
6. Determination of protein by Lowry's method.
7. Determination of protein by Bradford's method.
8. Enzymatic hydrolysis of starch by amylases.
9. The determination of acid value of a fat.
10. Determination of Nitrite content of effluents.
11. Determination of Chemical Oxygen Value of effluents by colorimetric and titricentric methods.
12. Determination of Dissolved Oxygen Value and Biochemical Oxygen Demand Value of effluents.

Recommended Book:

1. An Introduction to Practical Biochemistry; David T. Plummer, (2001) McGraw Hill.

STP-308: INDUSTRIAL / EDUCATIONAL TOUR
(Dec. / Jan.) 10 to 20 weeks

Credits: 0-0-3

STP-206: OFF SEASON IN PLANT TRAINING (4 Weeks)
(1^{st}-30^{th} June)

Credits: 0-0-4

B.TECH (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – VII
(Under Credit Based Continuous Evaluation Grading System)

STL-401: CONFECTIONERY TECHNOLOGY

Credits: 3-1-0
Note: Students can use the Non-Programmable scientific calculator.

Unit I

Sugar, glucose and invert syrup and sugar free sweeteners, crystalline and non crystalline confectionary, fondant, hard boiled candy, caramel, toffee, fudge, nut brittles, krokant, praline, truffles, pulled sugar, marshmallows.

Unit II

Fruit chews, jellies, gums, pastilles, turkish delight, marzipan, lozenges, panning.
Defects in confectionary: sugar bloom.

Chewing gum and bubble gum. Packaging requirements of sugar confectionary.

Unit III

Chocolate confectionary: Processing of cocoa beans. Chocolate refining, conching and molding, enrobing, panning. Ingredients used in chocolate. Cocoa butter substitutes. Fat bloom. Packaging requirements of chocolate confectionary.

References:

1. The Science of Sugar Confectionary by W.P. Edwards, RSC Publishers.
2. The Science of Chocolate by Stephent Becett, RSC Publisher.
3. Chocolate, Cocoa and Confectionary Science and Technology by Bernard W. Minifie.

B.TECH (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – VII
(Under Credit Based Continuous Evaluation Grading System)

STL–402: TECHNOLOGY OF MALTING AND BREWING

Credits: 3-0-0
Note: Students can use the Non-Programmable scientific calculator.

UNIT-I

1. Barley production and trade, composition and structure of barley. Preparation and storage of barley for malting, suitability of different cereals for malting, characteristics of barley for malting and brewing, problem of dormancy and water sensibility.
2. Steeping techniques, Germination of barley, morphological, enzymatic and chemical changes during malting, Role of Gibberellic acid in malting, Techniques of malting composition of malt, malting of wheat and other cereals.
3. Kilning, changes during kilning, Kilning techniques.

UNIT-II

4. Quality evaluation of malt, special malts, milling techniques.
5. Significance of water quality in brewing process
6. Mashing: changes during mashing, methods of mashing, treatment of cereals used as adjucts, properties and complications of using adjuncts of different sources.
   Filtration of wort and sparging.
7. Spent grain: composition and uses.

UNIT-III

8. Techniques of wort boiling, changes during boiling, hops, selection of hops, acidification of mash, wort cooling, methods of fermentation, management of primary fermentation.
9. Lagering: objectives and techniques
10. Beer: composition, filtration, racking, pasteurization & defects.
11. Application of malt in food: Baking, infant food etc.
12. Quality control–malt specifications and test procedures.
13. Brewing operations, constituents of hops. Brewing adjuncts
14. Bear quality–flavor, taste, alcohol content, chemical constituent etc. Head retention–factors affecting head retention. Haze formation.

BOOKS:

1. Malting and Brewing Science Vol. I: Lewis and Young (1981)
2. Malting and Brewing Science Vol. II: Lewis and Young (1982)

B.TECH (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – VII
(Under Credit Based Continuous Evaluation Grading System)

STL-403: ENVIRONMENTAL POLLUTION AND MANAGEMENT

Credits: 3-1-0
Note: Students can use the Non-Programmable scientific calculator.

UNIT-I

1. Introduction:

a. Basics of ecology, ecosystems, biotic and abiotic components, biogeochemical cycles, Food chain, energy flows.

b. Concepts of environmental toxicology, dose-response curve ; air, water soil pollutants and their pathways to human beings and their influence on human health, industrial hygiene and safety, need for environmental pollution control, emission standards.

c. Nature of processes in various specialized industries, sources of wastes, nature of wastes, quantities of wastes, traditional fate of such wastes, environmental hazards associated with such wastes.

2. Soil Pollution: Soil and its characteristics, pollutants discharged on soil (Solid, Liquid) ; solid and hazardous waste characteristics, impact on environmental health, wastes from specific process industries and disposal, treatment schemes for solid and hazardous waste, final disposal or residues. Also non-point soil pollutant.

UNIT-II

3. Water Pollution : Water sources and uses, natural water characteristic (suspended solids, turbidity, color, odour, taste and other physical characteristics ; BOD, COD, DO, inorganic and organic dissolved constituents and other chemical characteristics ; microorganisms, macro-organisms and such biological characteristics). Water polluting wastes and their nature (oxygen demanding wastes, disease causing agents, synthetic organic compounds, plant nutrients, inorganic, chemicals and minerals, sediments, radioactive substances, thermal discharges, oil). Water use and corresponding quality criteria, discharge standards for effluents. Treatment of waste water using physical, chemical and biological treatment processes. Setting up treatment train. Residuals from treatment, their processing and ultimate disposal. Waste water treatment for wastes from specific industries.

UNIT-III

4. **Air Pollution:** Air and its characteristics, basis meteorology, emission sources, air pollutants and their characteristics, air pollution standards, control technologies for air pollutants using physical and chemical processes, characteristics of air pollution control residues, disposal of such residues.

5. **Pollution Prevention:** Pollution control and remediation: Industrial process, waste separation, Waste minimization, waste treatment, contaminated site remediation techniques, economics of pollution prevention pollution and remediation.

Texts :

1. Environmental Engineering by Peavy, Rowe and Tchobanoglous, McGraw-Hill.
2. Industrial Waste Treatment by Eckenfelder, McGraw-Hill.
3. Environmental Pollution Control Engineering, CS Rao, Wiley-Eastern.

STP–401: CONFECTIONERY TECHNOLOGY

Credits: 0-0-2
Note: Students can use the Non-Programmable scientific calculator.

Study the preparation of confectionary products like:

Fondant

Hard boiled candy

Caramel Toffee

Butterscotch

Pulled sugar

Jellies and gums

Visit of confectionary industry

B.TECH (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – VII
(Under Credit Based Continuous Evaluation Grading System)

STP-402: TECHNOLOGY OF MALTING AND BREWING

Credits: 0-0-2
Note: Students can use Non–Programmable scientific calculators.

1. Evaluation of physic-chemical characteristics of barley.
2. Determination of germination capacity of barley.
3. Estimation of mealiness in barley malt.
4. Determination of husk content of barley.
5. Preparation of malt.
6. Measurement of length of acrospire of barley malt.
7. Determination of "Exact" in barley malt.
8. Determination of diastatic activity in barley malt.
9. Determination of Cold Water Extract of barley malt.
10. Determination of proteolytic activity in barley malt.
11. Estimation of alcohol content in beer.
12. Determination of viscosity of wort.
13. Estimation of saccharificaiton time.
14. Quality testing of beer.
15. Visits to beer manufacturing industries.
16. Determination of alpha amylase activity in barley.

B.TECH (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – VII
(Under Credit Based Continuous Evaluation Grading System)

STP-403: SEMINAR

Credits: 0-0-2

B.TECH (SUGAR & ALCOHOL TECHNOLOGY) SEMESTER – VII
(Under Credit Based Continuous Evaluation Grading System)

STL-406: Alcohol Technology

Credits: 3-1-0
Note: Students can use the Non-Programmable scientific calculator.

Unit-I

Brief Description about distillery, breweries & wineries. Differences between operation and process. Distillery Feed Stock. Feed stock selection, parameters influencing selection, Fermentable sugars. Criteria for selection of molasses for production of ethanol. Alternative feedstock for the process and feedstock flexibility.

Unit-II

Details of Fermentation Process, Influencing parameters, Material and energy balance over the process. Reaction Kinetics & Process flow with mass balance. Distillation process flows. Distillation Principles. Types of Distillation: Vacuum Distillation, Multi pressure Distillation, Azeotropic etc. Distillation process with details of columns used their construction, operational dynamics, and operational parameters. Steps for optimizing Performance of Distillation Columns, Effective utilization of column heat. Stripping, Reboilers & Heat exchange. Pinch Technology. Methods of calculation of steam requirement over the individual columns in the process and overall steam requirements.

Unit-III

Rectification for the production of rectified spirit, Ethanol Production Technology, Various Process for ethanol Technology, Molecular Sieves Dehydration unit. Uses of ethanol. Heat & Mass Balance. Distillation Process & instrumentation, Distillery Environmental Problem & Control, Different Effluent treatment Process, Govt .Regulations for Environmental Protection, Effluent Treatment and disposal, Process Management Theory.

Books:

1. The Alcohol Textbook 4th Edition, A Reference for the Beverage, Fuel and Industrial Alcohol Industries, K.A. Jacques, PhD T.P. Lyons, PhD D.R. Kelsall.
2. Chemical Engineers Handbook (5^{th} Edition) R.H. Parry & C.H. Chilton, McGraw Hill Book Company.

STP-404: INDUSTRIAL TRAINING
4 months i.e. (Jan. – April) (Sugar / Alcohol)

Credits: 0-0-16

STP-405: RESEARCH PROJECT

Credits: 0-0-4