SHIVAJI UNIVERSITY KOLHAPUR

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Accredited By NAAC

New Syllabus For

Bachelor of Science (Sugar Technology)

Part - I (Semester –I ,Semester – II & Practicals)

Syllabus to be implemented from June 2010 onwards

Shivaji University, Kolhapur

B.Sc. Sugar Technology

(Three Year integrated course – Six Semesters)

I N D E X

Shivaji University, Kolhapur

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1. Introduction:

1.1 Science and technology plays an important role in achieving national development. It is a well accepted fact that while studying conventional courses of pure science the graduates must get training in technology oriented courses. Therefore Shivaji University has decided to start job oriented course **B. Sc. (Sugar Technology)** from June 2010.

1.2 Maharashtra is a leading state in sugar production and its co-operative movement has contributed a lot in industrialization of sugar and sugar based industries. This potential made Shivaji University as an ideal place to start B. Sc. in sugar technology and allied products.

1.3 The said course includes important aspects related to the advanced method of sugarcane farming (agronomy), business and marketing of sugar and allied products.

1.4 There is a lot of scope for University and industry interactions for sponsored projects.

1.5 While introducing this course university intends to give an emphasis on

i) Training the graduates for advanced methods of cane-sugar production processes related to lab-chemist, supervisor, pan-man, boiler attendants, etc.

ii) Training the personnel for production of allied sugar based products like alcohol, acetone, acetic acid, oxalic acid, etc.

iii) Training the personnel for co-generation (power generation) from biomass.

iv) Training the personnel to start small scale sugar based industries.

v) Training the personnel for water management and pollution control.

2. Duration of course: Three academic years (6-semesters)

3. Eligibility for admission: 10 +2 (Science) Both A & B groups.
D- pharmacy, Diploma in Engineering, D.Ed., (After 12th Science),
PUC and equivalent examination passed.

4. Intake capacity :120

5. Admission procedure : Direct.

6. Teaching faculty:

i) English and Science subjects: M. A./M. Sc. (B+) & NET/SET
ii) Sugar Manufacture: B. Sc. Sugar Tech. (ANSI/VSI) + M.Sc, Chemistry.
iii) Sugar Engineering: B. E. (Chem.)/ B. Sc. Sugar Tech. (ANSI/VSI)

7. Teaching Periods :

i) B.Sc Sugar Technology Part-I : There shall be 4 lectures per week for English. In case of each science subject there shall be 5 lectures per week. One practical of 4 periods per science subject per week for a batch of 20 students (Except Mathematics).

ii) B.Sc Sugar Technology Part-II : Three will be 3 lectures per paper and 2 practical turns of 4 periods per science subject per week

iii) B.Sc Sugar Technology Part-III : Three will be 3 lectures per paper and 4 practical turns of 5 periods per science subject per week
In case English there shall be 4 lectures per week

8. Course structure and Nature of Examination :

Semester system (As per regular B.Sc. Degree Course)

Sr. No	Year	Semester	Nature of Examination
1	First Year	(A) Semester -I	Theory
		(B) Semester -II	Theory & Practical
2	Second Year	(C) Semester -III	Theory
		(D) Semester -IV	Theory & Practical
3	Third Year	(E) Semester -V	Theory
		(F)) Semester -VI	Theory, Practical & Viva on Research Project

9. Details of the Course and Maximum Marks :

Total Marks: 2500 (Excluding English) and 2700 (Including English)
Distribution of Marks : Year and semester wise (As fallows)

B.Sc Sugar Technology (First Year)

A. Semester - I

Sr. No	Name of the Paper	Maximum Marks		
		Theory	Internal	Practical
1	English Paper – I **(Compulsory)**	40	10	……
2	**Sc-I :** Applied Chemistry Paper –I & II	40+40	10+10	……
3	**Sc-II :** Applied Physics & Instrumentation Paper-I &II	40+40	10+10	……
4	**Sc-III** : Applied Mathematics & Statistics Paper –I & II	40+40	10+10	……
5	**Sc-IV :** Sugar cane Agriculture & Sugar Manufacturing Paper I & II	40+40	10+10	……

B. Semester - II

Sr. No	Name of the Paper	Maximum Marks		
		Theory	Internal	Practical
1	English Paper – II **(Compulsory)**	40	10	……
2	**Sc-I :** Applied chemistry Paper –III & IV	40+40	10+10	50
3	**Sc-II** : Applied Physics & Instrumentation Paper-III & IV	40+40	10+10	50
4	**Sc-III :** Applied Mathematics & Statistics Paper –III &IV	40+40	10+10	50
5	**Sc-IV :** Sugar cane Agriculture & Sugar Manufacturing Paper III & IV	40+40	10+10	50

B.Sc Sugar Technology (Second Year)

C. Semester – III

Sr. No	Name of the Paper	Maximum Marks		
		Theory	Internal	Practical
1	**Sc-I :** Sugar Manufacturing Paper III & IV	40+40	10+10	… …
2	**Sc-II :** Sugar Engineering Paper –I & II	40+40	10+10	……
3	**Sc-III :** Computer Application & Statistical quality control Paper –I & II	40+40	10+10	……

D. Semester – IV

Sr. No	Name of the Paper	Maximum Marks		
		Theory	Internal	Practical
1	Environmental Study with project **(Compulsory)**	35	…..	15 (Project)
2	**Sc-I :**Sugar Manufacturing Paper V & VI	40+40	10+10	100
3	**Sc-II :**Sugar Engineering Paper –III & IV	40+40	10+10	100
4	**Sc-III :**Sugar Process Control systems & Equipment Design Paper –I & II	40+40	10+10	100

B.Sc Sugar Technology (Third Year)

E. Semester – V

Sr. No	Name of the Paper	Maximum Marks		
		Theory	Internal	Practical
1	English Paper –III **(Compulsory)**	40	10	……
2	**Sc-I :** Sugar Industry - By Products Paper I	40	10	……
3	**Sc-II :** Allied Sugar Manufacture Paper - I	40	10	……
4	**Sc-III :** Business management and marketing for sugar industries Paper-I	40	10	……
5	**Sc-IV :** Elective subject : **(Any One of the followings)**			……
	1. Water Management in Sugar Industry Paper I	40	10	……
	2. Industrial Fermentation Technology Paper- I			

F. Semester – VI

Sr. No	Name of the Paper	Maximum Marks		
		Theory	Internal	Practical
1	English Paper –IV **(Compulsory)**	40	10	……
2	**Sc-I :** Sugar Industry - By Products Paper II	40	10	50
3	**Sc-II:** Allied Sugar Manufacture Paper - II	40	10	50
4	**Sc-III :** Business management and marketing for sugar industries Paper-II	40	10	50
5	**Sc-IV :** Elective subject : **(Any One of the followings studied in semester - V)**			
	1. Water Management in Sugar Industry Paper II	40	10	.....
	2. Industrial Fermentation Technology Paper- II			
6	Industrial Training & Research Project	-	-	50

- **Industrial Training & Research Projects** :
  1. Industrial (Inplant) training for at least one month in sugar factory is to be completed after fifth semester examination.. The training enables them to acquire more practical knowledge of factory working.
  2. The research projects is to submitted before sixth semester examination. The reports submitted by the students will be assessed by experts from the industry during the viva voce examination

Note : Other rules are applicable as per General B.Sc Course

11. Syllabus :

B.Sc. Sugar Technology Part –I

Semester – I

Subject : English – I (Compulsory)
English for Communication

(Syllabus for Semester Pattern from June, 2010)

Section I :- Communication Skills

Unit 1 : How to Express Your Views and Opinions.

Unit 2 : Talking About Personal Experiences.

Unit 3 : Preparing a C.V. and Writing a Letter of Application

Section II : Reading Comprehension Skill

Unit 4 : Forgetting -Robert Lynd

Unit 5 : Wife's Holiday -R.K. Narayan

Unit 6 : Man in the Future -Bill Williams

Unit 7 : Prafulla Chandra Ray

		Pattern of Question Paper Sem- I	
Q.1)	A)	Complete the following by choosing the correct option (Set to be on Reading skill Units)	05
	B)	Textual vocabulary Items Synonym – 1 Antonym – 1 Pairing the words (With meaning) – 1 Change the Grammar class-1 Word-formation-Affixation-1	05
Q.2	A)	**Answer any Three of the following in 2 to 3 sentences (Out of 4)**	06

		1 2. 3. 4.	
	B)	Write short notes on any **ONE** of the following (Out of 2)	04
Q.3	A)	Express your agreement or disagreement on the following topics.	05
		(Unit no 1) B) Express your opinions or views on the following topic in 5 to 6 sentences.	05
Q.4		(Unit no 2)A) Narration OR	
		Piece of conversation regarding personal problems / experiences	05
		(Unit No.3) B) Write an application letter OR C.V. ***Note:- A question should be set either on writing an application letter or C.V. only***	05

Semester – II

Subject : English –II (Compulsory)
English for Communication

Section I :- Communication Skills

Unit 1 : Telephonic and E-mail communication.

Unit 2 : Making Notes.

Unit 3 : Information Transfer.

Section II :- Reading Comprehension Skill

Unit 4 : Public Attitude towards Science -Stephen Hawking

Unit 5 : Smart Village : Hansdehar -Archana Binbusar

Unit 6 : Entertainment -Nissim Ezekiel

Unit 7 : Parachute -Lenrie Peters

Unit 8 : Argument with God -Y. S. Chemba

		Pattern of Question Paper Sem- II	
Q.1)	A)	Complete the following by choosing the correct option	05

		(Set to be on Reading skill Units)	
	B)	Textual vocabulary Items Synonym – 1 Antonym – 1 Pairing the words (With meaning) – 1 Change the Grammar class-1 Word-formation-Affixation-1	05
Q.2	A)	**Answer any Three of the following in 2 to 3 sentences (Out of 4)** 1. 2. 3. 4.	06
	B)	Write short notes on any **ONE** of the following (Out of 2)	04
Q.3	A)	(Unit no 4)Write apiece of Telephonic conversation based on a particular situation.	05
		B) Write an email or fax	05
Q.4	A)	Read the following passage and make notes out of it. Suggest suitable title. OR	
		(Unit No.5) Study the following notes and expand them into a passage.	05
		(Unit No.6) B) Study the following pie-diagram/table/flowcharts/tree diagram and write a paragraph with the help of it.	05

Semester – I

Science subject - I (Sc-I) : Applied Chemistry Paper - I & II

N. B. (i) Figures shown in bracket indicate the total lectures required for the respective unit.

(ii) The question paper should cover the entire syllabus. Marks allotted to questions should be in proportion to the lectures allotted to respective to units.

(iii) All units should be dealt with S.I. units.

(iv) Industrial tour (visit to sugar factory) is prescribed.

(V) Use of recent editions of reference books is essential.

(vi) Use of Scientific calculator is allowed.

Sc-I : Paper I : Applied Chemistry – I
(Organic & Sugar Chemistry)

UNIT – 1 Stereochemistry of organic compounds : [10]

1.1 Stereoisomerism – Introduction.

1.2 Optical isomerism –Introduction.

1.3 Elements of symmetry.

1.4 Chiral centre. (Explanation with lactic acid.)

1.5 Optical isomerism in tartaric acid and 2,3 dihydroxybutanoic acid.

1.6 Enantiomers and diastereoisomers.

1.7 Racemic modifications.

1.8 Geometrical isomerism – Cause of geometrical isomerism.

1.9 Geometrical isomerism with respect to >C = C< , –C = N – and –N=N- compounds(Introduction). Geometrical isomerism in maleic and fumaric acids.

Unit – 2 : Carbohydrates [10]

2.1– Introduction and Classification of Carbohydrates with suitable examples

2.2 Reactions of Monosaccharide such as

i) Mutarotation

ii) Alkaline degradation

iii)Rearrangements

iv)Acidic degradation

v)Polymetrisation

vi)Caramelisation

Unit – 3 : Di and Polysaccharides [08]

Structures and properties of sucrose, Maltose, Lactose, Starch and Cellulose (Chain structures)

Unit – 4 : Organic acids and Polyphenols [08]

4.1 Organic acids and their effects on the processing of sugar house products

4.2 Polyphenols : Occurrence, Classification and their effects on processing of sugar house products

Sc-I : Paper – II : Applied Chemistry - II
(Physical & Inorganic Chemistry)

Unit – 1 : Solution and strength of solution **[09]**

1.1 Definitions of the terms: Solute, solvent, solution and dilute solution.

1.2 Concentration units: Normality, Molarity, Molality, Mole fraction, Weight reaction, Percentage composition by weight and volume.

1.3 Concentrations of Bulk Solutions used in Laboratory and preparation of standard solutions from them (HCl, H_2SO_4, HNO_3 and Ammonia)

1.1 Numerical Problems.

UNIT - 2. Chemical Kinetics: **[09]**

2.1 Introduction: Rate of reaction, Definition and units of rate constants, Factors affecting the rate of reaction, Order and Molecularity of reaction.

2.2 First order reaction: Rate expression (Derivation not expected), Characteristics of first order reaction.

2.3 Pseudounimolecular reactions such as, (i) Hydrolysis of methyl acetate in presence of acid, (ii) Decomposition of hydrogen peroxide (KMnO4 method).

2.4 Second order reaction: Derivation of rate constants for equal and unequal concentrations of the reactants. Characteristics of second order reaction.

Examples: (i) Specification of ethyl acetate,
(ii) Reaction between $K_2S_2O_8$ and KI.

2.5 Numerical problems.

Unit – 3 Chemical Bonding: **[09]**

4.1 Introduction and definition with example of each.

(a) Ionic bond

(b) Covalent bond

(c) Coordinate bond

(d) Metallic bond

(e) Hydrogen bond

(f) Vander Waal's forces

Unit – 4. Corrosion and its prevention [09]

Introduction, corrosion and its causes, classification, Atmospheric corrosion : Corrosion due to oxygen and other gases (Hydrogen embitterment and absorption mechanism, factors influencing corrosion, testing and measurement of corrosion by weight loss method, prevention of corrosion by proper design and material selection, catholic and anodic protection, applications of metallic coatings by hot dipping, metal cladding, spraying and electroplating.

Reference books: Organic & Sugar Chemistry

1. Organic Chemistry: Hendrickson, Cram, Hammond.
2. Organic Chemistry: Morrison and Boyd.
3. Organic Chemistry: Volume I & II. I. L. Finar.
4. Organic Chemistry: Pine
5. Advanced Organic Chemistry: Sachin Kumar Ghosh.
6. Advanced Organic Chemistry: B. S. Bahl & Arun Bahl.
7. A Guide book to Mechanism in Organic Chemistry: Peter Sykes.
8. Stereochemistry of Organic Compounds: Kalsi.
9. Stereochemistry of Carbon Compounds: Eliel.
10. Text Book of Organic Chemistry: P. L. Soni.
11. Text Book of Practical Organic Chemistry: By A. I. Vogel.
12. Advanced Organic Chemistry - Reactions, Mechanism & Structure: Jerry March.
13. Organic Chemistry: M. R. Jain.
14. Organic Chemistry: J. M. Shaigel.
15. Organic Chemistry: Vol-I, II, and III by S.M. Mukharji, S.P. Singh, R.P. Kapoor (New Age International Pvt. Ltd. Publishers)
16. Organic Chemistry: By Bhupinder Mehta, Manju Mehta (Prentice-Hall of India Pvt. Ltd., New Delhi 110001
17. Text book of organic chemistry: Finar Vol I & II

18. Organic Chemistry: Fieser & Fieser
19. Organic Chemistry: Hendrikson Cram and Hammond.

Reference books: Physical & inorganic Chemistry

1. Mathematical preparation of Physical Chemistry: F. Daniel, Mc-Graw Hill Book company.
2. Elements of Physical Chemistry: S. Glasstone and D. Lewis (D. Van Nostrand Co-Inc)
3. Physical Chemistry: W. J. Moore (Orient Longman)
4. Principles of Physical Chemistry: Maron – Prutton
5. University Chemistry: B. H. Mahan (Addision – Weseley Publ. Co.)
6. Chemistry – Principle & Applications: P. W. Atkins, M. J. Clugsto, M. J. Fiazer, R. A. Y. Jone (Longman)
7. Physical Chemistry: G. M. Barrow (Tata Mc-Graw Hill)
8. Essentials of Physical Chemistry: B. S. Bahl & G. D. Tuli (S. Chand)
9. Physical Chemistry: A. J. Mee
10. Physical Chemistry: Daniels – Alberty.
11. Principles of Physical Chemistry: Puri – Sharma (S. Nagin)
12. Text Book of Physical Chemistry: Soni – Dharmarha.
13. University General Chemistry: CNR. Rao (McMillan)
14. Chemistry: Sienko – Plane (Recent Edn.)
15. Basic Chemical Thermodynamics: V. V. Rao.
16. Physical Chemistry through Problems: Dogra and Dogra (Wiley Eastern Ltd.)
17. Physical Chemistry: S. Glasstone.
18. A Text Book of Physical Chemistry: A.S. Negi and S.C. Anand (New Age International (P) Ltd.)
19. A textbook of engineering chemistry: M. M. Uppal, Khanna publishers, Delhi.
20. A textbook of engineering chemistry: S. S. Dara, S, Chand and Co. New Delhi.

21. Engineering Chemistgry: Jain and Jain, Dhanpat Rai and Co., Delhi
22. Engineering Chemistry: A. K Pahari and B. S. Chauhan, Laxmi Publication Pvt, New Delhi.
23. A text book of Engineering Chemistry: Shashi Chawala, Dhanpat Rai CO. Pvt., Delhi
24. Fundamentals of Engineering Chemistry: S. K. Singh, New Age International Pvt Publishers, New Delhi.
25. Instrumental Methods of Chemical Analysis: Chatwal and Anand, Himalaya Publishing House.

Semester – II

Sc-I : Applied Chemistry III & IV

Sc-I : Paper III : Applied Chemistry – III (Organic & Biochemistry)

Unit – 1 **[10]**

1.1 Organosulphur compounds :

Introduction and nomenclature.

Thiols (simple examples).

Methods of formation

(i) from sodium hydrosulphide and alkyl halide

(ii) from alcohol vapours and hydrogen sulphide

(iii) from Grignard reagent and sulphur.

Physical properties,

Chemical reactions

(i) Acidity-formation of mercaptide

(ii) Reaction with sodium

(iii) Reaction with carboxylic acids and acid chlorides

(iv) Reaction with aldehyde and ketones

(v) Oxidation

Thioethers (simple examples),

Method of formation

(i) from potassium sulphide and alkyl halide

(ii) from salt of thiol and alkyl halide

(iii) from thiols and alkynes

Physical properties.

Chemical reactions:

(i) Reaction with alkyl halides

(ii) Oxidation to sulphoxide and sulphone

(iii) Addition to halogens

1.2 Fundamentals of Organic reaction mechanism

Meaning of reaction mechanism.

Curved arrow notation; drawing electron movements with arrows,

Half headed and double headed arrows

Example of each with mechanism

(a) Substitution (b) Addition (c) Elimination (d) Rearrangement.

Reactive intermediates with examples – Carbonations, Carbanions, Free radicals, Carbenes, Arenes and Nitrenes.

Unit – 2 Carboxylic acids and their derivatives [09]

2.1 Monocarboxylic acids : Introduction, Method of formation of halo acids, mono – di- and trichloroacetic acids, Substitution reactions of monochloroacetic acids by nucleophiles CN, OH, I, and NH_3

2.2 Dicarboxylic acid - oxalic acid : Methods of formation and reactions of oxalic acid : action of heat, action of $NaHCO_3$. Uses of Oxalic acid.

2.3 Carboxylic acid derivatives: Acetyl chloride and Acetic anhydride,Acid halide derivative: acetyl chloride: methods of formation from acid by action withPCl_5 and $SOCl_2$. Reactions with H_2O, alcohol and NH_3. Uses of acetyl chloride Acid anhydride derivative: Acetic anhydride: Method of formation by dehydration of acetic acid. Reactions with H_2O, alcohol and NH_3. Uses of acetic anhydride.

Unit – 3 Cell as a biochemical entity : [10]

3.1 Introduction to living cells, classifications of living cells, structure and function of cells, Structure and typical characteristics of DNA & RNA.

3.2 Portions: Characteristics and classifications of proteins, protein structure, proteins in sugarcane juice.

3.3 Amino acids: Classifications and properties, Amino acids in

sugarcane juice and molasses.

Unit – 4 Carbohydrate Metabolism and Enzymes : [09]

4.1 Carbohydrate metabolism: Glycolysis, TCA cycle, pentose phosphate pathway, Glyoxalate cycle.

4.2 Enzymes: Definition, classification, mechanism of enzyme action, factors affecting reactivity, industrial applications of enzymes.

Sc-I : Paper IV: Applied Chemistry – IV (Physical & Analytical Chemistry)

Unit – 1. Distribution Law [09]

1.1 Nernst distribution law : Its limitations, and modification with reference to association and dissociation of solute in one of the solvents.

1.2 Application of Distribution law in

i) Process of extraction (derivation expected)

ii) Determination of solubility

iii) Distribution of indicators

iv) Determination of molecular weight.

Unit - 2. Colloidal State: [10]

2.1 Definition of colloids

2.2 Types of colloidal systems.

2.3 Solids in liquids (sols):

i) Preparation of sols: Dispersion and Aggregation methods

ii) Purification of Sols: Dialysis, Electrodialysis and Ultra-filteration.

iii) Properties of sols: Colour, optical, kinetic and electrical properties.

iv) Stability of sols, protective action, Hardy-Schulze law, gold number

2.4 Liquids in liquids (emulsions):

Types of emulsions, preparation, Emulsifier.

2.5 Liquids in solids (gels):

Classification, preparation and properties, inhibition.

2.6 General applications of colloids.

Unit – 3 Introduction to Analytical chemistry [09]

Basic concept , errors , types of errors , accuracy, precision, statistical representation of analytical data.

Unit -4 Chromatography [10]

4.1 Chromatography – Introduction, Classification of chromatographic methods, introduction of the terms used in chromatography.

4.2 Thin Layer chromatography: introduction of basic concept of the technique, methodology, applications.

4.3 Gas chromatography: General introduction to the terminology used, stationery phases, supports used in making GLC columns.

Practicals :

N.B.- a. Use of analytical or chainometric or Digital balance with 1 mg sensitivity is allowed

b. Use S.I. Units wherever necessary.

Group – A

i) Determination of purity of phosphoric acid by Sodium hydroxide method

ii) Determination of purity of phosphoric acid by Phosphomolybdate method.

iii) Determination of purity of hydrogen peroxide

iv) Determination of purity of hydros

v) Determination of purity of formine

vi) Determination of purity of caustic soda

vii) Determination of purity of washing soda

viii) Introduction to the instrumentation of GLC (Demonstration)

Group – B

i) Determination of CaO content in lime by using pattern and Redder indicator.

ii) To determine CaO content in given sample by EDTA Method

iii) To determine CaO content in given sample by Ammonium Oxalate Method

iv) Determination of content of mill sanitation chemical-Quaternary ammonium compounds

v)Determination of content of mill sanitation chemical –Dithocarbamate

vi)To determine the phosphate contain in the given sample by Uranium Acetate Method

vii) Determination of percentage of hydrochloric acid in commercial hydrochloric

viii) Analysis of amino acids from the given sample with TLC.

ix) Estimation of amino acids from sugar solution or sugarcane juice spectrophotometrically

x) Determination of polyphenols spectrophotometrically.

Reference books : Organic & Biochemistry

1. Biochemistry – Lehninger
2. Biochemistry – West and Todd
3. Organic Chemistry : Hendrickson, Cram, Hammond.
4. Organic Chemistry : Morrison and Boyd.
5. Organic Chemistry : Volume I & II. I. L. Finar.
6. Organic Chemistry : Pine
7. Advanced Organic Chemistry : Sachin Kumar Ghosh.
8. Advanced Organic Chemistry : B. S. Bahl & Arun Bahl.
9. A Guide book to Mechanism in Organic Chemistry : Peter Sykes.
10. Stereochemistry of Organic Compounds : Kalsi.
11. Stereochemistry of Carbon Compounds : Eliel.
12. Text Book of Organic Chemistry : P. L. Soni.
13. Practical Organic Chemistry : By A. I. Vogel.
14. Advanced Organic Chemistry - Reactions, Mechanism & Structure : Jerry March.
15. Organic Chemistry : M. R. Jain.
16. Organic Chemistry : J. M. Shaigel.
17. Organic Chemistry : Vol-I, II, and III by S.M. Mukharji, S.P. Singh, R.P. Kapoor (New Age

18. International Pvt. Ltd. Publishers)
19. Organic Chemistry : By Bhupinder Mehta, Manju Mehta (Prentice-Hall of India Pvt. Ltd., New Delhi 110001)

Reference books : Physical & Analytical chemistry

1) Basic concepts of analytical chemistry – S M. Khopkar
2) Instrumental methods of chemical analysis – G. M. Ewing
3) A quantitative Inorganic analysis – A. I. Vogel
4) Gas Chromatography – J. H. Knox
5) Instrumental Methods of analysis – Willand, Merrit & Olean
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7) Elements of Physical Chemistry : S. Glasstone and D. Lewis (D. Van Nostrand Co-Inc)
8) Physical Chemistry : W. J. Moore (Orient Longman)
9) Principles of Physical Chemistry : Maron – Prutton
10) University Chemistry : B. H. Mahan (Addision – Weseley Publ. Co.)
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12) M. J. Fiazer, R. A. Y. Jone (Longman)
13) Physical Chemistry : G. M. Barrow (Tata Mc-Graw Hill)
14) Essentials of Physical Chemistry : B. S. Bahl & G. D. Tuli (S. Chand)
15) Physical Chemistry : A. J. Mee
16) Physical Chemistry : Daniels – Alberty.
17) Principles of Physical Chemistry : Puri – Sharma (S. Nagin)
18) Text Book of Physical Chemistry : Soni – Dharmarha.
19) University General Chemistry : CNR. Rao (McMillan)
20) Chemistry : Sienko – Plane (Recent Edn.)
21) Basic Chemical Thermodynamics : V. V. Rao.
22) Physical Chemistry through Problems : Dogra and Dogra (Wiley Eastern Ltd.)
23) Physical Chemistry : S. Glasstone.

24) A Text Book of Physical Chemistry: A.S. Negi and S.C. Anand (New Age International (P) Ltd.)

25)A Text Book of Quantitative Inorganic Analysis Including Elementary Instrumental

Reference books for Practicals :

1. Biochemistry by Lehninger.
2. Biochemistry by West and Todd.
3. Basic concepts of analytical chemistry, S. M. Khopkar
4. Instrumental methods of chemical analysis by G.W. Ewing
5. A quantitative inorganic analysis by A. I. Vogel
6. Gas Chromatography by J. H. Knox
7. Instrumental Methods of analysis by Willand, Merrit & Olean

Semester – I

Sc-II : Applied Physics & Instrumentation I & II

Sc-II : Paper –I : Applied Physics –I
(Properties of matter & Thermodynamics)

Unit – 1 Surface tension: Explanation of surface tension and angle of **[09]**
Contact, relation between S.T., pressure and curvature, excess pressure in soup bubble and rise of liquid in capillary. Effect of S. T. on evaporation and condensation, effect of impurity and temperature on S.T.

Unit –2. Fluid Dynamics and viscosity : [09]
General concept of fluid flow, streamline and turbulent flow, equation of continuity, Bernoullies equation, its application to venturimeter
Coefficient of viscosity, flow of liquid through the capillary tube, Poiseuilles formula, searle's viscometer, determination of viscosity by ostwald's viscometer.

Unit - 3. Kinetic Theory of Gases : [09]
Mean free path and its calculation (approximate method), real and ideal gases, deviation from ideal gas (Boyles law), Vonder Waal's equation for real gas,
Andrew's and Amagat's experiments, critical point, critical constants and their relation with Vonder Waal's constants, reduced equation of state.

Unit – 4 . Thermodynamics : [09]
Idea of thermodynamic equilibrium, adiabatic and isothermal processes, carnot's cycle, its efficiency and carnot's theorem (heat engine), second law of thermodynamics, reversible and irreversible processes, entropy,

its physical significance, entropy changes during fusion of a solid and vaporization of a liquid,

Reference books :

1. Physics by S.G. Starling and Woodlal, Longmamas and green co. Ltd.
2. Textbook of properties of matter by N.S. Khare and S. Kumar, Atmaram & sons, New Delhi.
3. Physics Vol.I and II by Resnik & Halliday, Willey Ester ltd. New Delhi.
4. Treaties on heat by Shah and Shrivastava.
5. Kinetic Theory of gases by V. N. Kelkar.
6. Heat and thermodynamics by Brijlal & subramananyam, S.Chand & Co. Ltd, New Delhi.

Sc- II : Paper II : Instrumentation-I

Unit-I : Introduction : (09)

A] Introduction to Industrial Instrumentation, Recorders and Monitors, Characteristics of Instruments, static characteristics, error and types of errors, sensitivity, reproducibility and dynamic characteristics.

B] Liquid Level measurement:

Liquid level indicators. Direct Method - Hook Type, Sight glass, Float type, Indirect Method - Capacitance level indicator, Radiation level indicator,

Unit –II: Temperature measurements: (09)

High temperature measurements, Mechanical, mercury in glass thermometers, Bimetallic thermometers, Electrical, Thermocouples, Seebeck effect thermoelectric thermometers and pyrometers.

Unit-III: Pressure and vacuum measurements: (09)

Units and their conversions, manometers, U-type, Well type and barometer, vacuum gauges, Bourdon Tube, Ionization and Pirani gauge

Unit-IV: Flow measurements: (09)

Basic terms such as total flow, volumetric flow, mass flow, viscosity, Reynolds number, types of flow, flow transducers such as orifice plate, Pitot tube, anu-bar, venturimeter, variable area flow meter, Rotameter, magnetic flow meter, mass flow meter.

REFERENCE BOOKS:

1. R. N. Shreve: The Chemical Process Industries (MGH)
2. W. I. Badger and J. T. Bandchero: Introduction to Chemical Engineering (MGH)
3. O. A. Hougen, R. M. Watson and R. A. Ragetz: Chemical Process Principles (Vol. I, II (JW))
4. Industrial Instrumentation and Control by S. K. Singh
   Tata McGraw-Hill Publishing Company Limited, New Delhi.
5. Instrumentation by F.W.Kirk & N.R. Rimboi
6. Theory of Errors by Yardley Beers.

Semester – II

Sc - II : Applied Physics & Instrumentation III & IV

Sc - II : Paper –III : Applied Physics -II (Optics and Crystallography)

Unit -1 : Diffraction [09]

Types of Diffraction, plane diffraction grating, construction, theory and its application to determine wavelength of light, resolving power, r.p. of plane transmission grating.

Unit -2 : Polarisation [09]

Concept of polarisation, polarisation by reflection, Brewster's law, polarization by refraction, pile of plates, double refraction, Huygens theory, Nicol prism, optical activity, half shade polarimeter.

Unit -3 : Laser and Fibre Optics [10]

Interaction of radiation with matter- absorption, spontaneous and stimulated emission, meta- stable state, pumping, population inversion, types of lasers, properties of laser light, uses of lasers (Medical and industrial), qualitative idea of holography.

Structure and types of fibres, propagation of light through fibre, properties of fibre, fibre optical communication system, sensors.

Unit -4 : Crystallography [10]

Space lattice, the basis and the crystal structure, unit cell, coordination number, packing fraction, calculation of lattice constants, Miller indices

of plane, sketches of different planes, relation between interplaner distance and Miller indices,

Bragg's law, Bragg's X-ray spectrometer, X-ray diffraction, Laue method and powder method.

Reference books :

1. Geometrical and Physical optics by D.S.Mathur.
2. Textbook of optics (New Edition) by Subramananyam & Brijlal
3. Fundamentals of Optics by Jenkins & White.
4. Optics (Second Edition) by Ajay Ghatak.
5. Laser and non-linear optics by B. B. Laud.
6. Introduction to solid state Physics by Charles Kittle.
7. Solid state physics by S. O. Pillai, Estern Ltd, New age international Ltd.

Sc - II : Paper –IV : Instrumentation – II

Unit-I : Spectroscopy: (10)

A] General principles of absorption spectroscopy, theory of Colorimetry, Beers Law, Instrumentation of Photoelectric Colorimeter, construction of standard curve and applications.

B] Flame Photometry: General discussion and elementary theory, Instrumentation, flames, monochromators, detectors and applications.

Unit-II : Polarimetry: (9)

Introduction, plane polarized light, optical activity, Instrumentation of Polarimeter, types of polarimeter, Laurenz polarimeter, Industrial polarimeter, white lamp single wedge and double wedge polarimeter, automatic polarimeter, measurement of specific rotation and determination of unknown concentration and other applications in sugar technology.

Unit-III : Refractometry: (9)

Introduction, Snell's law, specific refraction, molar refraction, Hand Refractometer, Abbe's Refractometer, experimental techniques and applications.

Unit-IV : pH and Conductivity measurements: (10)

Introduction sensors, Electroanalytical Sensors, different types of sensor electrodes, pH meter, standardization and pH measurements, conductivity solutions, specific and equivalent conductivity, equivalent conductivity at infinte dilution, measurement of conuctivity/resistivity of solution, Conductometers, wheatstones bridge circuit, conductivity cell applications.

(Numerical peoblem on all units are expected)

Reference books :

1. Vogel's Textbook of quantitative Inorganic analysis revised by J. Bassett et al.
2. Instrumental Methods of Chemical Analysis by H.Kaur.
3. Instrumental methodsof analysis by Strobel.
4. Practical Physical Chemistry by Findley
5. Instrumental methods of chemical analysis by Bhal and Tuli

Practicals : Group – A (Physics)

1. Measurement of angle of rotation on automatic polarimeter.
2. Determination of recovery of sugar in juice by polarimeater
3. Determination of purity of sugar by polarimeter
4. Determination of purity of juice by polarimeter
5. Determination of purity of Massecuite by polarimeter
6. Determination of purity of syrup by polarimeter
7. Measurement of viscosity of juice by viscometer
8. Measurement of viscosity of Mascuite by viscometer
9. Measurement of viscosity of juice by viscometer

10. Determination of refractive index of juice / Sugar solution by Abbe's refroctometer.

Practicals : Group – B (Instrumentation)

1. Measurement of Pol % of sucrose/Molasses on Sucromat.
2. Measurement of Pol % of bagasses on sucromat
3. Measurement of Pol % of Filtercake on sucromat
4. Elemental analysis by flame photometer (Demonstration)
5. Determination of PH of Raw juice by PH meter
6. Determination of PH of Sulphitation juice by PH meter
7. Determination of PH of Syrup by PH meter
8. Measure of colour of juice by colorimeter
9. Measure of colour of Syrup by colorimeter
10. Measure of colour of Sugar by colorimeter

Reference books : Instrumentation – II

1. Instrument engineers handbook – Process measurement by BG Liptak
2. Instrumental methods of analysis by – Wilard , Merrit & Dean
3. Basic concepts of analytical chemistry – S.M. Khopkar
4. Instrumental methods of chemical analysis – G.W. Ewing
5. A quantitative Inorganic analysis – A. I. Vogel
6. Instrumental Methods of analysis – Willand, Merrit & Olean

Semester – I

Sc - III : Applied Mathematics & statistics I & II

Sc - III : Paper –I : Applied Mathematics -I

Unit 1: **(09)**

Revision: percentage, area and volume of regular and irregular figures. Co-ordinate system in a plane, Distance formula, section formula, collinearity, centroid of a triangle. Locus and its equations. Transformation of axes. Slope of a line, parallel and perpendicular lines. Intercepts of axes, Point slope form, Normal form, General form. Angle between lines Condition for parallel and perpendicular lines. Distance of a point from a line.

Unit 2: **(09)**

Trigonometric ratios. Trigonometric ratios of some standard angles. Trigonometric identities and their derivations. Trigonometric ratios of double and triple angle

Unit 3: **(09)**

Determinants and matrices. Evaluation of determinants. Fundamental properties of determinants. Cramer's rule. Solutions of homogeneous and non-homogeneous equations. Types of matrices, Algebra of matrices, Multiplication of Matrices. Inverse of a matrix, Application of matrices to solve system of simultaneous equations. Rank of a matrix

Unit 4: **(09)**

Function: Types of functions. Algebraic functions, exponential functions, trigonometric functions, logarithmic functions. Algebra of functions. Increasing and decreasing functions. Concept of limit. Limit of a function. Algebra of limits. Method of evaluation of limits. Evaluation of limit of a function at infinity. Continuity of a function.

Reference Books:

1. Analytical Geometry of two dimensions: R. M. Khan, Allied Pub. Colkatta.
2. A text book of Matrices: Shantinarayan, S. Chand and Company, New Delhi.
3. A text book of Engineering Mathematics: N. P. Bali, S. Chand and Company, New Delhi.
4. Differential Calculus: Shantinarayan, S. Chand and Company, New Delhi.
5. Algebra and Geometry: H. V. Kumbhojkar, Nirali Prakashan.

Sc - III : Paper– II : Applied Statistics – I

Unit-1 **(06)**

Introduction: Meaning and scope of statistics, Population and Sample, concept of sample with illustrations, methods of sampling.

Data: Raw data, Attributes and variables, discrete and continuous variables, frequency distribution.

Graphical Representation: Histogram, Ogive Curves and their uses.

Unit-2 Measures of central tendency and dispersion : **(14)**

Concept of central tendency, Criteria for good measures of central tendency.

Arithmetic mean: Definition for ungrouped and grouped data, combined mean, weighted mean.

Median: Definition, formula for computation for ungrouped and grouped data, graphical method.

Mode: Definition, formula for computing for ungrouped and grouped data.

Measures of Dispersion : Concept of dispersion, measures of dispersion, absolute and relative measures of dispersion, Range and its coefficient, Quartile Deviation and its coefficient, Standard deviation and its coefficient, Variance, coefficient of variation.

Unit-3 Moments and Measures of Skewness and Kurtosis **(07)**

Raw and central moments (only first four moments), Relation between central and raw moments,

Skewness: Skewness of a frequency distribution, positive

and negative skewness, Measures of skewness based on moments.

Kurtosis: Leptokurtic, platyokurtic and mesokurtic distributions.

Measures of kurtosis based on moments.

Unit-4 Correlation and regression (for ungrouped data) **(09)**

Bivariate data, Concept of correlation, positive correlation, negative correlation, scatter diagram, Karl Pearson's coefficient of correlation, Spearman's Rank Correlation coefficient.

Regression: Concept, lines of regression, least square method, regression coefficients, relation between correlation and regression coefficients.

Reference Books –

1. Bhat B. R., Srivenkatramana T. and Madhava Rao K. S. (1996): Statistics: A Beginner's Text, Vol. 1, New Age International (P) Ltd.
2. Croxton F. E., Cowden D.J. and Kelin S. (1973): Applied General Statistics, Prentice Hall of India.
3. Goon A.M., Gupta M.K., and Dasgupta B.: Fundamentals of Statistics Vol. I and II, World Press, Calcutta.
5. Gupta S. P. (2002): Statistical Methods, Sultan Chand and Sons, New Delhi.
6. Hogg R. V. and Crag R. G.: Introduction to Mathematical Statistics Ed.4.
7. Hoel P. G. (1971): Introduction to Mathematical Statistics, Asia Publishing House.

8. Mood A. m., Graybill F. A. and Boes D. C. (1974): Introduction to the Theory Of Statistics, McGraw Hill.
10. Rohatgi V. K. and Saleh A. K. Md. E. (2002): An Introduction to probability and statistics. John wiley & Sons (Asia)
11. Snedecor G.W. and Cochran W. G. (1967): Statistical Methods, Lowa State University Press.
12. Waiker and Lev.: Elementary Statistical Methods.
13. Gupta V.K. & Kapoor S.C. Fundamentals of Mathematical Statistics.-Sultan & Chand

Semester – II

Sc - III : Applied Mathematics & statistics III & IV

Sc - III : Paper –III : Applied Mathematics -II

Unit I: **(10)**

Derivative of a function. Derivative of some standard functions from first principle. Algebra of derivatives. Rules of differentiation with regards to sum, product, difference and quotient of two functions. Derivative of some simple composite functions, chain rules. Second order derivatives. Maxima and minima of a function of single variable and two variables. Application of derivatives tangent and normal, velocity and acceleration.

Unit 2: **(10)**

Integration: Integration of a given function and method of evaluation of integrals. Definite and indefinite integrals. Geometrical interpretation of definite integral as area and volume of revolution under respective curves. Length of a curve.

Unit 3: **(09)**

Differential equations: Variable separable form, Homogeneous and non-homogeneous differential equations. Exact differential equation, linear differential equation of first order. Bernoulli form of differential equation.

Unit 4: **(09)**

Application of Differential equations. Law of growth and decay, Newton's law of cooling, orthogonal trajectories of curves. Chemical reactions and solutions. Conduction of heat.

Reference Books:

1. Ordinary and Partial Differential Equations: M. D. RaisinghaniaAnalytical, S. Chand and Company, New Delhi.
2. Differential Equations: H. V. Kumbhojkar, Nirali Prakashan.
3. Differential Equations: Agashe
4. Integral Calculus: Shantinarayan, S. Chand and Company, New Delhi.
5. A text book of Engineering Mathematics: N. P. Bali, Manish Goyal, Laxmi publication

Practicals: Group – A (Mathematics)

1. Finding of distance between two parallel lines
2. Determination of eigen values and eigen vectors of a matrix.
3. Verification of Cayley -Hamilton Theorem for a square matrix.
4. Application of Differential Equation to Electric circuits.
5. Application of Differential Equation to Chemical Problems.
6. Orthogonal trajectories to curves, Use of Graph paper is recommended.
7. Newton's law of cooling.
8. Law of growth.
9. Law of decay.
10. Chemical Reactions and solutions.
11. Conduction of heat.

12. Determination of an angle θ with which coordinate axes be rotated so that the conic

$$ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$$

is transformed to new co-ordinate axes to the form

$$a'x'^2 + b'y'^2 + 2g'x' + 2f'y' + c' = 0\,.$$

13. Area bounded by a curve.
14. Volume bounded by a curve.
15. Extreme values of a function of two variables by Lagrange's Method.

Reference Books:

1. Analytical Geometry of two dimensions: R. M. Khan, Allied Pub. Colkatta.
2. A text book of Matrices: Shantinarayan, S. Chand and Company, New Delhi.
3. A text book of Engineering Mathematics: N. P. Bali, S. Chand and Company, New Delhi.
4. Differential Calculus: Shantinarayan, S. Chand and Company, New Delhi.
5. Algebra and Geometry: H. V. Kumbhojkar, Nirali Prakashan.
6. Ordinary and Partial Differential Equations: M. D. RaisinghaniaAnalytical, S. Chand and Company, New Delhi.
7. Differential Equations: H. V. Kumbhojkar, Nirali Prakashan.
8. Differential Equations: Agashe Integral Calculus: Shantinarayan, S. Chand and Company, New Delhi.

Sc - III : Paper – IV : Applied Statistics – II

Unit-1 Probability: **(10)**

Concept of random experiment, sample space, finite and countably infinite sample space, discrete sample space, events, types of events, power set, Classical (apriori) definition of probability of an event, equiprobable sample space, axiomatic definition of probability.

Theorems on probability : i) $P(\Phi) = 0$, ii) $P(A') = 1 - P(A)$

iii) P(A U B) = P(A) + P(B) – P(A ∩ B), iv) If A $\subseteq$ B then P(A) ≤ P(B)

v) 0 ≤ P(A ∩ B) ≤ P(A) ≤ P(A U B) ≤ P(A) + P(B) simple examples.

Unit-2 Conditional probability and independence of events: **(09)**

Independence of two events, statement of the result that if A and B are independent events then i) A and B', ii) A' and B, iii) A' and B' are also Independent, examples.

Definition of conditional probability, partition of sample space, Baye's theorem (only statement).

Unit-3 Univariate probability distributions **(09)**

Definitions: discrete random variable, probability mass function (pmf), cumulative distribution function (cdf), properties of c.d.f., median, mode and examples. Definition of expectation of random variable, expectation of function of random variable. i) E(c) = c, where c is constant.

ii) E(*a*X + *b*) = *a* E(X) + *b*, where *a* and *b* are the constants. Definition of mean and variance of univariate distributions.

Unit-4 Some standard discrete probability distributions: **(10)**

Discrete uniform distribution: pmf, mean and variance.

Binomial distribution: pmf, mean and variance, additive property, recurrence relation for probabilities.

Hypergeometric distribution: pmf, mean and variance.

Poisson distribution: pmf, mean and variance, additive property, recurrence relation for probabilities,

Practicals Group – B (Statistics)

1. Graphical presentation of the freq. distribution (Histogram, Ogive curves)
2. Measures of Central tendency
3. Measures of the Dispersion
5. Moments, Skewness & Kurtosis
6. Correlation coefficient

7. Regression
8. Applications of Binomial Distribution.
9. Applications of Hypergeometric Distribution.
10. Applications of Poisson Distribution.

Reference Books –

1. Bhat B. R., Srivenkatramana T. and Madhava Rao K. S. (1996): Statistics: A Beginner's Text, Vol. 1, New Age International (P) Ltd.
2. Croxton F. E., Cowden D.J. and Kelin S. (1973): Applied General Statistics, Prentice Hall of India.
3. Edward P. J., Ford J. S. and Lin (1974): Probability for Statistical Decision Making, Prentice Hall.
4. Goon A.M., Gupta M.K., and Dasgupta B.: Fundamentals of Statistics Vol. I and II, World Press, Calcutta.
5. Gupta S. P. (2002): Statistical Methods, Sultan Chand and Sons, New Delhi.
6. Hogg R. V. and Crag R. G.: Introduction to Mathematical Statistics Ed.4.
7. Hoel P. G. (1971): Introduction to Mathematical Statistics, Asia Publishing House.
8. Meyer P. L. (1970): Introductory Probability and Statistical Applications, Addision Wesley.
9. Mood A. m., Graybill F. A. and Boes D. C. (1974): Introduction to the Theory Of Statistics, McGraw Hill.
10. Rohatgi V. K. and Saleh A. K. Md. E. (2002): An Introduction to probability and statistics. John wiley & Sons (Asia)
11. Snedecor G.W. and Cochran W. G. (1967): Statistical Methods, Lowa State University Press.

12. Waiker and Lev.: Elementary Statistical Methods.
13. Gupta V.K. & Kapoor S.C. Fundamentals of Mathematical Statistics.-Sultan & Chand

Semester – I

Sc - IV : Sugarcane agriculture and Sugar manufacture - I & II

Sc - IV : Paper-I: Sugarcane Agriculture- I

Unit –1: Introduction, Origin, Distribution and Botany of Sugarcane (08)

1.1. Common name, English name, Botanical name, Classification upto genus.

1.2. Centers of sugarcane origin.

1.3. Distribution- Indian sugar industry on global screen, Sugarcane area, production and productivity in India.

1.4. External morphology

1.5. Internal morphology- root, stem and leaves.

Unit-2: Sugarcane cultivation practices (10)

2.1. Soil and sugarcane nutrition

2.2. Climatic conditions for sugarcane

2.3. Cultivation practices- Preparation of soil, Sugarcane planting methods: Planting in flat beds, ridges and furrows method, pit planting, bud transplanting, Weeds and their control (Chemical and Biological control methods)

Unit-3: Agronomy (08)

3.1. Manuring (Response of sugarcane crop to FYM and Chemical fertilizers, micronutrient), soil application and foliar application.

3.2. Irrigation and its methods- Furrow, sprinkler and drip method.

3.3. Sugarcane maturity, ripening, harvesting and ratoon management.

Unit-4: Sugarcane pathology (10)

4.1. Diseases of sugarcane with special reference to causal organism, symptoms and its control measures:

a) Fungal: Red rot, Whip smut.
b) Bacterial: Leaf scald, red strips.
c) Viral and Mycoplasmal: Mosaic and Grassy shoot.

4.2. Pests of sugarcane with special reference to morphology, symptoms and its control measures:

a)Termites, b) Shoot borer, c) White flies and d) Armyworms.

Reference Books-

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

9) Genetics and Plant Breeding- E. B. Babcock
10) Plant Taxonomy – O. P. Sharma.
11) Plant Breeding- Theory and Techniques – S. K. Gupta.
12) Breeding Asian Field Crops- John Milton Poehlman and Dhirendranath Borthakur.
13) Crop Production and Field Experimentation- Dr. V. G. Vaidya, K. R. Sahasrabudhe, Dr. V. S. Khuspe.
14) Agricultural Problems of India- A. N. Agrwal and Kundam Lal
15) Elementary Principles of Plant Breeding- H.K. Chaudhari.
16) Trends in Agricultural Insect Pest Management- G. S. Dhaliwal and Ramesh Arora.

Sc - IV : Paper –II : Sugar manufacture – I (Juice Extraction and Clarification)

Unit – 1 : **[09]**

1.1. Extraction of Juice from cane, maceration and imbibitions use of cold and hot water, maceration schemes and mill sanitation.

1.2. Measurement and weighment of juice – Measuring tanks, level meters, counters, weighing machines – hand operated, semiautomatic and automatic system – equipment details and operation.

1.3. Sulphur burning for production of SO_2 (Sulphur- di-oxide) different types of sulphur furnaces, batch type, continuous and Acme type-their contruction and operation, gas scrubbers, cooling of gas, composition of sulphur, different methods of melting and addition., air compressors of different types.

Unit – 2 : **[09]**

2.1. Lime kilns-batch type and continuous type, milk of lime preparation, slaker and grit removal CO_2 scrubbers and cooling of gases.

2.2. Juice heaters, plate type heat, exchanges, use of vapors for steam economy.

Unit – 3 : **[08]**

Composition of cane and juice – their difference, principles of cane juice clarification, influence of lime on the different constituents of juice, effect of pH, effect of heating, different processes of cane juice clarification, simple clarification compound clarification. Process, cold and hot sulphitation, continuous sulphitation, double sulphitation. carbonation, single and double, de-Hans' process, comparison of different clarification modern techniques middle juice carbonation, processes etc.

Unit – 4 : **[10]**

4.1.Setting tanks, system of draining clear juice and dirty juice, continuous subsiders, door, graver, batch trayless and other types of clarifiers.

4.2.Plate and frame type filter presses, continuous filters. leaf filters, oliver filter KCP filters, pressure filters. Sweetenting off different systems.

Reference books :

1. Hand of book of cane sugar – Meade & Chen
2. Introduction to cane sugar technology – Jenkins G. H.
3. Unit operation in cane sugar production – John H. Payne
4. Manufacture of sugar from sugarcane – C. C. M. Perk
5. Efficient Management for sugar factories – Mangal Singh
6. Cane sugar manufacture in India – D. P. Kulkarni

Semester – II

Sc - IV : Sugarcane agriculture & Sugar manufacture - III & IV

Sc - IV : Paper-III: Sugarcane Agriculture- II

Unit –1: Breeding techniques in Sugarcane. **(09)**

1.1. Introduction, varieties, scope of varietal planting, cytology

1.2. Raising of seed cane crop- Ideal seed cane, seed cane treatment, measures to obtain higher germination, transplanting technique and its advantages.

Unit-2: Breeding methods. **(10)**

2.1. Introduction and germ plasma collection.

2.2. Clonal selection.

2.3. Hybridization.

2.4. Mutation breeding.

Unit-3: Objectives of sugarcane breeding **(10)**

3.1. Breeding for yield, lodging resistance, resistance to frost, resistance to drought, resistance to water logging, resistance to diseases, resistance to insect pests and quality.

3.2. Sugarcane breeding institutes in India.

Unit-4. Physiology of sugarcane **(09)**

4.1. Physiology of sugarcane under normal conditions.

4.2. Physiology of sugarcane under saline conditions.

4.3. Rapid screening parameters for salt stress.

4.4. Agro-technology to improve germination under saline conditions.

4.5. Work on the physiology of various sugarcane clones.

Practicals : Group – A (sugarcane Agriculture)

Study of external morphology of sugarcane plant.

1) Study of internal morphology of sugarcane plant- T. S. of root,
2) Study of internal morphology of sugarcane plant- T. S. of stem
3) Study of internal morphology of sugarcane plant- T. S. of leaf.
4) Determination of soil pH (Any suitable method).
5) Study of soil texture.
6) Determination of humus content (fertility) of the soil sample.
7) Study of deficiency symptoms of macronutrients (N, P, K) in sugarcane plant. (Demonstration)
8) Study of sugarcane diseases- red rot, whip smut, leaf scald.
9) Study of sugarcane diseases red strips, mosaic and grassy shoot.
10) Study of sugarcane pests- termites, shoot borer, white flies and armyworms.
11) Study of different types of fertilizers. (Demonstration)

12) Study of different varieties of sugarcane with special reference to morphology, sugar percentage, yield. (Any four varieties available in the area).
13) Study of dimorphic chloroplast (Kranz anatomy) in sugarcane leaves.
14) Breeding techniques in sugarcane.

Occasional Field Work will be arranged to demonstrate various cultivation practices.

Reference Books:

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

15) Elementary Principles of Plant Breeding- H.K. Chaudhari.
16) Trends in Agricultural Insect Pest Management- G. S. Dhaliwal and Ramesh Arora.

Sc - IV : Paper –IV : Sugar manufacture – II (Evaporation)

Unit – 1 : Evaporators: [09]

Study of different types of evaporators, single effect and multiple effect, vapour cell and preevalaporators,

Unit – 2 : Vapor bleeding system: [09]

condensers – barometric, multijet, built in condensers, catchalls, scale formation and their removal , factor affecting evaporator performance.

Unit – 3 : Operation: [10]

3.1.operational problems, removal of condensate and non condensable gases, Brix measuring devices, automatic juice level regulators, Rising & falling film evaporator,

3.2. Scale removal: soda boiling & descaling procedures followed on general cleaning day.

Unit – 4 : Treatment : [10]

Syrup treatment, batch and continuous suspiration versels, sulphurrring – setting – filtering – pH and brix control of syrup.

Practicals : Group – B (Sugar manufacture)

i) To determine the Brix of the given sample by Bx Hydrometer & Handrefractomegter
ii) To find out the Purity of given sample of Juice.
iii) To determine the Purity of Syrup and Molasses
iv) To determine the purity of the Massecuite
v) To determine the Pol % and Moist % of the Bagasse
vi) To determine the Pol % and Moist % of the Filltercake

vii) To determine the pH of the given sample by
   a. Test Paper
   b. Helige comparator
   c. pH meter
viii) To determine the phosphate contents in the given sample by Spectrophotometer
ix) To determine the Reducing sugar by Eyon & lane Method
x) To determine the Reducing sugar by Potassium Ferrocynide Method
xi) To determine the Reducing sugar by Luffs Method
xii) To determine the Reducing sugar by Colorimetric Method

Reference books : Sugar manufacture

1. Hand of book of cane sugar – Meade & Chen
2. Introduction to cane sugar technology – Jenkins G. H.
3. Unit operation in cane sugar production – John H. Payne
4. Manufacture of sugar from sugarcane – C. C. M. Perk
5. Efficient Management for sugar factories – Mangal Singh
6. Cane sugar manufacture in India – D. P. Kulkarni

Nature of Question Paper for all (Theory) papers U.G. Courses under Under Faculty of Science.

Nature of Question Paper		
Q.No.1	Multiple Choice based objective type question (four options for each question be given)	8 Marks
Q.No. 2	Attempt any two of the following (out of three)	16 Marks
Q.No. 3	Shot notes (4 out of 6)	16 Marks
	Total	40 Marks

टीप: बी.ए./बी.कॉम - भूगोल, एस.टी.डी. तसेच बी.ए. गृहशास्त्र या अभ्यासक्रमांना अनुक्रमे सामाजिकशास्त्रे / वाणिज्य व सामाजिकशास्त्रे विद्याशाखांनी निश्चित केल्याप्रमाणे प्रश्नपत्रिकेचे स्वरूप राहील

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