PANJAB UNIVERSITY

CHANDIGARH

FACULTY OF SCIENCE

SYLLABI

FOR

FOOD SCIENCE & QUALITY CONTROL

(ELECTIVE)

(B.A./B.SC./B.COM.)

FOR

EXAMINATIONS, 2012
**SCHEME OF STUDIES FOR B.Sc. (FOOD SCIENCE & QUALITY CONTROL)**

**ELECTIVE**

*Note:* A student who has passed the +2 Examination under 10+2+3 system of education of a recognized university/Board/Council or any other examination recognized by the Panjab University as equivalent thereto shall be eligible to offer the subject of Food Science & Quality Control at the B.Sc. level, if the student has passed the +2 examination with Physics, Chemistry, Mathematics/ Biology as their subjects.

<table>
<thead>
<tr>
<th>S.NO.</th>
<th>YEAR</th>
<th>NAME OF PAPER</th>
<th>PAPER</th>
<th>MARKS</th>
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<tbody>
<tr>
<td>1.</td>
<td>1st Year</td>
<td>Basic nutrition And Food Chemistry (Theory)</td>
<td>A</td>
<td>70</td>
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<td>2.</td>
<td></td>
<td>Principles of food preservation and packaging(Theory)</td>
<td>B</td>
<td>70</td>
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<td>3.</td>
<td></td>
<td>Practical(related to Paper A&amp;B)</td>
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<td>On - Job Training in summer vacations for 4 weeks (to be awarded in 2nd yr.)</td>
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<td>5.</td>
<td>2nd Year</td>
<td>Processing of Foods of Plant Origin (Theory)</td>
<td>A</td>
<td>70</td>
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<td>6.</td>
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<td>Processing of Foods of animal Origin (Theory)</td>
<td>B</td>
<td>70</td>
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<td>7.</td>
<td></td>
<td>Practical(related to Paper A&amp;B)</td>
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<td>8.</td>
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<td>On - Job Training in summer vacations for 4 weeks (to be awarded in 3rd yr.)</td>
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<td>9.</td>
<td>3rd Year</td>
<td>Food Analysis &amp; Quality Control (Theory)</td>
<td>A</td>
<td>70</td>
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<td>10.</td>
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<td>General &amp; Food Microbiology (Theory)</td>
<td>B</td>
<td>70</td>
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<td>11.</td>
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<td>Practical (related to Paper A&amp;B)</td>
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<td><strong>Total Marks</strong></td>
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B.Sc (FOOD SCIENCE & QUALITY CONTROL)
FIRST YEAR

PAPER A - BASIC NUTRITION & FOOD CHEMISTRY

Instructions for the examiner: The Question Paper will have four sections. Examiner will set a total of nine questions comprising two questions from each unit, and one compulsory question of short answer type covering the whole syllabus. Students will attempt one question from each unit and the compulsory question. All questions may carry equal marks, unless specified.

Objectives: The paper provides basic information on chemical, physical and functional properties of various biomolecules present in food and how they contribute to the overall quality of foods.

SECTION-A

1. Introduction to nutrition- Definition of adequate, optimum & malnutrition. Functions of foods. Inter relationship between nutrition & health.
2. Food Guide- Food classification based on 5/7 food groups.
3. Use of food in the body- Digestion, absorption, transport, utilization of nutrients in the body (in brief)

SECTION -B

4. Introduction to bio molecules & their nutritive value- Major and minor constituents of food, bio-availability of nutrients, sources, energy and nutritive value
6. Carbohydrates- classification, structure, sources & properties, Maillard reactions, browning reactions, changes in carbohydrate during food processing and artificial sweeteners.

SECTION- C

7. Lipids- Structure & functions, classification, properties of fats & oils, biochemistry of emulsions, changes in lipids during processing.
8. Water- Biological properties of water, pH, ionization, biological buffers, acid-base balance, hydrogen bonding, bound water. Water activity concept and food stability
9. Vitamins and minerals- Classification, sources, functions and deficiency diseases, General loss of vitamins and minerals in foods. Fortification, enrichment & restoration of minerals and vitamins in foods

SECTION- D

12. Flavours- Definition & basic taste factors, chemistry of food flavors from cocoa, coffee, vanilla beans, and spices. Relationship of flavor with taste.
REFERENCES-
Food and Nutrition, Educational Planning Group, Arya Publishing House, New Delhi.
De, Amit Krishna, 2005, Biochemistry, S. Chand & Co. Ltd., New Delhi, India.
Jain, J. L., 2001, Fundamentals of Biochemistry, S. Chand & Co. Ltd., ND
Schaum’s Outline of theory & problems of Biochemistry, 2003, Tata Mcgraw Hill, ed, ND

PAPER B - PRINCIPLES OF FOOD PRESERVATION AND PACKAGING
Max. Marks : 70
Theory : 63
Int. Ass. : 7
Teaching hours : 3 Hrs/wk

Instructions for the examiner: The Question Paper will have four sections. Examiner will set a total of nine questions comprising two questions from each unit, and one compulsory question of short answer type covering the whole syllabus. Students will attempt one question from each unit and the compulsory question. All questions may carry equal marks, unless specified.

Objectives: The paper deals with different methods of food processing and preservation methods, recent advances and food packaging concepts.

SECTION A
1. Introduction – General principles of food preservation, Historical development.
3. Preservation by low temperature- Refrigeration and freezing of foods.

SECTION B
5. Preservation by concentration – Methods of concentration, types of evaporators.
6. Preservation by Radiations – Historical development, types of Radiation, Effects of radiations, Dose – Determining factors, status of irradiated foods in India.
7. Preservation by Chemicals – GRAS, food preservation by preservatives, food additives.
8. Recent Trends in food Preservation – Microwave processing, Extrusion cooking, Ohmic Heating, Reverse Osmosis, Electrolysis, Ultrafiltration, High Pressure processing, Super critical fluid extraction, Fat mimetics.

SECTION C


SECTION – D


13. Packaging Evaluation – Quality control tests on packaging materials, shelf life testing.

14. Packaging of food products – Description of packaging of –
   a. Frozen products
   b. Dried products
   c. Chemically preserved foods
   d. Fats and oils
   e. Confectionery
   f. Fruit juices
   g. Heat processed foods
   h. Fresh produce (Eggs, Fruits and Vegetables)

REFERENCES –
Jood, Sudesh, 2002, Food Preservation, Agrotech Publisher Academy, Udaipur.
Sethi, Mohini, 2001, Food Science, CBS Publishers, ND
Srilakshmi, B., 2001, Food Science, New Age International Pvt. Ltd., ND.
Mahendru, S.N., 2000, Food Additives, Tata McGraw Hills, ND

PAPER C- PRACTICALS

Max. Marks : 60
Int. Ass. : 6
Teaching hours : 3 Hrs/wk

SECTION A (BASIC NUTRITION & FOOD CHEMISTRY)

1. Determination of TSS value of given food product.
2. Determination of acidity of food products.
3. Determination of pH of food product.
4. Determination of moisture content on wet and dry basis by Oven drying and Infra-Red Moisture Analyzer.
5. Determination of acid value in given oil.
6. Estimation of salt content in given food stuff.
7. Determination of vitamin C by titration method.
8. Determination Protein by kjeldhal method.
10. Qualitative estimation of sugars.
11. Determination of ash content and different types of ash.
12. Fat estimation by Majonnier method.
SECTION –B (PRINCIPLES OF FOOD PRESERVATION AND PACKAGING )

1. To blanch a seasonal fruit or vegetable & assess quality of blanching process.
2. To study the effect of browning on raw fruits & vegetables.
3. Preparation of drying curve.
4. To study effect of heat and acidity on milk proteins.
5. To study the effectiveness of pasteurization by phosphatase test.
6. To study Pasteurization of milk using microwave technique.
7. To study the different packaging materials.
8. Determination of water vapour transmission rate for various packaging materials.
9. To determine grease resistance of packaging material.
10. To determine the wax content in given wax paper.
11. To estimate the basis weight of given packaging material.
12. To determine the chemical resistance of given packaging material.
Second Year

PAPER A- PROCESSING OF FOODS OF PLANT ORIGIN

Max. Marks : 70
Theory : 63
Int. Ass. : 7
Teaching hours : 3 Hrs/wk

Instructions for the examiner: The Question Paper will have four sections. Examiner will set a total of nine questions comprising two questions from each unit, and one compulsory question of short answer type covering the whole syllabus. Students will attempt one question from each unit and the compulsory question. All questions may carry equal marks, unless specified.

Objectives: To introduce to students post harvest processing of fruits, vegetables, cereals, pulses and oil seeds, preparation of processed fruit and vegetable products and their utilization.

SECTION A

I. FRUITS AND VEGETABLES TECHNOLOGY – I
1. Post harvest handling and storage of fresh fruits and vegetables, Preparation of fruits and vegetables for processing.
2. Thermal processing – process times evaluation for canned products, process optimization, aseptic canning, methods for canning of different fruits and vegetables.
3. Dehydration and freezing of fruits and vegetables.
4. Preparation and utilization of fruits and vegetables juices in non fermented/ fermented / aerated beverages.

SECTION B

II. FRUITS & VEGETABLE TECHNOLOGY – II
5. Chemistry and manufacture of pectin, role in gel formation and products like jams, jellies and marmalades.
6. Technology of preserves, pickles, chutneys and sauces, Nature and control of spoilage in these products.
7. Tomato products – juice, puree, soup, sauce and ketchup. Other convenience foods from fruits and vegetable . FPO standards of these products.
8. By-product utilization of fruits and vegetable processing industry.

SECTION C

III. CEREALS TECHNOLOGY
9. Structure and composition of different grains like wheat, rice, barley, oats, maize millets etc.
10. Milling of wheat, flour quality and bread technology.
11. Milling and parboiling of rice, Rice bran oil
13. Wet and dry milling of corn; manufacture of corn syrup, corn starch , corn steep liquor and germ oil.

SECTION D

IV. PULSES TECHNOLOGY
15. Nutritional value of pulses.
17. Toxic constituents of pulses,
18. Effect of cooking on pulses,
19. Medicinal value of pulses.
V- OILS AND FAT TECHNOLOGY
21. Sources of vegetable oils- groundnut, cottonseed, mustard, coconut, sunflower, soyabean.
23. Processing of oils and fats.

REFERENCES-
Kent, N.L., 1994, Technology of cereals
Srilakshmi, B., 2001, Food Science, new Age International Pvt. Ltd., N.D.

PAPER B- PROCESSING OF FOODS OF ANIMAL ORIGIN
Max. Marks : 70
Theory : 63
Int. Ass. : 7
Teaching hours : 3 Hrs/wk

Instructions for the examiner: The Question Paper will have four sections. Examiner will set a total of nine questions comprising two questions from each unit, and one compulsory question of short answer type covering the whole syllabus. Students will attempt one question from each unit and the compulsory question. All questions may carry equal marks, unless specified.

Objectives: The paper provides an insight to milk composition, milk processing techniques, milk products, fermented milk products, meat structure and processing as well as egg and fish technology

SECTION A
1. DAIRY TECHNOLOGY – I
PFA Definition of milk; Chemical composition of milk of different species i.e. Buffalo, Cow (foreign), Cow (sindhi), Goat, Murrah, Jersey; Diagrammatic representation of milk constituents; Factors affecting milk composition, Physico – chemical properties of milk; Processing of different types of market milk – Pasteurized, Sterilized, homogenized, flavored, single & double toned milk and humanized milk.

SECTION B
2. DAIRY TECHNOLOGY – II
Definition, composition and technology of milk products- Butter Ghee Buttermilk
Ice cream
Evaporated and condensed milk
Dried milk
Khoa.
Paneer

3. Fermented milk products – Nature and type of starters in fermented milk., Composition and processing milk products – Curd, Acidophilus milk, Bulgarecic milk, Cultured Buttermilk, Kefir, Kumiss, Yoghurt, Srikhand

4. Cheese - Definition, composition and types of cheese; Basic steps in cheese making; cheddar cheese, Blue cheese, Mozzarella cheese and Processed cheese.

SECTION C

5. EGG TECHNOLOGY
Structure and composition of egg.
Measures of egg quality and grading
Technology of egg products – Egg powder, Albumen flakes and Liquid frozen egg.

6. SEAFOOD TECHNOLOGY
Nutritional value of fish; procurement of fish.
Canning of fish and fish products; Spoilage in canned fish.
Fish products – Fish oil, Fish flour, Fish sauce, Dried fish meal and Fish protein concentrates.

SECTION D

7. POULTRY AND MEAT TECHNOLOGY
Glossary of live market terms for animals and birds; Retail and wholesale cuts, Chemistry and microscopic structure of meat tissue; Meat pigments and color changes, Antemortem inspection and Postmortem changes – rigor mortis; Slaughtering and dressing of various animals and poultry birds; Tenderization and ageing of meat; Curing, smoking and sausages of meat.

REFERENCES –
De, Sukumar, 1991, Outlines of Dairy Technology, Oxford Univ. Press, ND
Walstra, P., 2005, Dairy Technology, Oxford Univ. Press, ND.
Borresen, 2008, Improving Seafood Products for the Consumer, Woodhead Publishing Ltd.
Bremner, 2002, Safety & Quality Issues in Fish Processing, Woodhead Publishing Ltd.
SECTION A (PROCESSING OF FOODS OF PLANTS ORIGIN)
1. To determine benzoic acid content in fruits and vegetable products spectrophotometrically.
2. Estimation of Ascorbic Acid content spectrophotometrically.
3. Determine Brix : Acid ratio of fruits and vegetable products.
4. To study the physical characteristics of cereals.
5. Estimation of WAP and Gluten content of wheat flour.
6. To calculate flour acidity.
7. Estimation of particle size different types of flour.
8. Determination of physical characteristics (specific gravity, Refractive index & melting point) of coconut oil.
10. Determine Saponification number of Coconut Oil.
11. Qualitative and Quantitative determination of oil rancidity.
12. Cup test for soluble Coffee powder

SECTION B (PROCESSING OF FOODS OF ANIMAL ORIGIN)
1. To check the heat stability of milk by COB and Alcohol tests.
3. Determination of specific gravity. SNF % and TS% of milk.
4. Estimate the milk fat by Gerber method.
5. To determine the Casein content of the milk.
6. Estimation of lactose content by Lane-Eynon and picric acid method.
7. To check the sterility of milk by turbidity test.
8. Bacteriological estimation of milk MBRT.
9. To estimate the salt content in butter.
10. To estimate the purity of ghee by Baudouin test.
11. To prepare a chart of physico-chemical properties and microbiological standards of milk and milk products.
12. Preparation of ghee by different methods.
13. To determine different components of egg by candling.
Third Year

PAPER A – FOOD ANALYSIS AND QUALITY CONTROL  Max. Marks : 70
Theory : 63
Int. Ass. : 7
Teaching hours : 3 Hrs/wk

Instructions for the examiner: The Question Paper will have four sections. Examiner will set a total of nine questions comprising two questions from each unit, and one compulsory question of short answer type covering the whole syllabus. Students will attempt one question from each unit and the compulsory question. All questions may carry equal marks, unless specified.

Objectives: The paper focuses on techniques used in food analysis, physical, chemical, microbial and sensory analysis of food, concepts of quality control and quality management.

SECTION A

1. Sampling – Sampling techniques and preparation of food samples.
2. Technology used in food analysis –
   a. Chromatography
   b. Electrophoresis
   c. Electrometric determinations
   d. Refractometry & Polarimetry
   e. Spectrophotometry
   f. Fluorimetry
   g. Radio-active tracer techniques
   h. Atomic absorption

SECTION B

3. Physico chemical methods for food analysis
   a. Moisture & total solids
   b. Carbohydrates
   c. Proteins
   d. Fats
   e. Fiber
   f. Ash & its types
   g. Minerals
   h. Vitamins
   i. Enzymatic methods

4. Biological methods of food analysis
   a) Standard Plate Count, Plate loop method; Spiral plate; Droplet technique.
   b) Dye reduction; Catalase test and ELISA
   c) Testing of food for organisms such as E. coli., S.aureus, B.cereus, C.botulinum, L.monocytogenes, Salmonella & shigella.

SECTION C

5. Sensory assessment of food quality -
   a) Appearance of food
   b) Flavor of food
   c) Texture of food

7. **Quality control of following food products** -
   a) Milk & milk products
   b) Oils & Fats
   c) Cereal grains & flours
   d) Fruits & vegetable products
   e) Canned foods
   f) Egg & egg products
   g) Meat & meat products

**SECTION D**


**REFERENCES**

PAPER B – GENERAL AND FOOD MICROBIOLOGY

Max. Marks: 70
Theory: 63
Int. Ass.: 7
Teaching hours: 3 Hrs/wk

Instructions for the examiner: The Question Paper will have four sections. Examiner will set a total of nine questions comprising two questions from each unit, and one compulsory question of short answer type covering the whole syllabus. Students will attempt one question from each unit and the compulsory question. All questions may carry equal marks, unless specified.

Objectives: To introduce to students fundamental concepts of microbiology which includes microbial diversity, their morphological and functional properties, techniques to study microorganisms, growth and control of microorganisms, fermented foods as well as food spoilage and its control.

SECTION A
Historical development, Application of microbiology and its relevance to food technology. Evolution of life forms, species concept and microbial nomenclature. Theories and methods of microbial classification. General information on Sterilization techniques.

Microbial Groups – A general account of characteristics, structure and function of bacteria, fungi, protozoa and viruses (bacterial, plant and animal).

SECTION B

Microbial Growth – Growth Curve, Mathematical expression of growth, Methods of measurement of growth, Factors affecting growth, Growth in continuous and batch culture, synchronous and diauxic growth.

Control of microbes – General information on Sterilization techniques, Control of micro-organisms in foods by physical, chemical methods, Thermal death time-Z, F & D values.

SECTION C
Traditional Fermented Foods – Yogurt, Cottage Cheese, Idli, Dosa, Miso, Tempeh, Jalebi, Sauerkraut, Pickles, Sausages, etc.

Microbiology of different foods – Principles of food spoilage, contamination, sources of contamination, types and effects on the following food products: a) Cereals and cereal products b) Sugar and sugar products c) Vegetables and fruits d) Meat and meat products e) Fish and other sea foods f) Egg and poultry g) Milk and milk products h) Canned foods

SECTION D
Food-borne intoxications: caused by bacteria, viruses, molds, yeast and parasites (symptoms & their method of control), other foods hazards- chemical, antibiotics, hormones, metal contamination.

Environmental Microbiology – Water, air, soil and sewage microbiology (in brief).

Food Sanitation & Hygiene – Importance of hygiene & sanitation in food industry, cleaning agents, disinfectants, chemical test for sanitizer strength, personal
hygiene of food handler, indicator organisms and microbiological standards in foods.

REFERENCES
Nester, E.W, 2009, Microbiology, McGraw-Hill Higher Education
Dubey, R.C., Maheshwari, D.K., 2005, Textbook of Microbiology, S.Chand Publications., ND
Adams, M.R., Moss, M.O., 2000, Food Microbiology, New Age international Pvt. Ltd., ND
Jay, James M., 1996, Modern Food Microbiology, CBS Publishes, ND
Powar, C.B., 2000, General Microbiology, Himalaya Publisher House, ND
Sharma, P.D., 2005, Environmental Microbiology, Narosa Publication House, ND

PAPER C – PRACTICALS

SECTION A (FOOD ANALYSIS AND QUALITY CONTROL)
1. Detection of different type of sugars in fruit juices by TLC
2. Electrophoretic separation of Amino Acids
3. Separation of amino acids by two dimensional paper chromatography
4. Testing of given canned product
5. Shelf life testing of packaged product by HVP method
6. Proximate analysis of Buffer
7. Determination of Consistency of tomato ketchup
8. Determination of adulterants in milk oils & Fats, spices, Tea and Coffee
9. Estimation of Vitamin C spectrophotometrically
10. Estimation of iron content in given food sample spectrophotometrically
11. To prepare a chart of specifications for different food products as specified by BIS
12. Determination the Critical Control Points for production line of milk, Fruits & Vegetables and Meat industry as HACCP system
13. Estimation of total sugars and reducing sugars spectrophotometrically
SECTION B (GENERAL AND FOOD MICROBIOLOGY)
1. Introduction and study of microbiological instruments.
2. Media preparation and dispensing for cultivation of different types of microorganisms.
3. Microscopy: study, use and care of compound microscope.
4. Different staining techniques for identification of microbes: simple staining, negative staining, gram staining, acid fast staining, spore staining, Hanging drop techniques.
5. Determination of viable cell count by haemocytometer.
7. Bacteriological examination of water.
8. Chemical and Biological examination of Sewage (BOD & COD)
10. Isolation of food spoilage organisms.
11. Preparation of fermented food.

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