FACULTY OF SCIENCES

SYLLABUS

FOR

Bachelor of Food Science & Technology [Honours]
(Four Years Programme)
(SEMESTER: I–VIII)

Examinations: 2019-20

GURU NANAK DEV UNIVERSITY
AMRITSAR

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## Scheme

### Semester-I

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course title</th>
<th>Teaching Periods</th>
<th>Marks</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>FST – 101</td>
<td>Communication Skills in English-I</td>
<td>3</td>
<td>50</td>
<td>50</td>
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<tr>
<td>FST – 102</td>
<td>Punjabi (Compulsory) OR <em>ਪੰਜਾਬੀ ਭਾਸ਼ਾ</em> OR <strong>ਪੰਜਾਬੀ ਇਤਿਹਾਸ &amp; ਸੌਂਗਲੀਕਤਾ</strong></td>
<td>3</td>
<td>-</td>
<td>50</td>
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<tr>
<td></td>
<td>*<strong>Drug Abuse: Problem, Management and Prevention (Compulsory)</strong></td>
<td></td>
<td>50</td>
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</tr>
<tr>
<td>FST – 103</td>
<td>Crop Science</td>
<td>3</td>
<td>40</td>
<td>60</td>
</tr>
<tr>
<td>FST – 104</td>
<td>Fundamentals of Food Nutrition</td>
<td>3</td>
<td>30</td>
<td>80</td>
</tr>
<tr>
<td>FST – 105</td>
<td>Introductory Biochemistry</td>
<td>3</td>
<td>30</td>
<td>80</td>
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<tr>
<td>FST – 106</td>
<td>Principles of Food Preservation</td>
<td>3</td>
<td>50</td>
<td>80</td>
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</tbody>
</table>

**Note:**

1. *Special Paper in lieu of Punjabi Compulsory*
2. **For those students who are not domicile of Punjab**
3. ***This paper marks will not be included in the total marks.***
### SEMESTER–II

<table>
<thead>
<tr>
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<tr>
<td></td>
<td></td>
<td>Theory</td>
<td>Practical</td>
<td>Theory</td>
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<tr>
<td>FST – 201</td>
<td>Communication Skills in English-II</td>
<td>3</td>
<td>-</td>
<td>35</td>
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<tr>
<td>FST – 202</td>
<td>Punjabi (Compulsory) OR ਪੰਜਾਬੀ ਪ੍ਰੌਦਾਪੀ OR Punjabi History &amp; Culture</td>
<td>3</td>
<td>-</td>
<td>50</td>
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<td></td>
<td>***Drug Abuse: Problem, Management and Prevention (Compulsory)</td>
<td></td>
<td></td>
<td>50</td>
</tr>
<tr>
<td>FST – 203</td>
<td>Introduction to Computers</td>
<td>3</td>
<td>3</td>
<td>40</td>
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<tr>
<td>FST – 204</td>
<td>General Microbiology</td>
<td>3</td>
<td>3</td>
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<tr>
<td>FST – 205</td>
<td>Food Chemistry</td>
<td>3</td>
<td>3</td>
<td>50</td>
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<tr>
<td>FST – 206</td>
<td>Food Additives</td>
<td>3</td>
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</table>

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<td>FST – 301</td>
<td>Food Microbiology</td>
<td>3</td>
<td>3</td>
<td>50</td>
</tr>
<tr>
<td>FST – 302</td>
<td>Fluid Milk Processing</td>
<td>3</td>
<td>3</td>
<td>50</td>
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<tr>
<td>FST – 303</td>
<td>Processing of Meat and Meat Products</td>
<td>3</td>
<td>3</td>
<td>50</td>
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<tr>
<td>FST – 304</td>
<td>Post Harvest Management of Fruits and Vegetables</td>
<td>3</td>
<td>3</td>
<td>50</td>
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<tr>
<td>FST – 305</td>
<td>Cereal Milling and Legumes</td>
<td>3</td>
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**SEMIESTER–IV**

<table>
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<td></td>
<td>Theory</td>
<td>Practical</td>
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<tr>
<td>FST – 401</td>
<td>Processing of Milk Products-I</td>
<td>3</td>
<td>3</td>
<td>50</td>
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<tr>
<td>FST – 402</td>
<td>Egg, Poultry and Fish Technology</td>
<td>3</td>
<td>3</td>
<td>50</td>
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<tr>
<td>FST – 403</td>
<td>Fruits and Vegetables Processing</td>
<td>3</td>
<td>3</td>
<td>50</td>
</tr>
<tr>
<td>FST – 404</td>
<td>Processing of Cereals and Legumes</td>
<td>3</td>
<td>3</td>
<td>50</td>
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<tr>
<td>FST – 405</td>
<td>Food Plant Hygiene and Sanitation</td>
<td>3</td>
<td>3</td>
<td>50</td>
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<tr>
<td>ESL –221</td>
<td>*Environmental Studies (Compulsory)</td>
<td>1.5</td>
<td>-</td>
<td>100</td>
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Note: *This paper marks will not be included in the total marks.
### SEMESTER–V

<table>
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<th>Teaching Periods</th>
<th>Marks</th>
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</thead>
<tbody>
<tr>
<td>FST – 501</td>
<td>Principles of Fermentation Technology</td>
<td>3 3</td>
<td>50 30</td>
</tr>
<tr>
<td>FST – 502</td>
<td>Food Packaging-I</td>
<td>3 3</td>
<td>50 30</td>
</tr>
<tr>
<td>FST – 503</td>
<td>Confectionery &amp; Sugar Technology</td>
<td>3 3</td>
<td>50 30</td>
</tr>
<tr>
<td>FST – 504</td>
<td>Oil &amp; Fat Technology – I</td>
<td>3 3</td>
<td>50 30</td>
</tr>
<tr>
<td>FST – 505</td>
<td>Processing of Milk Products-II</td>
<td>3 3</td>
<td>50 30</td>
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</table>

### SEMESTER–VI

<table>
<thead>
<tr>
<th>Course code</th>
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<tbody>
<tr>
<td>FST – 601</td>
<td>Quality Assurance</td>
<td>3 3</td>
<td>50 30</td>
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<tr>
<td>FST – 602</td>
<td>Grain Storage</td>
<td>3 3</td>
<td>50 30</td>
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<tr>
<td>FST – 603</td>
<td>Food Packaging-II</td>
<td>3 3</td>
<td>50 30</td>
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<tr>
<td>FST – 604</td>
<td>Spices &amp; Flavour Technology</td>
<td>3 3</td>
<td>50 30</td>
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<tr>
<td>FST – 605</td>
<td>Technology of Fermented Foods</td>
<td>3 3</td>
<td>50 30</td>
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<tr>
<td>FST – 606</td>
<td>In Plant Training 4 weeks</td>
<td>-</td>
<td>-</td>
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</tbody>
</table>

**Note:** All the students are required to undergo ‘In Plant Training’ for 4 weeks in a food processing unit after VIth semester’s final examinations. Final degree to the students will be awarded subject to their successfully completing the ‘In Plant Training’. In Plant Training will be evaluated as satisfactory / unsatisfactory internally by the department of the college concerned.
### SEMESTER–VII

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course title</th>
<th>Teaching Periods</th>
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<tbody>
<tr>
<td>FST – 701</td>
<td>Food Safety &amp; Laws</td>
<td>3 3</td>
<td>50 30</td>
<td>80</td>
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<tr>
<td>FST – 702</td>
<td>Industrial Microbiology</td>
<td>3 3</td>
<td>50 30</td>
<td>80</td>
</tr>
<tr>
<td>FST – 703</td>
<td>Oil &amp; Fat Technology-II</td>
<td>3 3</td>
<td>50 30</td>
<td>80</td>
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<tr>
<td>FST – 704</td>
<td>Food Engineering – I</td>
<td>3 3</td>
<td>50 30</td>
<td>80</td>
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<tr>
<td>FST – 705</td>
<td>Malting &amp; Brewing Technology</td>
<td>3 3</td>
<td>50 30</td>
<td>80</td>
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### SEMESTER–VIII

<table>
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<th>Marks</th>
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<tbody>
<tr>
<td>FST – 801</td>
<td>Food Biotechnology</td>
<td>3 3</td>
<td>50 30</td>
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<tr>
<td>FST – 802</td>
<td>Enzymes in Food Processing</td>
<td>3 3</td>
<td>50 30</td>
<td>80</td>
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<tr>
<td>FST – 803</td>
<td>Food Engineering-II</td>
<td>3 3</td>
<td>50 30</td>
<td>80</td>
</tr>
<tr>
<td>FST – 804</td>
<td>Food Plant Layout</td>
<td>3 3</td>
<td>50 30</td>
<td>80</td>
</tr>
<tr>
<td>FST – 805</td>
<td>Food Analysis &amp; Instrumentation</td>
<td>3 3</td>
<td>50 30</td>
<td>80</td>
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</tbody>
</table>
FST-101: COMMUNICATION SKILLS IN ENGLISH-I

Time: 3 Hours

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

The syllabus is divided in four sections as mentioned below:

Section–A
Reading Skills: Reading Tactics and strategies; Reading purposes–kinds of purposes and associated comprehension; Reading for direct meanings.

Section–B
Reading for understanding concepts, details, coherence, logical progression and meanings of phrases/expressions.

Activities:
- Comprehension questions in multiple choice format
- Short comprehension questions based on content and development of ideas

Section–C
Writing Skills: Guidelines for effective writing; writing styles for application, personal letter, official/business letter.

Activities
- Formatting personal and business letters.
- Organising the details in a sequential order

Section–D
Resume, memo, notices etc.; outline and revision.

Activities:
- Converting a biographical note into a sequenced resume or vice-versa
- Ordering and sub-dividing the contents while making notes.
- Writing notices for circulation/boards

Recommended Books:
2. English Grammar in Use (Fourth Edition) by Raymond Murphy, CUP
BACHELOR OF FOOD SCIENCE & TECHNOLOGY (HONS.) (SEMESTER-I)
(4 YEARS COURSE)

FST-102: भूतात्म (अध्ययन)

भाग : 3 पृष्ठें 
वर्ग अंक : 50

अंक-दौड़ अद्य धार्मिकांक तथा उचाई

1. भूतात्म भवन द्वारा नव नव नव नव। उद रात्रि दिन्यां दे भूतात्म पृथ्वि मार्गे।
2. द्वितीयाणि दे स्वरूप भूतात्म भवन द्वारा उम। उद रात्रि दिन्यां दे भूतात्म अध्ययन डें।
3. चतुर्थ भूतात्म दे पक्षण अंव नह।
4. मेल िंट बल राजा मेल नीव उम भूतात्म ची लैंड ओंग लंघ दे लंघ चतुःक्षण भूतात्म दिन्यां वत्त कर मूर्त भाव

भाषा-चूह अद्य भल-युग्मवां

मैत्रसह-डिनि

अध्याय चूहां (विद्यामय रत्ना),
(धर. मणि प्रभु नव नव दिन्यां भूतात्म रात्रि में) नाफ िंटल दे स्वरूप भूतात्म शुद्ध िथिताम्।
(भूतात्म भुवन राजशाखान, मंद)

मैत्रसह-त्रिनि

विद्यामय नाराण (विद्यामय नेर-नेवारी)
मेघ. मणि कपिल, भूतात्म भुवन, शुद्ध िथिताम्। (संख्या 1 ते 6)
(तिथं या नद, तिथं-शैली)

मैत्रसह-पति

(०) घेतु िंटला
(अ) घेतु गल्ले बुनां दे भूतात्म

मैत्रसह-पंक्ति

(०) भूतात्म भुवन हिदित: घुर्षण भूतात्म, घुर्षण मार्ग दे हिदिता, मार्ग, हिदिता, महत-पृथ्वि।
(अ) भूतात्म गठनीय भूतात्म: भूतात्म दे टवरांची भुवं, भूतात्म हिदित-भूतात्म दे भूतात्म, भूतात्म िुथुभुवन दे पदार्थ-हिदित।
BACHELOR OF FOOD SCIENCE & TECHNOLOGY (HONS.) (SEMESTER-I) (4 YEARS COURSE)

FST-102: पूष्पकी धारणी
(In lieu of Compulsory Punjabi)

मात्रा : 3 पट्टे  
बन्ध आंक : 50

भव-पूष्प अथवा धारणीधार चौड़ा उपाधियाँ

1. पूष्प पंट के चार दिन उत्सव। उन दिन विचे वे पूष्प पंट के साथ होते।
2. निःशुल्क के तीन दिन पूष्प की तरह होते हैं। उन दिन विचे हिंदु पूष्प समाधी है।
3. निःशुल्क पूष्प के चार दिन उत्सव होत।
4. स्थापित मै वैसे एक सुनेक रोज़ा में पूष्प की तीन अंगी हेंग पार हेंग चार विध-पूष्प समाधी हिंदु चार महीना है।

पत्थर-सूखा

मैवाल-शी

पैरी चीलकी, भैया वृषि, पैंथ किसी दर्द भरे पेंच निचे पेंच, 
देवर दर्द भरे आए भावुक (पूष्पकी सर्द-भाव)
स्थापत (विसौ, निधि, आयुष) : पाठ भरे दर्दुए

मैवाल-बी

पैंथ की सब-पहाड़ : पूष्पकी सर्द-भाव
(सिवाल बख्त, मंगल बख्त, कृष्ण बख्त, भृत्त बख्त, भृत्त बख्त भरे भिड़ड)

मैवाल-भी

पिंड दर्दुए की धारणी समाधी : घाटान, ढांग, फिरे-फिरे, पैंथ की आए उन पैंथकी आए तील में भाल में केवल}

मैवाल-बी

उहुए दे मैं सिका दे तं, भावुक भावुक दे तं, ढोंगुए दे तं, ढिंग दे में उन विशी चार्ट दिं दिं
FST-102 : Punjab History & Culture (From Earliest Times to C 320)
(Special Paper in lieu of Punjabi compulsory)
(For those students who are not domicile of Punjab)

Time: 3 Hours
Max. Marks: 50

Instructions for the Paper Setters:-
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Section A
1. Physical features of the Punjab and its impact on history.
2. Sources of the ancient history of Punjab

Section B
3. Harappan Civilization: Town planning; social, economic and religious life of the Indus Valley People.

Section C
5. Social, Religious and Economic life during Rig Vedic Age.

Section D
7. Teachings and impact of Buddhism
8. Jainism in the Punjab

Suggested Readings
1. L. M Joshi (ed.), History and Culture of the Punjab, Art-I, Patiala, 1989 (3rd edition)
Drug Abuse: Problem, Management and Prevention
(COMPULSORY PAPER)

PROBLEM OF DRUG ABUSE

Time: 3 Hours
Max. Marks: 50

Instructions for the Paper Setters:-
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Section – A
Meaning of Drug Abuse:

Section – B
Consequences of Drug Abuse for:
- Family: Violence.
- Society: Crime.
- Nation: Law and Order problem.

Section – C
Management of Drug Abuse:
Medical Management: Medication for treatment and to reduce withdrawal effects.

Section – D
Psychiatric Management: Counselling, Behavioural and Cognitive therapy.
Social Management: Family, Group therapy and Environmental Intervention.

References:
1. Ahuja, Ram (2003), Social Problems in India, Rawat Publication, Jaipur.
**FST – 103 CROP SCIENCE**

(Theory)

Time: - 3 Hrs.  
Max. Marks: 60  
Theory: 40  
Practical: 20

**Instructions for the Paper Setters:-**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

**SECTION-A**

Classification of crops, Study of the following crops with particular reference to climatic and soil requirements, their improved cultural practices with special emphasis on seed bed preparation, improved varieties, rotations, seed and seed treatment, sowing, manures and fertilizers, irrigation requirements, weed control, harvesting and marketing.

**Cereal crops**: Paddy, Maize, Wheat

**SECTION-B**

Study of the following crops with particular reference to climatic and soil requirements, their improved cultural practices with special emphasis on seed bed preparation, improved varieties, rotations, seed and seed treatment, sowing, manures and fertilizers, irrigation requirements, weed control, harvesting and marketing.

**Pulses**: Green gram, Black gram, Bengal gram and Soyabean.

**Oilseeds**: Groundnut, Sunflower and Mustard.

**SECTION-C**

Study of the following crops with particular reference to climatic and soil requirements, their improved cultural practices with special emphasis on seed bed preparation, improved varieties, rotations, seed and seed treatment, sowing, manures and fertilizers, irrigation requirements, weed control, harvesting and marketing.

**Vegetables**: Egg plant (Brinjal), Tomato, Ladyfinger, Peas, Cauliflower, Cabbage, Carrot, Potato.

**SECTION-D**

**Horticultural Crops**: Study of fruits with special emphasis on selection of site and soil, their cultural practices with particular reference to training, pruning, propagation methods, harvesting and fruit handling of Mango, Papaya and Kinnow.
FST – 103 CROP SCIENCE
(Practical)

Instructions for the Paper Setters:
Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

Identification of crops, vegetables and fruits studied. Identification and composition of fertilizers and computation of doses of different fertilizers for different crops. Identification and collection of weeds associated with crops studied.
FST–104: FUNDAMENTALS OF FOOD NUTRITION
(Theory)

Time: - 3 Hrs.
Max. Marks: 80
Theory: 50
Practical: 30

Instructions for the Paper Setters:-
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A
Definition, Scope & History of Nutrition.
Functions of Food, Food types and groups,
Water Balance & Energy Balance.
Energy value of Carbohydrates, Fats & Proteins.

SECTION-B
BMI & BMR of an individual.
Balanced diet,
Recommended daily allowances and requirement of infants, children, adults, old people, Athletes, Expectant and nursing mothers.

SECTION-C
Diet surveys & Diet groups, Food Exchange List.
Importance of therapeutic nutrition, Deficiency diseases and disorders of metabolism.

SECTION-D
Protein and carbohydrate malnutrition.
Planning of diets for patients suffering from Ulcer, Anaemia, Diarrhoea, Diabetes, Cardiac diseases, Jaundice, Nephritis and Tuberculosis.
FST–104: FUNDAMENTALS OF FOOD NUTRITION
(Practical)

Marks: 30

Instructions for the Paper Setters:
Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

1. Identification of food sources for various nutrients.
2. Instruction to diet planning using food exchange list.
3. Calculation of BMI & BMR.
5. Planning of diet for children, adult and old people.
6. Planning of diet for patient suffering from Ulcer, Anaemia, Diabetes, Diarrhoea and Cardiac diseases.

Recommended Book:
FST-105: INTRODUCTORY BIOCHEMISTRY
(Theory)

Time: - 3 Hrs.          Max. Marks: 80
Theory: 50
Practical: 30

Instructions for the Paper Setters:-
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four
Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are
required to attempt five questions, selecting at least one question from each Section. The fifth
question may be attempted from any Section.

SECTION-A
General introduction and importance of Biochemistry. Different nutrients of food.
Proteins - Introduction, classification, sources, structural organisation and biochemical
functions, amino acids and their importance.

SECTION-B
Carbohydrates - Introduction, sources, classification, structure and biochemical functions,
metabolic pathways (glycolysis, TCA and HMP) of carbohydrates, Lactic acid and alcoholic
fermentation.

SECTION-C
Lipids - Introduction, classification, sources, structure and biochemical functions, a brief
introduction to fatty acids, oxidation of fatty acids.
Digestion and Absorption of carbohydrates, proteins and lipids.

SECTION-D
Vitamins - Introduction, sources and biochemical functions, daily requirements & deficiency
diseases of fat and water soluble vitamins.
Minerals - Introduction, classification as major and minor elements, sources, biochemical
functions, daily requirements & deficiency diseases of Ca, Fe, I, P, Na, K, F & Zn.
FST-105: INTRODUCTORY BIOCHEMISTRY
(Practical)

Marks: 30

Instructions for the Paper Setters:
Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

1. Preparation of standard solutions of acid and alkali.
2. Determination of pH using indicators and with pH meter.
3. Determination of moisture in a given sample.
4. Determination of ash in a given sample.
5. Determination of acidity in a given sample.
7. Estimation of free fatty acid of given sample.
8. Determination of total solids in the given food product.
9. Determination of crude fibre in the given food.

Books Recommended:
FST-106 Principles of Food Preservation
(Theory)

Time: 3 Hrs.                      Max. Marks: 80

Theory: 50
Practical: 30

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A
Preservation by Low Temperature: Low temperature storage, refrigeration and freezing.

SECTION-B

SECTION-C
Preservation by Drying: Methods of drying – dehydration by Air drying, sun drying and freeze drying.
Preservation by Concentration Methods, Intermediate moisture foods.

SECTION-D
Microwave Heating: Properties, mechanism, microwave generator and microwave food application.
Preservation by Radiations: Ultraviolet and ionizing irradiations. Their effect on microorganisms, use in the treatment of food.
FST-106 Principles of Food Preservation
(Practical)

Instructions for the Paper Setters:
Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

1. Adequacy of blanching.
2. Dehydration of foods.
3. Preservation of food products by low temperature.
4. Preservation of food products by concentration method.
5. Use of chemicals in preservation of foods.
6. Cut out examination of canned foods.
7. Visit to food industry.

Books Recommended:

Principle of Food Preservation:
3. The Technology of Food Preservation by Desrosier & Desrosier.
FST-201 : COMMUNICATION SKILLS IN ENGLISH-II

Time: 3 Hours

Max. Marks: 50
Theory Marks: 35
Practical Marks: 15

Instructions for the Paper Setters:-
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Contents:

SECTION–A
Listening Skills: Barriers to listening; effective listening skills; feedback skills.
Activities: Listening exercises – Listening to conversation, News and TV reports

SECTION–B
Attending telephone calls; note taking and note making.
Activities: Taking notes on a speech/lecture

SECTION–C
Speaking and Conversational Skills: Components of a meaningful and easy conversation; understanding the cue and making appropriate responses; forms of polite speech; asking and providing information on general topics.
Activities: 1) Making conversation and taking turns 2) Oral description or explanation of a common object, situation or concept

SECTION–D
The study of sounds of English, Stress and Intonation, Situation based Conversation in English, Essentials of Spoken English.
Activities: Giving Interviews

PRACTICAL / ORAL TESTING

Marks: 15

Course Contents:-
1. Oral Presentation with/without audio visual aids.
2. Group Discussion.
3. Listening to any recorded or live material and asking oral questions for listening comprehension.

Questions:-
1. Oral Presentation will be of 5 to 10 minutes duration (Topic can be given in advance or it can be student’s own choice). Use of audio visual aids is desirable.
2. Group discussion comprising 8 to 10 students on a familiar topic. Time for each group will be 15 to 20 minutes.

Note: Oral test will be conducted by external examiner with the help of internal examiner.
BACHELOR OF FOOD SCIENCE & TECHNOLOGY (HONS.) (SEMESTER – II)
(4 YEARS COURSE)

FST-202 : प्रत्यक्ष (लघुभाषी)

भाग : 3 पृष्ठ
बहु लेख : 50

ङ्ङे-खे अंिे वर्तमान सजी उपलब्धियाँ

1. पुष्प भेंडल के सच जज खेलते हैं। उन जज दिये हुए पुष्प पैके लगाते हैं।
2. विंशिया के बुंध पुष्प बिने बिने हुए। उन जज दिये हुए पुष्प पाया जाता है।
3. अंिज भुमि जे घरिक भेंडल गए।
4. पेटेन मैंट फ़र्न फैक्टर खेलते अंिे पुष्प वी बेन बेन डेंप जंग खंज खंज-पुष्पां दिये बिने मजदूर रहे।

पाट-पुष्प अंिे पाट-पुष्पां

मैवसह-डे

आवास असल (सच्ची जज),
(संघ. मुखिया दीन अंिे दलित भाषा संघ मंड)।
वांछ लगवते हैं धूलीपुर तक, अभिज्ञान।
(रिप-रमाज, प्रवास रिकेल)

मैवसह-डी

विधिमान जज (विधिमान जंग-संघुरि)
संघ. म.म.अंसल,
पाया मध्य भ्राता भ्राता, भ्रात भ्रात। (केंद्र 7 जून 12)
(संघ, संघत मैली)

मैवसह-ढी

(१) मध्य-घटना अंिे मध्य उत्तर : परिवार, भेंडल भवनः
(अ) नाम गुप्तांग

मैवसह-ढी

(२) मतिम उत्तर
(अ) पुष्पां अंिे मतिम
बैचेलर ऑफ फ्यूड साइंस एंड टेक्नोलॉजी (हंस.) (सेमेस्टर – II)
(4 साल कौर्स)

FST-202 : खनियाँ
(In lieu of Compulsory Punjabi)

संख्या : 3 अंक
पूर्ति अंक : 50

1. पूर्ति प्लांट के छत्र बनाए दें। उन छत्रों किचनें दें पूर्ति प्लांट नए लाए।
2. फिशियर्जी के हुए घंटे पूर्ति बनाए उठाँ। उन छत्रों किचनें दें पूर्ति सत्तानी है।
3. वर्तमान पूर्ति के घराबन अंक उठाँ।
4. पेषें मैंट करके उत्तर नेट करें और पूर्ति प्लांट की टूटी लंगें दें। पूर्ति विध-पूर्ति लिश वर्त मजबूत दें।

पद-विभाग

मैचरहेन

मस्तर मूलीगी: पहाड़ अंक दवड़
(छाँद, पहाड़कं, विवैक, विसेंट, विवैक विसेंट, सब्जपे, मजबूत अंक दिल)-विभिन्न

मैचरहेन-वी

पहाड़ी वात मस्तर: खोटी सत्ता-पहाड़
(ई) माध्यम वात, मस्तरवर वात अंक भीमसेन वात (पहाड़ अंक दवड़)
(अ) फिशियर्जी वात, पूर्ति कारण वात अंक गुलाली वात (पहाड़ अंक दवड़)

मैचरहेन-मी

पेशु वात
मिष्ठ मस्तर

मैचरहेन-वी

विल्ही वात (पहेली अंक दवड़)
अध्यात्म अंक भूणिते
FST-202: Punjab History & Culture (C 320 to 1000 B.C.)
(Special Paper in lieu of Punjabi compulsory)
(For those students who are not domicile of Punjab)

Time: 3 Hours                              Max. Marks : 50

Instructions for the Paper Setters:-
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Section A
1. Alexander’s Invasion and its Impact
2. Punjab under Chandragupta Maurya and Ashoka.

Section B
3. The Kushans and their Contribution to the Punjab.
4. The Panjab under the Gupta Empire.

Section C
5. The Punjab under the Vardhana Emperors
6. Socio-cultural History of Punjab from 7th to 1000 A.D.

Section D
7. Development of languages and Education with Special reference to Taxila
8. Development of Art & Architecture

Suggested Readings
1. L. M Joshi (ed), History and Culture of the Punjab, Art-I, Punjabi University, Patiala, 1989 (3rd edition)
Drug Abuse: Problem, Management and Prevention  
(COMPELLARY PAPER)

DRUG ABUSE: MANAGEMENT AND PREVENTION

Time: 3 Hours

Max. Marks: 50

Instructions for the Paper Setters:-
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Section – A
Prevention of Drug abuse:
Role of family: Parent child relationship, Family support, Supervision, Shaping values, Active Scrutiny.

Section – B
School: Counselling, Teacher as role-model. Parent-teacher-Health Professional Coordination, Random testing on students.

Section – C
Controlling Drug Abuse:
Media: Restraint on advertisements of drugs, advertisements on bad effects of drugs, Publicity and media, Campaigns against drug abuse, Educational and awareness program

Section – D

References:
1. Ahuja, Ram (2003), Social Problems in India, Rawat Publication, Jaipur.


FST-203 Introduction to Computers
(Theory)

Time: 3 Hrs.

Max. Marks: 60
Theory: 40
Practical: 20

Instructions for the Paper Setters:-
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A
FUNDAMENTAL OF COMPUTER: Introduction to computer, Applications of computer. Components of computer. Primary and Secondary storage. Number systems.

SECTION-B
INTRODUCTION TO WINDOWS: Parts of window screen (Desktop, Window, Icons), Start menu, Taskbar, settings, application & document window, anatomy of a window (Title bar, minimize, maximize button, control box, scroll bars, scroll buttons, scroll boxes), Window explorer (expansion, collapsing of directory free, copying, moving, deleting files, folder, creating folders), About desktop icons (recycle bin, my computer, network neighbourhood, briefcase), folder, shortcut creation, setting of screen savior, color settings, wallpaper, changing window appearance.

SECTION-C
MS-WORD: Introduction to MS-word, Parts of window of word (Title bar, menu bar, status bar, ruler), Creation of new document, opening document, insert a document into another document. Page setup, margins, gutters, font properties, Alignment, page breaks, header, footer, deleting, moving replace, a filing text in document. Saving a document, spell checker, printing a document, creating a table, entering editing text in tables, changing format of table, height width of row or column Editing, deleting, rows, Columns in table. Borders, shading, Templates, Wizards Drawing objects, mail merge.

SECTION-D
MS-POWER POINT: Introduction, elements of Power Point Package, starting Power Point, Exploring Power Point menus, starting a new slide, Adding Titles, Text and Art, Moving text area and resizing text box starting a slide show, saving a presentation, printing slides, opening an existing presentation, Inserting and deleting slides in a presentation, changing text and correcting error, checking spelling, adding header and footer, closing a presentation, To quit from Power Point views, slide setup, setting up slide show, setting transistors and slide timings, Automatic slide show, Formatting and Enhancing text, Slide with graph.
FST-203 Introduction to Computers
(Practical) 

Marks: 20

Instructions for the Paper Setters:
Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

WINDOW-95:
1. Change the Background of the Desktop and also set the screen saver.
2. Create a Folder RAMAN and also create a Folder MOHAN with in the RAMAN folder.
3. Create a short cut of MS-Word on the desktop.
4. Delete some files from the MOHAN folder and also recall these files from the Recycle Bin. Empty the remaining recycle bin.
5. Copy some files from the C drive to floppy drive A using the Windows Explorer facility.

MS-WORD:
1. Create a document files, save it and print it.
2. Spell check the created document file.
3. Create a Table and sort the data within the table.
4. Mail Merge a invitation to your friends.
5. Apply border to a particular paragraph and shade it 10% with Background yellow colour.

MS-POWER POINT:
1. Create a presentation, save it and print it.
2. Format a presentation with changing the fonts and size and selecting text style and colours.
3. Creat a graph ; add titles, axes and legends to a graph.
4. Add a Clipart picture to a chart.

Book Recommended:
PC Software by Rachhpal Singh & Gurinder Singh.
FST-204 GENERAL MICROBIOLOGY
(Theory)

Time: 3 Hrs.  Max. Marks: 80
Theory: 50  Practical: 30

Instructions for the Paper Setters:-
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A

SECTION-B
General characteristics and Nutritional requirements: General characteristics of bacteria, yeast, mold, viruses, algae. Types of bacteria, nutritional classification of bacteria.
Reproduction of micro-organisms: Brief account of bacteria, yeast and mold reproduction.

SECTION-C
Microbial Growth: Definition of growth, growth cycle, growth rate, generation time, measurement of growth, effect of environmental factors such as temperature, oxygen, moisture, salt, pH, oxidation-reduction potential and radiations on growth.

SECTION-D
Control of Micro organisms: Control of micro organisms by physical, chemical and other chemotherapeutic agents.
Instructions for the Paper Setters:
Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

1. To study different parts of a microscope.
2. Study of instruments (Autoclave, Hot air oven, Incubator, Laminar flow, pH meter, and spectrophotometer) of microbiology laboratory.
3. Preparation of nutrient agar and MacConkey’s Agar plates, slants and broth.
4. To study the serial dilution method.
5. To perform pour plate, spread plate and streak plate methods for isolation and enumeration of micro-organisms.
6. To demonstrate acid fast staining.
7. To stain the given bacteria by Gram’s staining method.
8. To measure the size of given micro-organisms by ocular and stage micrometer.
9. To determine the number of micro-organisms with a Haemocytometer.
10. To determine the motility of bacteria by hanging drop method.

Books Recommended:
FST-205: FOOD CHEMISTRY
(Theory)

Time: 3 Hrs.  
Max. Marks: 80
Theory: 50
Practical: 30

Instructions for the Paper Setters:-
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A

SECTION-B
Carbohydrate: functional properties of sugars and polysaccharides in foods, chemical reactions of carbohydrates-Hydrolysis, Enolization, Mutarotation, Dehydration, Browning reactions, Gelatinization and Retrogradation of starch.

SECTION-C

SECTION-D
Enzymes: Nomenclature, Definition, mechanism of enzyme action, factors affecting enzyme action, Enzyme inhibition, enzymes important in foods.
Colouring and Flavouring agents: brief introduction.
FST-205: FOOD CHEMISTRY
(Practical)

Instructions for the Paper Setters:
Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

1. Determination of reducing sugar in the given food sample.
3. Determination of salt in food products.
4. Qualitative analysis of carbohydrates.
5. Qualitative analysis of proteins in given sample.
6. Qualitative analysis of lipids in the given sample.
7. Determination of food enzymes.
8. Estimation of vitamin C.

Books Recommended:
1. Food Chemistry by L. H. Mayer.
3. Food Chemistry by Fennemma.
FST-206: FOOD ADDITIVES
(Theory)

Time: 3 Hrs. Max. Marks: 80
Theory: 50
Practical: 30

Instructions for the Paper Setters:-
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A
Definitions, nutritional and non-nutritional food additives, uses and functions of Acid, Base, Buffer systems, Salts and chelating / sequestering agents.

SECTION-B
Low calorie and non nutritive sweeteners.
Antioxidants, Emulsifying and stabilizing agents, Anti-caking agents, Humectants, thickeners, Firming agents., Clarifying agents.

SECTION-C
Anti microbial agents/ Class I and Class II preservatives.
Flour bleaching agents and Bread improvers.

SECTION-D
Food colour, pigments, their importance and utilization,
Flavoring agents and related substances
Instructions for the Paper Setters:
Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

1. Description of generally recommended as safe (GRAS) food additives.
2. Spectrophotometric method for total chlorophyll.
3. Clarification of fruit juices,
4. Use of additives in bakery, fruits, vegetables, milk and meat products.
5. Determination of adulteration in milk, cereals, oils & fats, spices.

Books Recommended:
1. Food Chemistry, O.R.Fennema
2. Food Chemistry, Belitz, Grosch
Instructions for the Paper Setters:
Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

1. Description of generally recommended as safe (GRAS) food additives.
2. Spectrophotometric method for total chlorophyll.
3. Clarification of fruit juices,
4. Use of additives in bakery, fruits, vegetables, milk and meat products.
5. Determination of adulteration in milk, cereals, oils & fats, spices.

Books Recommended:
1. Food Chemistry, O.R. Fennema
2. Food Chemistry, Belitz, Grosch
FST–301: FOOD MICROBIOLOGY
(Theory)

Time: 3 Hrs.  Max. Marks: 80
Theory: 50
Practical: 30

Instructions for the Paper Setters:-
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A
Introduction - Origin of food microbiology as science, Food as nutrient for various microorganisms, Factor affecting the growth and survival of microorganisms in foods, General features and importance of different groups of bacteria, yeasts and molds important in foods.

SECTION-B
Methods for microbial examination of foods - Traditional, non-traditional and rapid methods for the microbial examination of food and food products.

SECTION-C
Food Spoilage - Microbial and biochemical aspect of food spoilage, role of bacteria, yeast and molds in food spoilage, Spoilage of cereal and cereal products, fruits and vegetables, meat and meat products, milk and milk products, fish and fish products, spoilage of egg and poultry and heated canned foods.

SECTION-D
Food Borne Illness - Food intoxication and food infection, Bacterial food poisoning by Staphylococcus aureus, Clostridium botulinum, Salmonella, E. coli, Clostridium perfringens, Listeria monocytogenes, and Campylobacter jejuni, Food borne viruses, Aflatoxigenic molds, Investigation of food borne disease outbreak

Books Recommended:
3. Adams MR and Moss MO “Food microbiology” New Age International (P) Ltd. 1996
Instructions for the Paper Setters:
Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

1. Sterilization and disinfection of equipment used in food microbiology laboratory.
2. Preparation of media, slant and broths required in the microbial analysis of foods.
3. To count the number of microorganisms by direct microscopic count method.
4. Study of different types of microorganism colony shapes on agar plates.
5. Study of the capsular and spore staining methods.
6. Isolation of fungi from food materials.
7. Study of incubation test of heated canned foods.
9. Microbiological analysis of egg, cereal product and fruit product.
FST–302: FLUID MILK PROCESSING
(Theory)

Time: 3 Hrs.                      Max. Marks: 80
Theory: 50
Practical: 30

Instructions for the Paper Setters:-
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four
Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are
required to attempt five questions, selecting at least one question from each Section. The fifth
question may be attempted from any Section.

SECTION-A
Milk: Definition, composition of milk, important characteristics of major constituents of milk i.e.
milk fat, milk proteins, lactose and minerals and minor constituents of milk. Factors affecting the
quality and quantity of milk produced by milch animals.

SECTION-B
Physical, chemical and nutritive properties of milk. UNIT-II Market Milk: Brief introduction to
Standard milk, Toned milk, Double toned milk, Flavoured milk, Vitamin enriched milk,
Reconstituted milk and recombined milk. Legal and ISI standards of milk.

SECTION-C
Adulteration of milk and its detection. Common preservative used in milk and their detection.

SECTION-D
Standardization: Definition of standardization, purpose and uses of standardization process.
Use of pearson’s square method to solve the standardization problems in dairy industry.
Homogenization: Definition, Effect of homogenization on milk. Uses of homogenization.
Checking the effectiveness of homogenization.
Pasteurization: Definition, purposes and objects of pasteurization – LT LT and HTST processes
UHT process.

Recommended Books:
Instructions for the Paper Setters:
Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

1. Sampling equipment and sampling of milk.
2. Platform tests (Acidity, COB and Alcohol test).
3. Organoleptic Tests.
4. Determination of milk fat percentage by Gerber’s method.
5. Determination of specific gravity by lactometer.
6. Determination of SNF percentage and TS percentage of milk with lactometer.
7. Detection of common adulterants and preservatives of milk.
8. Reporting on the suitability of milk for heat processing.
10. Visit to milk processing plants/NDRI, Karnal.
FST-303: PROCESSING OF MEAT & MEAT PRODUCTS
(Theory)

Time: 3 Hrs. 
Max. Marks: 80
Theory: 50
Practical: 30

Instructions for the Paper Setters:-
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A
1. Scope of meat processing industry in India.

SECTION-B
5. Ante-mortem examination of meat animal, their slaughtering & dressing.
6. Postmortem changes in meat: Rigor mortis, biochemical changes associated with rigor-mortis, conversion of muscle to meat.

SECTION-C
7. Chilling, freezing, canning, drying, curing & smoking of meat.
8. Beef dressing and Pork dressing

SECTION-D

Books Recommended:
1) The Meat We Eat by Romans. JR and Costllo WJ, Carlson WC, Greaser ML and Jones KW, 2004, Interstate Publishers, USA.

Instructions for the Paper Setters:
Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

1) Pre slaughter operations of meat animals.
2) Slaughtering and dressing of meat animals.
3) Study of post-mortem changes.
4) Evaluation of meat quality.
5) Preservation of meat by different methods
6) Preservation of meat by pickling method.
7) Preparation of different meat products- canned, dehydrated and barbecued.
8) Preparation of sausages, burger, kabab, meat balls, meat patties.
9) Visit to slaughter houses.
BACHELOR OF FOOD SCIENCE & TECHNOLOGY (HONS.) (SEMESTER – III)  
(4 YEARS COURSE)

FST-304: POST HARVEST MANAGEMENT OF FRUITS AND VEGETABLES  
(Theory)

Time: 3 Hrs.  
Max. Marks: 80  
Theory: 50  
Practical: 30

Instructions for the Paper Setters:-
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A
Present status of post harvest technology in India. Importance and role of post harvest technology. Post harvest losses of fruits and vegetables and factors affecting the post harvest losses.

SECTION-B
Post harvest changes in fruits and vegetables Harvesting methods – manual and mechanical. Maturity indices of fruits and vegetables - Importance of maturity indices, determination of harvest maturity Climacteric and Non climacteric fruits,

SECTION-C
Fruit ripening and changes, Ethylene biosynthesis. Cleaning, Sorting & Grading of fruits and vegetables Post harvest physical and chemical treatments to enhance the shelf life of fruit and vegetables.

SECTION-D
Transportation methods of fruits and vegetables Storage of fruits and vegetables Post harvest diseases of fruits and vegetables, Post harvest loss assessment and loss reduction.

Books Recommended:


2. Food facts & principles by Shanuntala Manay N & Shadoksharaswamy N, 1996, New Age World Publisher, CA.

3. Food Science by Potter, N.N., CBS Publisher, New Delhi.
Instructions for the Paper Setters:
Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

1. Analyze the maturity stages of fruits and vegetables.
2. To study the effect of pre-packing of fruits and vegetables.
3. To study the effect of pre-cooling of fruits and vegetables.
4. To study the ripening of fruits and vegetables.
5. To study the shelf life of fruits and vegetables at low-temperature.
6. To study the different types of spoilage in fruits and vegetables.
7. To determine the optimum temperature for storage of different fruits and vegetables.
8. To study the effect of wax coating on shelf life of fruits and vegetables.
9. Visit to a cold store and controlled atmosphere storage.
FST–305: CEREAL MILLING AND LEGUMES
(Theory)

Time: 3 Hrs.               Max. Marks: 80

Theory: 50
Practical: 30

Instructions for the Paper Setters:-
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A
Cereal grain definition and different types of grains. Structure and chemical composition of wheat, rice, maize, barley, oat, sorghum and millets. Introduction and chemical composition of pulses,

SECTION-B
Milling criteria and quality criteria for grains. Traditional and modern milling of wheat, wheat cleaning and conditioning, extraction rate.

SECTION-C

SECTION-D
Status of Pulse milling Traditional Processing steps – Pre-cleaning, Pitting, Oil application, conditioning, Dehusking and splitting Decortication and polishing of pulses.

Recommended Books

5. Technology of cereal, legume and oil seeds by Chakrobrty S. Deor, IBH Publisher.
Instructions for the Paper Setters:
Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

1. Determination of physical characteristics of wheat.
2. Determination of physical characteristics of rice.
3. Determination of moisture, ash and crude fibre in cereal grains.
4. Milling of wheat into flour.
5. Milling of paddy to brown rice and white rice.
7. Visit to flour mill, rice mill and pulse mill.
FST–401: PROCESSING OF MILK PRODUCTS-I
(Theory)

Time: 3 Hrs.                              Max. Marks: 80

Instructions for the Paper Setters:-
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four
Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are
required to attempt five questions, selecting at least one question from each Section. The fifth
question may be attempted from any Section.

SECTION-A
Cream: Different types of cream with their respective fat content, composition of cream,
production methods: gravity methods, mechanical method- by the use of cream separator.
Factors affecting the richness of cream produced by cream separator. Efficiency of cream
separator. Care of cream separator. Selection of site for setting up creamery.

SECTION-B
Neutralization of cream, use of different types of neutralizers, double neutralization of cream.
Ripening of cream for butter making: natural ripening, ripening with the use of starter cultures.
Objects of cream ripening. Various changes during the ripening of cream.

SECTION-C
Butter: Types of butter, composition. Preparation of butter. Factors affecting the churnability of
procedure 3. Score card method. Defects of butter their possible causes and their remedies.
Standards of butter and shelf life.

SECTION-D
method Granularity in ghee, storage of ghee and shelf life.

Recommended Books:


Publishers, USA.

FST–401: PROCESSING OF MILK PRODUCTS-I
(Practical)  Marks: 30

Instructions for the Paper Setters:
Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

1. To study the construction and working of a cream separator.
2. Cream separation.
3. Neutralization of cream.
4. Ripening of cream.
5. Preparation of Butter.
6. Determination of moisture content in butter.
7. Preparation of ghee from cream.
8. Preparation of ghee from butter.
9. Visit to different milk plants to learn about cream, butter and ghee processing operations.
10. Visit to N.D.R.I., Karnal.
FST–402: EGG, POULTRY & FISH TECHNOLOGY
(Theory)

Time: 3 Hrs.                                           Max. Marks: 80
                                             Theory: 50
                                             Practical: 30

Instructions for the Paper Setters:-
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A
Structure and composition of egg. Nutritive value, interior qualities, grading, handling, packaging, storage, transportation, freezing, pasteurization, de-sugarization, dehydration, functional properties of eggs. Factors affecting interior and exterior quality of egg.

SECTION-B

SECTION-C
Types of fish, composition, structure and nutritive value, post – mortem changes in fish, on-board handling, storage and transportation of fish

SECTION-D
curing, smoking, salting, canning, freezing and drying of fish, Comminuted Fish Products, Fish protein concentrate, Packaging of fish, Utilization of fish and marine industry by-products.

Books Recommended:

3. Fish Processing & Preservation by Charles L. Cutting
FST–402: EGG, POULTRY & FISH TECHNOLOGY
(Practical)  
Marks: 30

Instructions for the Paper Setters:
Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

1. Slaughtering of hen.
2. Determination of egg components.
3. Grading and quality evaluation of eggs.
4. Preservation of shell eggs.
5. Preparation of egg products, boiled, fried, poached, scrambled, omelette.
6. Determination of egg density
7. To check freshness of fish.
8. Chilling & freezing of fish.
10. Visit to industry.
Time: 3 Hrs. 

Max. Marks: 80
  Theory: 50
  Practical: 30

Instructions for the Paper Setters: -
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A
Classification, chemical composition and nutritive value of fruits and vegetables. Preparing fruits and vegetables for processing - washing, sorting, grading, peeling, blanching, cutting, destoning and pitting.

SECTION-B
Canning and bottling of fruits and vegetables products. Freezing - General Methods of freezing of fruits and vegetables, their packaging and storage. Drying of fruits and vegetables.

SECTION-C
Definition, formulation, preparation and standards of fruit juices, Squashes and cordials; Fruit syrups, nectar, RTS, pulp. Tomato processing - Tomato juice, puree, paste, chutney, sauce, soup and ketchup.

SECTION-D
Preparation and standards of Jam, Jelly & marmalades, preserve, candied and crystallized fruits. Preparation of Pickles.

Recommended Books:


3. Food Science by Potter, N.N., CBS Publisher, New Delhi.
FST–403: FRUITS AND VEGETABLES PROCESSING
(Practical)  

Instructions for the Paper Setters:
Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

1. Preparation of fruit juice.
2. Preparation of squashes.
3. Preparation of jam, jellies, marmalade.
4. Preparation of potato chips.
5. Preparation of pickles- sweet and sour.
7. Preparation of tomato puree, paste and ketchup.
8. Organoleptic evaluation of fruits and vegetable products.
9. Visit to food industry.
BACHELOR OF FOOD SCIENCE & TECHNOLOGY (HONS.) (SEMESTER – IV)
(4 YEARS COURSE)

FST-404: PROCESSING OF CEREALS AND LEGUMES
(Theory)

Time: 3 Hrs.  Max. Marks: 80

Theory: 50  Practical: 30

Instructions for the Paper Setters:-
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A
Wheat flour- types, storage and use, quality criteria for wheat flour, physical dough testing instruments, Improvers and Bleachers used in flour- their principle and action,

SECTION-B
Major and minor ingredients used for bakery products, leavening agents. Preparation methods of bread, biscuits, cookies and cakes. Breakfast cereals and pasta products-ingredients and method of preparation,

SECTION-C
Parboiling of paddy-methods, advantages and disadvantages, various changes during parboiling Storage and uses of rice bran, extraction of rice bran oil and its use. Corn starch and corn sweeteners.

SECTION-D
Pulse flour products and their applications Pulse protein concentrates, soybean curd, milk and paneer. Protein enriched cereal foods. Toxic constituents of pulses and their elimination.

Recommended Books

Instructions for the Paper Setters:
Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

1. Preparation of bread, biscuits and cakes.
2. Parboiling of paddy.
3. Estimation of free fatty acids in flour and rice bran.
4. Determination of dry and wet gluten in flour.
5. Malting of barley.
6. Extraction of oil from rice bran.
7. Visit to food industry.
FST–405: FOOD PLANT HYGIENE & SANITATION
(Theory)

Time: 3 Hrs.  
Max. Marks: 80
  Theory: 50
  Practical: 30

Instructions for the Paper Setters:-
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A
Importance of personal hygiene of food handler-habits, clothes, illness, education of handler in handling and service. Cleaning agents and disinfectants.

SECTION-B
Cleaning methods – sterilization, disinfection, heat & chemicals, chemical tests for sanitizer strength. Food sanitation-Principles & methods, control, inspection.

SECTION-C
Sanitation in fruits & vegetables industry, cereals industry, dairy industry, meat, egg & poultry units.

SECTION-D
Control of infestation, rodent control, vector control, Use of pesticides. Hygiene of water used for processing. Planning & implementation of training programmes for health personnel.

Recommended books:-
Instructions for the Paper Setters:
Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

1. Sterilization of equipments used in the laboratory by using heat and chemicals.
2. Determination of B.O.D
3. Determination of C.O.D
4. Determination of sanitary status of plant equipment.
5. Chlorination of water.
6. To study the bacteriology of water.
7. Chemical analysis of water.
ESL-221 : Environmental Studies (Compulsory Paper)
(Student can opt this Paper whether in 3rd or 4th Semester)

Time: 3 Hrs. Max. Marks: 100

Teaching Methodologies
The Core Module Syllabus for Environmental Studies includes class room teaching and field work. The syllabus is divided into 8 Units [Unit-I to Unit-VII] covering 45 lectures + 5 hours for field work [Unit-VIII]. The first 7 Units will cover 45 lectures which are class room based to enhance knowledge skills and attitude to environment. Unit-VIII comprises of 5 hours field work to be submitted by each candidate to the Teacher in-charge for evaluation latest by 15 December, 2018.

Exam Pattern:
End Semester Examination- 75 marks
Project Report/Field Study- 25 marks [based on submitted report]
Total Marks- 100

The structure of the question paper being:

Part-A, Short answer pattern with inbuilt choice – 25 marks
Attempt any five questions out of seven distributed equally from Unit-I to Unit-VII. Each question carries 5 marks. Answer to each question should not exceed 2 pages.

Part-B, Essay type with inbuilt choice – 50 marks
Attempt any five questions out of eight distributed equally from Unit-I to Unit-VII. Each question carries 10 marks. Answer to each question should not exceed 5 pages.

Project Report / Internal Assessment:

Part-C, Field work – 25 marks [Field work equal to 5 lecture hours]
The candidate will submit a hand written field work report showing photographs, sketches, observations, perspective of any topic related to Environment or Ecosystem. The exhaustive list for project report/area of study are given just for reference:

1. Visit to a local area to document environmental assets: River / Forest/ Grassland / Hill / Mountain / Water body / Pond / Lake / Solid Waste Disposal / Water Treatment Plant / Wastewater Treatment Facility etc.
2. Visit to a local polluted site – Urban / Rural / Industrial / Agricultural
3. Study of common plants, insects, birds
4. Study of tree in your areas with their botanical names and soil types
5. Study of birds and their nesting habits
6. Study of local pond in terms of wastewater inflow and water quality
7. Study of industrial units in your area. Name of industry, type of industry, Size (Large, Medium or small scale)
8. Study of common disease in the village and basic data from community health centre
9. Adopt any five young plants and photograph its growth
10. Analyze the Total dissolved solids of ground water samples in your area.
11. Study of Particulate Matter (PM$_{2.5}$ or PM$_{10}$) data from Sameer website. Download from Play store.
12. Perspective on any field on Environmental Studies with secondary data taken from Central Pollution Control Board, State Pollution Control Board, State Science & Technology Council etc.
Unit-I
The multidisciplinary nature of environmental studies
Definition, scope and importance, Need for public awareness

(2 lectures)

Unit-II
Natural Resources: Renewable and non-renewable resources:
Natural resources and associated problems.
(a) Forest resources: Use and 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, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
(e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies.
(f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.
• Role of an individual in conservation of natural resources.
• Equitable use of resources for sustainable lifestyles.

(8 Lectures)

Unit-III
Ecosystems
• 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 ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, ocean estuaries)

(6 Lectures)

Unit-IV
Biodiversity and its conservation
• Introduction – Definition: genetic, species and ecosystem diversity
• Biogeographical classification of India
• Value of biodiversity: consumptive use, productive use, social, ethical aesthetic and option values
• Biodiversity at global, national and local levels
• India as a mega-diversity nation
• Hot-spots of biodiversity
• Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts
• Endangered and endemic species of India
• Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity
Unit-V

**Environmental Pollution**

**Definition**

- Causes, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear pollution
- 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

(8 Lectures)

Unit-VI

**Social Issues and the Environment**

- From unsustainable to sustainable development
- Urban problems and 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 warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
- Wasteland reclamation
- Consumerism and waste products
- Environmental Protection Act, 1986
- Air (Prevention and Control of Pollution) Act, 1981
- Water (Prevention and control of Pollution) Act, 1974
- Wildlife Protection Act
- Forest Conservation Act
- Issues involved in enforcement of environmental legislation
- Public awareness

(7 Lectures)

Unit-VII

**Human Population and the Environment**

- Population growth, variation among nations
- Population explosion – Family Welfare Programmes
- 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

(6 Lectures)
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:
2. Down to Earth, Centre for Science and Environment, New Delhi.
9. State of India’s Environment 2018 by Centre for Sciences and Environment, New Delhi
FST – 501: PRINCIPLES OF FERMENTATION TECHNOLOGY
(Theory)

Time: 3 Hrs. Max. Marks: 80

Instructions for the Paper Setters:
Theory: Question paper will contain eight questions in all and students will be asked to attempt any five questions. Each question will carry equal marks.

UNIT-I
Introduction to fermentation, Fermentation an ancient tradition, Developments in fermentation technology, Scope and future prospects of fermentation microbiology, Gaden’s fermentation classification, Rate of microbial growth and death, Rate of Product formation, Classification of food fermentations - Alcoholic, lactic and acetic acid fermentations.

UNIT-II
General methods of fermentation – Aerobic fermentation, Anaerobic fermentation, Solid state fermentation, and submerged fermentation, Batch and continuous fermentation. Pre-requisite for Industrial fermentation process.

UNIT -III
Component parts of a fermentor and their functions, Peripheral parts and accessories of a fermentor, Online and off-line devices of fermentor, Biosensors in fermentation monitoring, Common measurement and control systems in fermentor, Contamination problems in fermentation process, Computer applications in fermentation process.
FST – 501: PRINCIPLES OF FERMENTATION TECHNOLOGY
(Practical)  

Instructions for the Paper Setters:
Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

1. To study different parts of a fermentor
2. To study the operation /working of a fermentor
3. To study media formulation and sterilization of a fermentation process
4. To study the growth of given microorganism in a batch culture
5. To perform fermentation test for a given microorganism
6. To study the effect of different temperatures on growth of a given Microorganism
7. To study the effect of aeration on growth kinetics of a given Microorganism
8. To study the product synthesis kinetics of any microorganism

Recommended Books:
1. Principles of Fermentation Technology by Stanbury and Whittaker.
3. Comprehensive Biotechnology by Moo and young (4 volumes)
FST–502: FOOD PACKAGING–I
(Theory)

Time: 3 Hrs. \hspace{1cm} \text{Max. Marks: 80}
Theory: 50 \hspace{1cm} \text{Practical: 30}

Instructions for the Paper Setters:
Theory:– Question paper will contain eight questions in all and students will be asked to attempt any five questions. Each question will carry equal marks.

UNIT-I
Packaging Technology: Definitions, functions of packaging. Properties of packaging material in relation to these functions, package design, Tests for flexible packaging materials, different levels of packaging, materials used in packaging, types of containers-primary & secondary, flexible & rigid, hermatic & non hermatic.

UNIT II
Packaging materials: Wood- structure, types, properties and wooden containers used in packaging, types of wooden boxes.
Paper and paper board- structure, making, properties, types and uses of paper and paper board, CFB boxes and their comparison with wooden containers.
Glass – composition, properties, structure, types & manufacture of glass containers, their uses, breakage in glass, closure for glass containers.

UNIT III
Metals- properties of metals, different metals used in food packaging, steel plate and functions of various constituents of steel, formation of two piece and three piece cans, tinning process, tin free steel, aluminium containers, lacquering –type and applications, aluminium foil, corrosion of metal cans
Instructions for the Paper Setters:
Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

1. To determine basis weight of paper and paper board
2. To determine thickness of paper and paper board
3. To determine Cobb’s value of a paper board
4. To find out the uniformity and amount of wax on wax paper
5. To determine the thermal shock resistance of a glass container
6. To find out the porosity of tin plate.
7. To find out the tin coating weight.
8. To identify the different types of packaging materials

Recommended Books
3. Food Packaging – Stanley Sacharow
5. A Handbook of Food Packaging, Frank – A – Paine, Heather Y. Paine
Instructions for the Paper Setters:
Theory: Question paper will contain eight questions in all and students will be asked to attempt any five questions. Each question will carry equal marks.

UNIT-I
Composition and characteristics of cane Juice, Cane Juice extraction. Manufacturing of sugar.

UNIT-II
Deterioration of sugars during storage & transportation and its prevention, By-products of sugar industry and their utilization.

UNIT-III
1. Classification of confectionary
FST–503: CONFECTIONERY & SUGAR TECHNOLOGY  
(Practical)  

Instructions for the Paper Setters:  
Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

1. Quality testing of raw as well as finished products of confectionary.  
3. Collection of various types of confectionary packages.  
4. Determination of sugar in confectionary product by saccharometer.  
5. Determination of refractive index of sugar – solutions of different consistencies.  
6. Organoleptic testing of different confectionary products.  
7. Visit to sugar and confectionary industry

Recommended Books:  

FST-504: OIL & FAT TECHNOLOGY-I
(Theory)

Time: 3Hrs.  
Max. Marks: 80
Theory: 50
Practical: 30

Instructions for the Paper Setters:
Theory: – Question paper will contain eight questions in all and students will be asked to attempt any five questions. All questions will carry equal marks.

UNIT-I
1. Introduction to oils and fats and their nomenclature.
2. Physical and chemical Properties of fats and oils.
3. Nutritional importance of oils and fats.

UNIT-II
4. Source and physico-chemical properties of following oils:-
   a) Animal – Butter oil, lard and tallow.
   b) Plant – Mustard, groundnut, sunflower, soybean, coconut, rice bran, cottonseed, linseed, etc.

UNIT-III
5. Extraction of oils/fats.
Instructions for the Paper Setters:
Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

1. To determine moisture content of oilseed
2. To determine FFA of oil
4. To determine Iodine value, Saponification value, anisidine value, peroxide value and melting point of fats
6. Detection of sesame oil in vanaspati by furfural test.
7. Detection of adulteration with mineral oil, Cotton seed oil, Ground nut oil.
8. Organoleptic evaluation of fats and oils
9. Visit to vegetable oils industry.

Recommended Books:
1. Food Chemistry by Meyer LH, 2006, CBS Publisher, New Delhi
2. Food Science by Potter NN, 5th Ed, 2006, CBS Publisher, New Delhi
FST–505: PROCESSING OF MILK PRODUCTS-II
(Theory)

Instructions for the Paper Setters:
Theory:— Question paper will contain eight questions in all and students will be asked to attempt any five questions. Each question will carry equal marks.

UNIT-I
Cheese: Classification of cheese. Quality of milk for cheese. Preparation methods of cheddar cheese.
Paneer and Channa: Manufacturing processes.

UNIT-II
Condensed and evaporated milk: Definition, composition & standards. Condensing operations.
Dried milk products: Introduction, objects of production, standards and composition.
Preparation of dried milk and milk powder by roller and spray drying methods. Packaging and storage. Malted milk powders and infant milk food.

UNIT-III
Ice Cream: Different types of ice creams and their composition. Ingredients used and their role in processing. Manufacturing process. Defects of ice cream, their causes and remedies.
Indigenous milk products: Kulfi, Srikhand, Lassi and Rabri, Preparation of Khoa.
BIS and legal standards of different milk products.
Instructions for the Paper Setters:
Practical:— Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

1. Preparation of flavoured milk.
2. Preparation of Khoa.
3. Preparation of Paneer and Channa.
4. Preparation of common varieties of ice-cream.
5. Visit to different milk plants to learn about milk condensing and drying operations.

Recommended Books:
1. Outlines of Dairy Technology by Sukumar De, 1980, Oxford University Press, UK
FST – 601: QUALITY ASSURANCE
(Theory)

Time: 3 Hrs.  Max. Marks: 80
Theory: 50  Practical: 30

Instructions for the Paper Setters:
Theory:– Question paper will contain eight questions in all and students will be asked to attempt any five questions. Each question will carry equal marks.

UNIT-I
Objectives, importance and functions of quality control. Methods of quality assessment of food materials– fruits, vegetables, cereals, dairy products, meat, egg and processed products.

UNIT-II
Sampling, specifications of raw materials and finished products. Sensory evaluation.

SQC and control chart technique: concept of ISO 9000.

UNIT-III
Quality Attributes: Size, Shape, Colour, Aroma, Texture.
Instructions for the Paper Setters:
Practical:– Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

2. Quality evaluation of cereals.
3. Quality evaluation of fruits and vegetables.
6. Adulterants in milk, cereals, oils & fats and their detection.

Recommended Books:

FST–602: GRAIN STORAGE
(Theory)

Time: 3 Hrs.  Max. Marks: 80
Theory: 50
Practical: 30

Instructions for the Paper Setters:
Theory:– Question paper will contain eight questions in all and students will be asked to attempt any five questions. Each question will carry equal marks.

UNIT-I
General problems of storage. Sources and detection of infestation in stored food grains. Causes, types and content deterioration in stored food grains and methods to check them. Traditional and modern methods of bag and bulk storage.

UNIT-II
Insect pest of stored grain. Chemical, non–chemical and integrated methods of controlling stored grain insect pest.
Toxic contamination in good grains, their ill effects.
Pesticidal contamination tolerance limits, residue and precautions of safe handling of pesticides.

UNIT-III
Cleaning aeration and drying of stored products at farmers, commercial and Govt. levels.
Role of moisture in spoilage of stored grains. Categorisation of food grains for storage, Principle of godown sanitation and hygiene.
FST–602: GRAIN STORAGE
(Practical)  

Marks: 30

Instructions for the Paper Setters:
Practical:– Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

1. To study various insect pests of grains.
2. To study the quality tests for grains.
3. To store the grains and check its shelf life.
4. To study the various pesticides used for grain storage.
5. To study the effect of moisture on spoilage of grains.
6. Visit to grain storage godowns.

Recommended Books:

1. Introduction of Insect – By Metalf & Lukemann.
2. Pesticides and Pollution – By Mollan.
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BACHELOR OF FOOD SCIENCE & TECHNOLOGY (HONS.) (SEMESTER – VI)
(4 YEARS COURSE)

FST–603: FOOD PACKAGING–II
(Theory)

Time: 3 Hrs. Max. Marks: 80
Theory: 50
Practical: 30

UNIT-I
Cellophane - preparation, properties and uses. Plastics - thermoplastics & thermosets. polyethylene, polypropylene, polyvinylchloride, polyvinylidenechloride, polyester, polystyrene & polyamide, rubber hydrochloride (properties and uses).

UNIT-II
Polymerization and processing of plastics - compression moulding, injection moulding, blow moulding, thermoforming and extrusion, coextrusion, calendaring, orientation. Plastic containers-bottles, cans, jars, cups, tubes, cartons, retort pouch, laminates. biodegradable plastics Aseptic packaging, shrink packaging, gas packaging, vacuum and modified atmosphere packaging, edible packaging.

UNIT-III
Techniques & methods used for Packaging of cereals and cereal product, fruits and vegetables & their products, milk and milk products and meat and meat products, beverages. Shelf life evaluation of packed products. Food packaging & environment-recycling, composting, thermal treatment & land fill.

Recommended Books:

1. Fundamentals of Food Packaging by F.A. Paine.
2. Packaging of Food Beverages by F.T. Day.
3. Food Packaging by Saccharow and Grifith.
5. Principles of Food Packaging by R. Heiss.
Instructions for the Paper Setters:
Practical:– Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

1. To determine the sorption isotherm of a given sample of food.
2. Shelf life studies of packaging foods.
3. To determine grease resistance of packaging materials.
4. To see the chemical resistance of packaging material.
5. Determination of water vapour transmission rate of various packaging materials
6. Identification of packaging materials
7. To study the different layers of a laminate
8. Visit to various industries, dealing with food packaging materials like / paper, board and metal cans.

Recommended Books
3. Food Packaging – Stanley Sacharow
5. A Handbook of Food Packaging, Frank – A – Paine, Heather Y. Paine
FST-604: SPICES & FLAVOUR TECHNOLOGY  
(Theory)

Time: 3 Hrs.  Max. Marks: 80 
Theory: 50  
Practical: 30

Instructions for the Paper Setters:
Theory:– Question paper will contain eight questions in all and students will be asked to attempt any five questions. Each question will carry equal marks.

UNIT-I
Classification & use of spices  
Chemical constituents of spices.  
Processing of white pepper.  
Dehydration products of onion, garlic.

UNIT-II
Cryomilling of spices.  
Spice oleoresins and spice emulsion.  
Packaging of spices and spice products.  
Microbial contamination and insect infestation in spices and its control.

UNIT-III
Classification of flavouring compounds.  
Processing of Cocoa and Coffee.  
Stability of flavourings.
Instructions for the Paper Setters:
Practical:– Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

1. Determination of moisture in ground spices.
2. Determination of total ash in spices.
3. Determination of extraneous matter in spices.
4. Determination of pungency rating (Scoville method) in Red Pepper.
5. Adulteration tests for different spices.
6. Organoleptic evaluation of flavours.

Recommended Books:
2. Spices and Condiments by Pruthi, J.S., 1976, NBT India.
FST–605: TECHNOLOGY OF FERMENTED FOODS
(Theory)

Time: 3 Hrs.  Max. Marks: 80
Theory: 50
Practical: 30

Instructions for the Paper Setters:
Theory:– Question paper will contain eight questions in all and students will be asked to attempt any five questions. Each question will carry equal marks.

UNIT-I


Fermented milk products:
Curd, Yoghurt, Acidophilic milk, Bulgarian milk, Koumiss and Kefir.

UNIT-II

Legume products:
soy sauce, miso, tempeh, idli.

Fruit and Vegetable products:
Sauerkraut, Kimchi, Cucumber pickles.

UNIT-III

Meat products:
Fermented meat sausages.

Alcoholic beverages:
Beer, wine, vinegar.
FST–605: TECHNOLOGY OF FERMENTED FOODS
(Practical)  
Marks: 30

Instructions for the Paper Setters:
Practical:– Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

Preparation of following fermented foods in the laboratory and study their spoilage:

- Sauerkraut
- Pickles
- Cheese
- Yoghurt
- Idli
- Fruit Wine
- Dosa

Books:
1. Industrial-Microbiology by Prescott & Dunn
2. Indigenous fermented foods by Steinkraus
3. Comprehensive Biotechnology by Moo and young (4 volumes)
FST-701 FOOD SAFETY AND LAWS
(Theory)

Time: 3 Hrs.  
Max. Marks: 80  
Theory: 50  
Practical: 30

Instructions for the Paper Setters:  
Theory: – Question paper will contain eight questions in all and students will be asked to attempt any five questions. All questions will carry equal marks.

UNIT – I

INTRODUCTION TO FOOD SAFETY

Definition, Historical background of food safety, Factors affecting Food Safety, Importance of Safe Foods.

UNIT – II

FOOD HAZARDS OF PHYSICAL, CHEMICAL AND BIOLOGICAL ORIGIN

Introduction, Physical Hazards with common examples, Chemical Hazards (naturally occurring environmental and intentionally added and contaminants due to processing), Seafood and Shell fish poisoning, Microbiological hazards (Bacterial, Fungal, Non-aflatoxigenic, Protozoal helminths and prions), Basic pathogenesis of Food borne infections.

UNIT – III

FOOD SAFETY MANAGEMENT TOOLS

Basic concept, HACCP, TACCP, ISO series, TQM - concept and need for quality, structure of risk Analysis. Implementation of food safety programme, testing for food safety and performance standards. Food safety laws and regulations (FSSAI). New approaches to food safety, food labelling and nutrition labelling. Food traceability.
FST-701 FOOD SAFETY AND LAWS
(Practical)  

Instructions for the Paper Setters:
Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

1. Detection and estimation of food additives and adulterants.
2. Preparation of HACCP charts for meat industry.
3. Preparation of HACCP charts for dairy industry.
4. Preparation of HACCP charts for fruits and vegetable industry.
5. Preparation of HACCP charts for cereal industry.
6. Analysis of aflatoxins in fungal contaminated food product.
7. Detection of Food borne microorganisms by ELISA.

RECOMMENDED BOOKS:

1. Adam MR and Moss MO  Food microbiology New Age International (P) Ltd. ND
2. Jay JM Modern Food Microbiology CBS publishers ND
3. Potter NN Food Science CBS Publishers ND
4. Bhunia AK Food borne Microbial Pathogens (Mechanism and Pathogenesis) Food Science text series Springer
5. Food Safety by Ian C Shaw: Publisher Wiley Blackwell
FST-702 INDUSTRIAL MICROBIOLOGY
(Theory)

Time: 3 Hrs.  Max. Marks: 80

Instructions for the Paper Setters:
Theory: – Question paper will contain eight questions in all and students will be asked to attempt any five questions. All questions will carry equal marks.

UNIT - I
Introduction, Scope and Historical development of industrial microbiology, Methods of Isolation, Screening, improvement & maintenance of industrially important microorganisms.

UNIT - II
Scale up of fermentations, Different types of industrial fermentors, Substrates for industrial fermentation, Principles and Production of citric acid, lactic acid, amino acids, alcohol for fuel, Single cell protein, enzymes (general) and vitamins (Riboflavin, carotenes and B12),

UNIT - III
Utilization of cheap agricultural by-products/wastes for industrial fermentation, Downstream processing: Centrifugation, filtration, precipitation, extraction, drying, cell disruption
FST-702 INDUSTRIAL MICROBIOLOGY (Practical)  

Marks: 30

Instructions for the Paper Setters:
Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

Isolation of amylolytic microorganisms from a source  
Isolation of cellulytic microorganism from soil  
Maintenance of industrial microorganisms by various methods  
Production of lactic acid in the laboratory  
Production of ethanol in the laboratory  
Determination of alcohol strength by potassium dichromate method  
Alcohol determination by specific gravity method

BOOKS:

1. Industrial-Microbiology by Prescott & Dunn  
2. Industrial Microbiology by Casida  
3. Principles of Fermentation technology by Stanbury and Whittaker  
4. Biotechnology: Food Fermentation by VK Joshi & Ashok Pandey  
5. Biotechnology: Food Fermentation by VK Joshi & Ashok Pandey
FST – 703: OIL & FAT TECHNOLOGY-II
(Theory)

Time: 3 Hrs. \hspace{1cm} \text{Max. Marks: 80}
\hspace{1cm} \text{Theory: 50}
\hspace{1cm} \text{Practical: 30}

Instructions for the Paper Setters:
Theory: – Question paper will contain eight questions in all and students will be asked to attempt any five questions. All questions will carry equal marks.

UNIT-I

1. Refining: degumming, choice of alkali, batch and continuous refining,
2. Bleaching: choice of adsorbent, batch and continuous bleaching.
3. Deodorization: process parameters : batch and continuous processing

UNIT-II

4. Hydrogenation of oils: mechanism, process parameters and batch processing.
5. Fractionation and winterization of oils.
6. Alternative processing methods: PCT (physical cleaning techniques)

UNIT-III

7. Manufacture of margarine, shortenings, salad dressings & mayonnaise.
8. Quality assessment tests for fats and oils.
10. Functions of oils and fats in foods processing: Frying, Cooking, Baking.
11. By products of oil processing: soap and lecithin
Instructions for the Paper Setters:
Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

1. Detection of sesame oil in vanaspati by furfural test.
2. To determine fat, moisture and salt content of margarine and butter.
3. To carry out refining and bleaching of oil in lab
4. To estimate colour of oil.
5. To determine phospholipid content of oils.
6. To perform melting point, SFI on shortenings

Recommended Books:
1. Food Chemistry by Meyer LH, 2006, CBS Publisher, New Delhi
2. Food Science by Potter NN, 5th Ed, 2006, CBS Publisher, New Delhi
UNIT-I

UNITS AND MEASUREMENTS: Brief introduction to dimensions, fundamental units and derived units. Systems of measurement-fps, cgs, mks, SI units.

DEHYDRATION: Moisture-dry and wet basis, free and bound, critical moisture content and equilibrium moisture content, drying theory and drying rate curves, drying time, mechanical drying by using tray dryer, conveyer dryer, rotary dryer, drum dryer, fluidized bed dryer, spray dryer, vacuum dryer, and freeze dryer.

PSYCHROMETRY: Psychrometric properties and psychrometric chart Determination of humidity, relative humidity, dry bulb temperature, wet bulb temperature and dew point.

UNIT-II

PRINCIPLES OF HEAT TRANSFER: Conductive heat transfer-Fourier’s law, thermal conductivity, conduction through rectangular slab, hollow cylinder, spherical shell, composite rectangular wall (series), and composite cylinder. Convective heat transfer-convective heat transfer coefficient, free and forced convection, overall heat transfer coefficient. Radiative heat transfer-StefenBoltzman law, Radiative heat transfer in two objects.

HEAT EXCHANGERS: Steam injection and steam infusion. Tubular, scrapped surface, plate heat, shell and tube heat exchangers.

UNIT-III

EVAPORATION: Parts of evaporator, single effect and multiple effect evaporator, different types of evaporators, steam economy, design of evaporator, thermal and mechanical vapour recompression system. Use of steam table.

FILTRATION: Introduction, filtration theory, types of filtration, filtration equipments-pressure filters and vacuum filters.
Instructions for the Paper Setters:
Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

Study of psychrometric chart-use and applications.
Determination of moisture content on wet and dry basis
Study of dehydration characteristics of different food materials.
To determine the EMC of a food product.
To study the working principle of an evaporator.
Determination of thermal conductivity of a food.
To study the different modes of heat transfer in foods.
Shelf life evaluation of a food product.

RECOMMENDED BOOKS:
2. Fundamentals of Food Processing Engineering by Romeo T Taledo, CBS Publications.
4. Unit Operations of Chemical Engineering by Mccab and Smith, Mcgraw Hill, New Delhi.
FST – 705 MALTING AND BREWING TECHNOLOGY
(Theory)

Time: 3 Hrs. Max. Marks: 80
Theory: 50
Practical: 30

Instructions for the Paper Setters:
Theory: – Question paper will contain eight questions in all and students will be asked to attempt any five questions. All questions will carry equal marks.

UNIT – I
Composition and structure of barley, Preparation and storage of barley for malting Characteristics of barley for malting, Malting operations: Steeping, germination, kilning and modification, Composition of malt.

UNIT – II
Brewing operations, Grinding, Mashing: changes during mashing, Filtration of wort Sparging and boiling, changes during boiling, Hops, selection of hops, Acidification of mash, Wort cooling.

UNIT – III
Beer manufacturing, Wort production, Fermentation, Pasteurization, Types and characteristics of beer.
Instructions for the Paper Setters:
Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

- Determination of moisture content of barley.
- To determine the seed germination capacity of barley.
- Determination of % protein content of barley.
- Determination of amount of husk in barley.
- Preparation of malt.
- To determine the length of acrospires.
- Determination of Total Soluble Solids and Total Solids of malt.
- Determination of % reducing sugars in malt.

Recommended Books:
FST-801 FOOD BIOTECHNOLOGY  
(Theory)

Time: 3 Hrs.  
Max. Marks: 80  
Theory: 50  
Practical: 30

Instructions for the Paper Setters:  
Theory: – Question paper will contain eight questions in all and students will be asked to attempt any five questions. All questions will carry equal marks.

UNIT – I

Introduction:
Components of Molecular Biotechnology, Recombinant DNA Technology, Restriction Endonucleases, Cloning Vectors, Polymerase Chain Reaction

UNIT – II

Applications of Food Biotechnology:
Plant Biotechnology for Food Production, Improvement of Plant Nutritional and Functional Quality, Plant Proteins, Lipids, Saturated Fatty Acids, Unsaturated Fatty Acids, Carbohydrates, Plant Vaccines, Milk Proteins, Reconstitution of Human Milk Proteins in Food Plants, Carotenoids, Vitamins, Minerals, Manipulation of Fruit Ripening,

UNIT – III

Genetic Modification of microorganisms and crops:
Genetically modified crops for food production, Future trend of GM crops, Food ingredients, processing aids, dietary supplements derived from GM microorganisms, Risk of GMOs and GM Foods to Human Health and Environment
FST-801 FOOD BIOTECHNOLOGY
(Practical)

Instructions for the Paper Setters:
Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

Isolation of DNA from micro-organisms.
Isolation of RNA from yeast cells.
Colorimetric estimation of DNA.
Colorimetric estimation of RNA.
Demonstration of PCR.
Demonstration of tissue culturing in Lab.
Digestion of DNA by Restriction Endonucleases.
Making & Selection of competent E. coli.

RECOMMENDED BOOKS:

1. Lopez G.F.G and Canovas G.V.B. Food Science and Food biotechnology CRC press
2. Fundamentals of Food Biotechnology by Byong H. Lee: Wiley VCH
3. Tripathy S. N. Food Biotechnology Dominanat Publishers and distributors ND
4. Singh R.P. Biotechnology Central Book depot Allahabad
FST-802 ENZYMES IN FOOD PROCESSING
(Theory)

Time: 3 Hrs.                         Max. Marks: 80
                                        Theory: 50
                                        Practical: 30

Instructions for the Paper Setters:
Theory: – Question paper will contain eight questions in all and students will be asked to attempt any five questions. All questions will carry equal marks.

UNIT I

Enzymes– classification, properties and mechanism of enzyme action, co-enzymes & activators, co-factors.

Enzymes for production of maltodextrins and corn syrup solids (liquefaction, saccharification, dextrinization, isomerization for production of high-fructose-corn-syrup), fructose and fructo-oligosaccharides.

UNIT II

Enzymes in dairy industry: natural enzymes in milk, hydrogen peroxide-catalase treatment, rennin and its formation, lactose intolerance, Role of enzymes in cheese making and whey processing.

Fruit juices: Cell wall degrading enzymes for liquefaction, clarification, peeling, debittering, decolourization of very dark coloured juices such as anthocyanases.

Immobilized enzyme technology.

UNIT III

Baking: fungal α-amylase for bread making; maltogenic α-amylases for anti-staling; xylanses and pentosanases as dough conditioners; lipases or dough conditioning; synergistic effect of enzymes.

Meat and meat processing: meat tenderization; egg processing.

Enzymes in brewing, mashing and beer finishing operations.
Instructions for the Paper Setters:
Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

1. To study the effect of temperature on enzyme activity.
2. To study the effect of substrate concentration on enzyme activity.
3. Determination of enzyme activity of α-amylase in starch hydrolysis.
5. To demonstrate the effects of papain enzymes in meat tenderization.
7. Determination of oxidase activity of given sample.
9. To determine the adequacy of pasteurization in milk.

Books Recommended:

BACHELOR OF FOOD SCIENCE & TECHNOLOGY (HONS.) (SEMESTER –VIII)
(4 YEARS COURSE)

FST-803 FOOD ENGINEERING -II
(Theory)

Time: 3 Hrs.  Max. Marks: 80
Theory: 50  Practical: 30

Students are allowed to use scientific calculators.

UNIT-I

REFRIGERATION: Components of Refrigeration system, refrigeration cycle and refrigeration load, primary and secondary refrigerants.

FREEZING: Direct and indirect contact freezing, freezing time calculation.

UNIT-II

FLUID FLOW: Properties of fluid- density, pressure, surface tension and viscosity. Newtonian and non Newtonian fluids, laminar and turbulent fluid, Reynold’s number, Equation of continuity, Bernoulli’s theorem, Poiseuille’s equation-viscosity measurement in tube, manometer, flow measuring devices-Pitot tube, Venturimeter, orifice meter.

PUMPS: Definition, classification, positive displacement and centrifugal pumps, factors affecting choice of a pump.

UNIT-III

SIZE REDUCTION: Definition and requirements of size reduction, forces used in size reduction, equipments for size reduction-crushing rolls, hammer mill, disc attrition mill, buhr mill, tumbling mill- ball and rod mill. Critical speed in a tumbling mill. Modes of operation, energy requirements for comminution of solids- Rittenger’s law, Kick’s law and Bond’s law.

SCREENING: Types of screens-grizzly, trammels, vibrating screens, screen openings, and aperture, perforated metal screens and wire mesh.
Instructions for the Paper Setters:
Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

To calculate the refrigeration load in cold storage plant.
To determine the freezing time of a food.
Determination of relative viscosity of a liquid food.
Determination of coefficient of viscosity.
Determination of pressure drop by using manometer.
Determination of flow rate of a liquid.
To study the working principle and operation of a hammer mill.
To study the working principle and operation of a ball mill.
Determination of particle size of given flour sample using Sieve analysis.

RECOMMENDED BOOKS:

2. Fundamentals of food processing engineering by Romeo T Taledo, CBS Publications.
4. Unit operations of chemical engineering by Mccab and Smith, Mcgraw Hill, New Delhi.
6. Experimental Methods in food engineering by Rizvi and Mittal, CBS Publishers
UNIT-I

Plant design concepts and general design considerations;
plant location - location factors and their interaction with plant location, location theory models,
plant size-factors affecting plant size and their interactions.

UNIT-II

Process selection; process flow charts, equipment selection including economic analysis of
equipment alternatives; plant layout, layout symbols; planning and design of service facilities,
human resource.

UNIT-III

Importance of a plant layout selection of site and layouts of different food industries, selection of
equipment, machinery and building material, selection and planning of manufacturing process
and service facilities.
FST – 804: FOOD PLANT LAYOUT
(Practical)

Instructions for the Paper Setters:
Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

- Calculation of depreciation of machinery and processing costs.
- Preparation of layout and process diagram of potato crisp manufacturing plant.
- Preparation of layout and process diagram of Jam/Marmalade manufacturing plant.
- Preparation of layout and process diagram of Bread making plant.
- Preparation of layout and process diagram of a dairy industry.
- Preparation of layout and process diagram of wine making unit.
- Preparation of layout and process diagram of a modern slaughter house.
- Preparation of layout and process diagram of a confectionary unit.

Recommended Books:

2. Food Processing Waste Management by Green JH and Kramer A, 1979, AVI Publishers, USA.
4. Plant layout and material handling by Sharma S.C.
5. Plant layout & design by James Moore
BACHELOR OF FOOD SCIENCE & TECHNOLOGY (HONS.) (SEMESTER –VIII)
(4 YEARS COURSE)

FST-805 FOOD ANALYSIS & INSTRUMENTATION
(Theory)

Time: 3 Hrs.  Max. Marks: 80
Theory: 50  Practical: 30

Instructions for the Paper Setters:
Theory: – Question paper will contain eight questions in all and students will be asked to attempt any five questions. All questions will carry equal marks.

UNIT I
Brief introduction and principles: Spectroscopic techniques using UV/Visible, polarimetry, refractometry, microscopic techniques in food analysis (light microscopy).
Electron microscopy: principle and brief introduction to types of electron microscopy (SEM, TEM): application of electron microscopy in food processing

UNIT II
Principle and working of Column chromatography, Gas chromatography and High Pressure Liquid Chromatography.
Brief introduction and principles to Separation techniques: ultrafiltration and supercritical fluid extraction.

UNIT III
Brief introduction and principles to Special techniques: surface tension; thermal methods in food analysis (Differential scanning colorimetry). Texture analyzer, rheometer, hunterlab, amylograph and farinograph, calorimeter.
FST-805 FOOD ANALYSIS & INSTRUMENTATION
(Practical)

Instructions for the Paper Setters:
Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

1. Sorption isotherms by measuring water activity in any hygroscopic food material (for instance - biscuits/potato chips/coffee powder).
2. Estimation of tannin/phytic acid/ pigments by spectrometric method.
3. Estimation of calorific values using calorimeter
4. Separation of amino acids/coal tar dyes by two dimensional paper chromatography.
5. Separation and identification of carotenoids by column chromatography.
6. Analysis of dietary fibre/glucose by enzymatic method.
7. Demonstration of instruments: GLC, HPLC, Atomic absorption, Flame photometer, Farinograph, UV-Vis spectrophotometer and microscopes.

Recommended Books: