FOOD CHEMISTRY AND ANALYSIS & FOOD SCIENCE AND EXPERIMENTAL FOODS

M.Sc. FOOD AND NUTRITION SCIENCE

SEMESTER-I, PAPER-VI

LESSON WRITERS

Dr. Ch. Manjula

Faculty
Department of FSND
University College of Sciences
Acharya Nagarjuna University

EDITOR

Dr. B. Babitha

Associate Professor
Department of FSND
University College of Sciences
Acharya Nagarjuna University

DIRECTOR, I/c.

Prof. V. Venkateswarlu

M.A., M.P.S., M.S.W., M.Phil., Ph.D.

Professor
Centre for Distance Education
Acharya Nagarjuna University
Nagarjuna Nagar 522 510

Ph: 0863-2346222, 2346208
0863- 2346259 (Study Material)
Website www.anucde.info
E-mail: anucdedirector@gmail.com

Ravi

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FOREWORD

Since its establishment in 1976, Acharya Nagarjuna University has been forging ahead in the path of progress and dynamism, offering a variety of courses and research contributions. I am extremely happy that by gaining 'A+' grade from the NAAC in the year 2024, Acharya Nagarjuna University is offering educational opportunities at the UG, PG levels apart from research degrees to students from over 221 affiliated colleges spread over the two districts of Guntur and Prakasam.

The University has also started the Centre for Distance Education in 2003-04 with the aim of taking higher education to the door step of all the sectors of the society. The centre will be a great help to those who cannot join in colleges, those who cannot afford the exorbitant fees as regular students, and even to housewives desirous of pursuing higher studies. Acharya Nagarjuna University has started offering B.Sc., B.A., B.B.A., and B.Com courses at the Degree level and M.A., M.Com., M.Sc., M.B.A., and L.L.M., courses at the PG level from the academic year 2003-2004 onwards.

To facilitate easier understanding by students studying through the distance mode, these self-instruction materials have been prepared by eminent and experienced teachers. The lessons have been drafted with great care and expertise in the stipulated time by these teachers. Constructive ideas and scholarly suggestions are welcome from students and teachers involved respectively. Such ideas will be incorporated for the greater efficacy of this distance mode of education. For clarification of doubts and feedback, weekly classes and contact classes will be arranged at the UG and PG levels respectively.

It is my aim that students getting higher education through the Centre for Distance Education should improve their qualification, have better employment opportunities and in turn be part of country's progress. It is my fond desire that in the years to come, the Centre for Distance Education will go from strength to strength in the form of new courses and by catering to larger number of people. My congratulations to all the Directors, Academic Coordinators, Editors and Lesson-writers of the Centre who have helped in these endeavors.

Prof. K. Gangadhara Rao
M.Tech., Ph.D.,
Vice-Chancellor I/c
Acharya Nagarjuna University.

M.Sc. FOOD AND NUTRITION SCIENCE

SEMESTER-I, PAPER-V

PRACTICAL-II

106FN24-FOOD CHEMISTRY AND ANALYSIS & FOOD SCIENCE AND EXPERIMENTAL FOODS

SYLLABUS

I)

1) Determination of moisture content in different foods.
2) Estimation of protein by Kjeldahl method.
3) Fats and oils-Determination of
    - Iodine Number
    - Free Fatty Acid Number
    - Saponification Number
    - Peroxide Value of Fresh and Heated Oils
    - Determination of Fat in Milk.
4) Carbohydrates-Determination of Starch
    - Diastatic Value of Wheat Flour
    - Reducing Sugars-Sucrose in Honey
5) Determination of total mineral content of foods
6) Estimation of Vitamin C
7) Calcium.
8) Qualitative analysis of enzymes in plant foods.
9) Qualitative analysis of enzymes in animal foods.

II)

1) Standardization of weights and measures of various foods
2) Starch cookery-Structure, gelatinization and factors affecting gelatinization
3) Baking Determination of gluten content, Preparation of plain cake, Bread and evaluation by subjective and objective methods.
4) Pulse cookery effect of different processing methods-Soaking, germination, malting-effect of factors.
5) Vegetable cookery-Effect of time, temperature, media and cooking methods on pigments.
6) Fruit-Enzymatic Browning- Preventive measures.
7) Sugars and confections Factors affecting crystallization in candies like fondant, experiments on applying scientific methods to Indian confectionary, preparation of confections - role of ingredients and processing of confectionary.
8) Fats and Oils-Smoke points, oil absorption and stability of emulsion-mayonnaise.
9) Milk Cookery-preparation of milk products-Effect of cooking.
10) Egg Cookery-Egg white foams: preparation of the eggs acting as binding, emulsifying and thinking agent.
11) Meat and Fish Cookery-Effect of different cooking methods and tenderizers.
12) Sensory Evaluation of food.

EXPERIMENT-1.1

DETERMINATION OF MOISTURE CONTENT IN DIFFERENT FOODS

OBJECTIVES:

After going through this lesson, students will understand the procedure for determining moisture content in foods.

PRINCIPLE:

Moisture content of any biological sample is determined to assess its dry matter. Moisture is estimated by heating the fresh sample at high temperature (100-110°C) to constant weight. Concentrations of macromolecules like protein, lipid, carbohydrate, etc., are expressed on a dry weight basis.

INTRODUCTION:

This method is mostly used for cereals and cereal products. Wheat, rye, millets, pulses, oats, macaroni, corn, palm, sago products, meat, soy products, texturized vegetable products, etc., are analyzed through this process. Malted foods are excluded.

REAGENTS/EQUIPMENTS/APPARATUS:

1) Hot air oven
2) Food sample
3) Desiccator
4) Crucible
5) Weighing Balance

METHOD:

1) About 5 g of chilled and non-chilled almond are weighed and is noted as W1
2) Dry the sample in oven at 100-105°C for about one hour and measure its weight W2
3) Cool the sample and place it again in the oven for one more hour.
4) Note the weights as W2. Repeat the same process until the two weights appear to be nearer and note those weights as W4 and W5.

CALCULATION:

Dry weight = Average weight - Crucible weight

$$\text{Moisture} = \frac{Initial\ \ Weight - Dry\ Weight}{Wet\ (or)\ Initial\ Weight} * 100$$

SELF-ASSESSMENT QUESTIONS:

1) Write the procedure for moisture analysis in foods.
2) What is the principle of moisture estimation in foods?

REFERENCE BOOKS:

1) IS 4333 (Part II): 2002 Methods of Analysis of food grains Part II Moisture
2) AOAC Official Method 926.06 Macaroni Products Preparation of Samples
3) AOAC Official Method 925.10 Solids (Total) and Loss on Drying (Moisture) in Flour Air Oven Method

EXPERIMENT-1.2

ESTIMATION OF PROTEIN BY KJELDAHL METHOD:

OBJECTIVES:

After going through this lesson, students will understand the procedure for the determination of protein in foods by the Kjeldahl method.

PRINCIPLE:

The nitrogen that is present in protein or any other matrix is converted to ammonium sulfate by sulfuric acid during digestion. On steam distillation, this salt liberates ammonia. That is collected in boric acid solution. The solution is titrated against standard acid. 1 mL of 0.1 N acid is equivalent to 1.401 mg N. The total nitrogen content of sample is multiplied by 6.25 and is also known as nitrogen-to-protein conversion factor

INTRODUCTION:

Nitrogen is the major element along with carbon, hydrogen, and oxygen in all living organisms. It occurs in amino acids, purines and pyrimidines, Vitamins, aminosugars, alkaloids, lipids, etc. Among all, the major source is protein.It estimates nitrogen from microbial cells to meat. The following procedure mostly suits cereals and pulses.

APPARATUS/INSTRUMENTS:

1) Kjeldahl flasks (hard, glass flasks, 30mL capacity)
2) Distillation apparatus (Glass)
3) Digestion apparatus.
4) Sulphuric acid (specific gravity 1.84)
5) Mercuric Oxide
6) Potassium sulphate
7) Sodium Hydroxide - Sodium Thiosulphate Solution
8) Indicator solution
9) Boric Acid 4% solution
10) Standard Hydrochloric acid or sulphuric acid (0.02N)
11) Boiling Chips/Glass beads

METHOD:

1) Weigh 100 mg of food sample and transfer to a 30mL digestion flask
2) Add 1.9 g of potassium sulphate, 80 mg of mercuric oxide, and 2 mL of concentrated sulphuric acid to the digestion flask

3) If the sample size is more than 20 mg dry weight, for each 10 mg, 0.1 mL of sulfuric acid is added.
4) Add glass beads to digest the sample till colorless.
5) Cool the digested sample and add distilled ammonia-free water for dilution.
6) Transfer the sample to the distillation apparatus. Kjeldahl flask should be rinsed with water
7) Place a 100 mL conical flask containing 5 mL of boric acid solution with a few drops of mixed indicator with the tip of the condenser dipping below the surface.
8) Add 10mL of sodium hydroxide-sodium thiosulphate solution to the test solution in apparatus
9) Distill and collect ammonia on boric acid
10) Rinse the tip of the condenser and titrate against the standard acid. Violet colour is the end point
11) Run a reagent blank with an equal volume of distilled water and subtract the titration volume from that of the titration volume.

CALCULATION:

The nitrogen content of the sample can be calculated based on following formula:

$$\text{Ng/Kg} = \frac{(ml\ HCL - ml\ Blank) * Normality * 14.01}{Weight(g)}$$

SELF-ASSESSMENT QUESTIONS:

1) Write the steps for the Kjeldahl process for protein estimation.
2) Explain the process for the Kjeldahl method of protein estimation.

REFERENCE BOOKS:

1) AOAC 979.09 (2005), Proteins in grains, Final action 1994.
2) FAO nutritional studies No. 24, Amino Acid Content of Foods and Biological Data on Proteins FAO, Rome

EXPERIMENT-1.3

FATS AND OILS-DETERMINATION OF IODINE NUMBER

OBJECTIVES:

After going through this lesson, students will understand the importance of the iodine number and the procedure for the iodine number.

PRINCIPLE:

Oils contain saturated and unsaturated fatty acids. Iodine reacts with fatty acids when there is a presence of a double bond. Hence, the amount of iodine absorbed by an oil gives the degree of unsaturation. Iodine number is defined as grams of iodine absorbed by 100 g of oil

INTRODUCTION:

Iodine number is the measure of the degree of unsaturation in oils. It is used to study oxidative rancidity of oils. Higher unsaturation has a greater possibility of rancidity.

APPARATUS/INSTRUMENTS/REAGENTS:

1) Hanus Iodine Solution
2) 15% Potassium Iodide solution
3) 0.1 N sodium Thiosulphate
4) 1% starch

PROCEDURE:

1) Weigh 0.5 or 0.25g of oil in iodine flask and dissolve in 10mL of chloroform
2) Add 25mL of Hanus iodine solution using a pipette, draining it in some time.
3) Mix the solution and allow to stand in dark for 30 minutes
4) Add 10mL of 15% KI and shake thoroughly
5) Add 100mL of freshly boiled and cooled water to wash down free iodine
6) Titrate against 0.1N sodium thiosulphate until yellow solution till it is colorless.
7) Add few drops of starch as indicator and titrate till blue colour disappears
8) By the end of titration, shake the flask and run the blank without sample

CALCULATION:

$$\text{Iodine value} = \frac{(B-S)*N*12.69}{W}$$

Where, B = volume in mL of standard sodium thiosulfate solution required for the blank.

S = volume in mL of standard sodium thiosulfate solution required for the sample.

N = normality of the standard sodium thiosulfate solution.

W = weight in g of the sample.

SELFASSESSMENT QUESTIONS:

1) Write about the procedure for estimation of fats and oils Iodine number
2) Give the principle for estimation of iodine number in fats

REFERENCE BOOKS:

1) William Horowitz (1975), Official Methods of Analysis of AOAC, Association of Official Analytical Chemists, Washington, p. 488.

EXPERIMENT-1.3A

FATS AND OILS-DETERMINATION OF FREE FATTY ACID NUMBER

OBJECTIVES:

After going through this lesson students will understand the procedure for determination of free fatty acid number in foods

PRINCIPLE:

The free fatty acid in oil is estimated by titrating against KOH in the presence of phenolphthalein indicator. The acid number is defined as the mg KOH required to neutralize the free fatty acids present in 1gm of sample

INTRODUCTION:

Triacylglycerols are the predominant components of most food fats and oils. A triacylglycerol is composed of glycerol and three fatty acids. Fatty acid composition differs for each of edible oils. Keeping quality of foods will be determined by using fatty acid number.

REAGENTS:

1. 1% Phenolphthalein in 95% ethanol
2. 0.1N potassium hydroxide
3. Neutral solvent

Mix 25mL ether, 25mL 95% alcohol and 1mL of 1% phenolphthalein solution and neutralize with 0.05N NaOH

METHOD:

1) Dissolve 1-10 g of oil in 50mL of neutral solvent in 250mL conical flask
2) Add few drops of phenolphthalein
3) Titrate the contents against 0.1N Potassium Hydroxide
4) Shake constantly until a pink colour persisting for 15 seconds is obtained.

CALCULATION:

$$\text{Acid Value (mgKOH/g)} = \frac{Titre\ value^{*}\ Normality\ of\ KOH^{*}56.1}{Weight\ of\ the\ sample\ in\ grams}$$

The free fatty acid is calculated as oleic acid using the below equation

1mL N/10 KOH = 0.028g oleic acid

SELF ASSESSMENT QUESTIONS:

1) Write about the procedure for estimation of fats and oils FFA number
2) Give the principle for estimation of FFA number in fats

REFERENCE BOOKS:

1) A textbook on Biochemical Methods, Second edition by Sadasivam and A Manickam.

EXPERIMENT-1.3B

FATS AND OILS DETERMINATION OF SAPONIFICATION NUMBER

OBJECTIVES:

After going through this lesson students will understand the procedure for determination of saponification number in foods

PRINCIPLE:

A Known quantity of oil is refluxed with an excess amount of alcoholic KOH. After saponification, the remaining KOH is estimated by titrating it against a standard acid

INTRODUCTION:

The saponification value is the number of mg of Potassium hydroxide required to saponify 1 g of oil/fat.

APPARATUS/INSTRUMENTS/REAGENT:

1) Hydrochloric acid, 0.05 N
2) Alocoholic KOH
3) Phenopthelien Indicator
4) Air Condensor

PROCEDURE:

1) Sample should be melted and filtered to remove impurities and moisture
2) Weigh 4-5g of sample into a conical flask. Add 50mL of alcoholic KOH from burette by allowing it to drain for a definite period of time
3) Prepare a blank also by taking only 50mL of alcoholic KOH allowing it to drain at the same duration of time
4) Add about 1mL of indicator and titrate against 0.5N HCL until the pink colour just disappears

CALCULATION:

$$\text{Saponification Value} = \frac{28.05*(titre\ value\ of\ blank - titre\ value\ of\ sample)}{Weight\ of\ sample(g)}$$

SELF ASSESSMENT QUESTIONS:

1) Write about the procedure for estimation of fats and oils saponification number
2) Give the principle for estimation of saponification number in fats

REFERENCE BOOKS:

1) A textbook on Biochemical Methods, Second edition by S.Sadasivam and A Manickam.

2) AOAC 17th edn, 2000, Official method 920.160 Saponification number of oils and fats IUPAC 2. 202

3) ISI Handbook of Food Analysis (Part XIII) 1984, page 78).

4) IS: 323-1959 Specification for Rectified Spirit (Revised).

EXPERIMENT-1.3C

FATS AND OILS - DETERMINATION OF PEROXIDE VALUE

OBJECTIVES:

After going through this lesson, students will understand the determination procedure of Peroxide value in foods

PRINCIPLE:

Peroxide value is a measure of the peroxides contained in the oil. The peroxides present are determined by titration against thiosulfate in the presence of KI. Starch is used as indicator

INTRODUCTION:

Rancidity is the characteristic, unpalatable odour and flavour of edible fats and oils following oxidative or hydrolytic degradation. When edible oil is stored for a long time, it undergoes oxidation and becomes rancid. Fats and oils have carbon-carbon double bonds in their structure. This process can occur in raw foodstuffs, refined or used edible oils, and processed foods containing edible oils.

APPARATUS/REAGENTS/MATERIALS:

- Solvent Mixture: Mix two volumes of glacial acetic acid with chloroform
- 5% Potassium Iodide solution
- 1% starch solution
- N/500 sodium thiosulphate solution

METHOD:

1) Weigh 1g of oil into a clean dry boiling tube and add 1g of powdered potassium iodide and 20mL of solvent mixture
2) Place the tube in boiling water so that the liquid boils within 30 seconds and allow to boil vigorously for not more than 30 seconds
3) Transfer the contents quickly to a conical flask containing 20mL of 5% potassium iodide solution
4) Titrate against N/500 sodium thiosulphate solution until yellow colour is almost disappeared
5) Add 0.5mL of starch, shake vigorously and titrate carefully till the blue colour just disappears
6) A Blank should also be set at same time

CALCULATION:

$$\text{Peroxide value (milliequivalent peroxide/kg sample)} = \frac{S*N*1000}{Weight\ of\ sample}$$

SELF ASSESSMENT QUESTIONS:

1) Write about the procedure for estimation of fats and oils peroxide value
2) Give the principle for estimation of peroxide value in fats

REFERENCE BOOKS:

1) AOAC 17th edn, 2000, Official Method 965.33 Peroxide Value in Oils and Fats.
2) Pearson's Composition and Analysis of Foods 9th edn page 641
3) A textbook on Biochemical Methods, Second edition by S Sadasivam and A Manickam

EXPERIMENT-1.3D

FATS AND OILS-DETERMINATION OF FAT IN MILK

OBJECTIVES:

After going through this lesson, students will understand how to determine fat in milk

PRINCIPLE:

Dilute H_2SO_4 is added to know the amount of milk in the Babcock bottle. The sulfuric acid digest protein gives heat and releases the fat. Centrifuge and then add hot water in fat for quantification in the graduated portion of the test bottle. The fat is measured volumetrically, but the results are expressed as per concentrated fat by weight.

APPARATUS/INSTRUMENTS/REAGENTS:

Babcock test tube

Sulfuric acid

METHOD:

1) Accurately add 17.5 mL of milk into a Babcock test tube.
2) Now add 17.5 ml of sulfuric acid into the bottle, allowing the acid to flow gently down the neck of the bottle.
3) Slowly rotate the test tube so that the acid digester protein adds and liberates the fat.
4) If the fat gets solidified, place the test tube in hot water and allow the fat to liquefy.
5) Measure the amount of fat present by reading the markings of the test tube.

CALCULATION:

The amount of fat present in the given milk sample is

SELF-ASSESSMENT QUESTIONS:

1) Write about the procedure for estimating fat in milk
2) Give the principle for estimation of fat in milk

REFERENCE BOOKS:

1) Manual of Analysis of Milk and Milk Products, Food Safety and Standards Authority of India (Ministry of Health and Family Welfare) FDA Bhawan, Kotla Road, New Delhi-110002

EXPERIMENT-1.4

CARBOHYDRATES-DETERMINATION OF STARCH

OBJECTIVES:

After going through this lesson, students will understand process for determining starch in foods

PRINCIPLE:

The sample is treated with 80% alcohol to remove sugars, and then starch is extracted with perchloric acid. In a hot acidic medium, starch is hydrolyzed to glucose and dehydrated to hydroxymethyl furfural. The compound forms a green-colored compound with anthrone.

INTRODUCTION:

Starch is an important polysaccharide. It is the storage form of carbohydrate in plants abundantly found in roots, tubers, stems, fruits, and cereals. Starch, which is composed of several glucose molecules, is a mixture of two types of molecules, namely amylose and amylopectin. Starch is hydrolyzed to simple sugars by dilute acids, and the quantity of simple sugars is measured calorimetrically.

.**REAGENTS:**

- Anthrone: Dissolve 200 mg anthrone in 100mL of ice-cold 95% sulphuric acid
- 80% Ethanol
- 52% perchloric acid
- Standard Glucose: Stock-100 mg in 100 mL water. Working standard: 10 mL of stock diluted to 100mL with water

METHOD:

1) Homogenize 0.1 to 0.5 g of the sample in hot 80% ethanol to remove sugars. Centrifuge and retain the residues. Wash the residue repeatedly with hot 80% ethanol till the washings do not give the color of anthrone reagent. Dry the residue well over a water bath.
2) To the residue, add 5.0mL of water and 6.5mL of 52% perchloric acid
3) Extract at 0 C for 20 minutes. Centrifuge and save the supernatant
4) Repeat the extraction using fresh perchloric acid. Centrifuge and pool the supernatants ad make up to 100 mL.
5) Pipette out 0.1 or 0.2 mL of the supernatant and make up the volume to 1mL with water

6) Prepare the standard by taking 0.2, 0.4, 0.6, 0.8, and 1 mL of the working standard and making up the volume to 1 mL in each tube with water
7) Add 4 mL of anthrone reagent to each tube
8) Heat for 8 minutes in boiling water bath
9) Cool rapidly and read the intensity of green to dark green colour at 630 nm

CALCULATION:

Find out the glucose content in the sample using the standard graph. Multiply the value by a factor 0.9 to arrive at the starch content

SELF-ASSESSMENT QUESTIONS:

1) Write about the procedure for estimation of starch
2) Give the principle for estimation of starch

REFERENCE BOOK:

1) A Textbook on Biochemical Methods, Second edition by S.Sadasivam and A.Manickam.

EXPERIMENT-1.4A

DIASTATIC VALUE OF WHEAT FLOUR

OBJECTIVES:

After going through this lesson students will understand the procedure for determination of diastatic value in wheat flour

PRINCIPLE:

By using Visco/Amylo/Graph diastatic activity can be determined.

INTRODUCTION

This method uses the amylograph to estimate α-amylase activity (diastatic activity) in an aqueous suspension of flour as it gelatinizes during heating. The high viscosity of the starch gel is counteracted by the action of α-amylase, which liquefies starch granules as the slurry is heated. The amylograph value, or peak viscosity, also called malt index, is therefore inversely correlated with α-amylase activity. The method measures α-amylase that naturally occurs in flour or is added as malt; it does not respond to fungal α-amylase.

PRINCIPLE:

By using Visco/Amylo/Graph diastatic activity can be determined

REAGENTS:

Buffer solution - Make a concentrated buffer by dissolving and diluting 14.8 g anhydrous disodium phosphate (Na2HPO4) and 10.3 g citric acid monohydrate to 1 liter with water. Dilute 46.0 ml concentrated buffer to 460 ml with water (pH 5.3–5.35). Store in the refrigerator to prevent mold growth. Prepare a fresh buffer at least every month.

METHOD:

1) Place 100 g flour (14% moisture basis) in a 1-liter Erlenmeyer flask. (For soft wheat flour, use 65 g [14% moisture basis] with buffer solution or 60 g [14% moisture basis] with water.)
2) Add 360 ml dilute buffer and enough water to adjust flour moisture to 14.0% (see Example)
3) Shake with wrist motion for 0.5 min (100 shakes per min). Alternatively, mix flour and water in a stainless steel bowl, using a whisk.
4) Do not use antifoaming agents.
5) Pour flour slurry into an amylograph bowl. Rinse flask with remaining 100 ml buffer and add this to an amylograph bowl.

6) Place the spindle in a bowl and move the head of the amylograph into the proper position. Adjust starting temperature to 30° by hand, with clutch in neutral position, or set electronic controller to 30°.
7) Set the clutch on an increased temperature position and start the amylograph bowl in motion.
8) Record viscosity of slurry as temperature increases from 30 to 95°; temperature should increase 1.5°/min.
9) Read maximum viscosity in Brabender Units (BU) at center of peak. This value is called the malt index of the flour.
10) Standard error for single determination for individual instruments should not exceed 10 BU.
11) For studying effect of different concentrations of cereal malt α-amylase on viscosity of flour, add different increments of malt flour (0.1–1.0 g) to unmalted flour, total weight of mixture being 100 g (14.0% moisture basis), and determine malt index as described above.
12) Different malt flours can be compared by adding the same amount of different malt flours to standard flour and determining malt index as described above.
13) For determining malt index of unmalted red spring or unmalted hard red winter wheat flours, use 65 g (14.0% moisture basis). For these two methods, use a 460 ml buffer and enough water to adjust flour moisture to 14.0%.

CALCULATION:

If the flour sample contains 12.5% moisture, place 98.3 g flour in a flask, add 1.7 ml water and 460 ml diluted buffer.

100 -14/100 -12.5 * 100 = 98.3

SELF ASSESSMENT QUESTIONS:

1) Write about the procedure for estimation of diastatic value?
2) Give the principle for estimation of diastatic value?

REFERENCE BOOKS:

1) Anker, C. A., and Geddes, W. F. 1944. Gelatinization studies upon wheat and other starches with the amylograph. Cereal Chem. 21:335.
2) Brown, R. O., and Harrel, C. G. 1944. the use of the amylograph in the cereal laboratory. Cereal Chem. 21:360.
3) Johnson, J. A. 1954. Amylograph standardization. Trans. Am. Assoc. Cereal Chem. 12:292.

4) Johnson, J. A., Shellenberger, J. A., and Swanson, C.O. 1946. Amylograph curve characteristics of various types of commercial flours and their relation to flour maltose and gassing power values. Cereal Chem. 23:410.

5) Loska, S. J., Jr. 1957. The effect of bowl speed upon amylogram curve characteristics. Cereal Chem. 34:305.

6) Loska, S. J., Jr., and Day, J. A. 1956. The heating characteristics of an amylograph. Cereal Chem. 33:266.

EXPERIMENT-1.4B

DETERMINATION OF REDUCING SUGARS-SUCROSE IN HONEY

OBJECTIVES:

After going through this lesson, students will understand the procedure for determining reducing sugars in foods

INTRODUCTION:

This is the simple, sensitive method and is adoptable during the handling of a large number of samples at a time.

PRINCIPLE:

By the use of DNS reagent, the reducing sugars are extracted. By pipetting the extract, heat is applied, and 40% of Rochelle salt solution is added. By using series of standards of glucose, graph is plotted

REAGENTS:

1) Dinitrosalicylic Acid Reagent (DNS reagent)

   Dissolve by stirring 1 g dinitrosalicylic acid, 200 mg crystalline phenol, and 50 mg sodium sulfite in 100mL 1% NaOH. Store at 4°C. Since the reagent deteriorates due to sodium sulphite, if long storage is required, sodium sulphite may be added at the time of use

2) 40% Rochelle salt solution (Potassium sodium tartrate)

METHOD:

1) Weigh 100 mg of the sample and extract the sugars with hot 80% ethanol twice (5mL each time)
2) Collect the supernatant and evaporate it by keeping it on a water bath at 80°C.
3) Add 10mL water and dissolve the sugars
4) Pipette out 0.5 to 3mL of the extract in test tubes and equalize the volume to 3mL with water in all the tubes
5) Add 3mL of DNS reagent
6) Heat the contents in a boiling water bath for 5 min
7) When the contents of the tubes are still warm, add 1mL of 40% Rochelle salt solution
8) Cool and read the intensity of dark red colour at 510 nm
9) Run a series of standards using glucose (0 to 500 µg) and plot a graph

CALCULATION:

Calculate the amount of reducing sugars present in the sample using the standard graph

SELF-ASSESSMENT QUESTIONS:

1) Write about the procedure for estimating reducing sugars
2) Give the principle for estimation of reducing sugars

REFERENCE BOOK:

1) A Textbook on Biochemical Methods, Second edition by S.Sadasivam and A. Manickam.

EXPERIMENT-1.5

DETERMINATION OF TOTAL MINERAL CONTENT OF FOODS

OBJECTIVES:

After going through this lesson, students will understand the procedure for determining the total minerals in foods

PRINCIPLE:

Minerals are not dissolved by heating, and they have low volatility compared to other food components. Ash is inorganic residue removal after the heating in the presence of a measure of oxidizing agents, which provides a measure of the total amount of mineral within a food.

APPARATUS/INSTRUMENTS/REAGENTS:

- Food Sample
- Crucibles
- Muffle furnace
- Desiccator

PROCEDURE:

1) Solid food is weighed for 5 grams.
2) This food sample is placed on a heat mantle to remove moisture content.
3) The moisture-free sample is again weighed, and this is taken as the weight before ashing or as dry weight.
4) This sample is taken into crucibles and placed in a muffle furnace.
5) The muffle furnace is set at 250°C & 300°C for 15 minutes.
6) The sample is weighed after ashing and noted as the afterweight.

CALCULATION:

$$\% \text{ Ash (dry basis)} = \frac{Weight\ after\ ashing}{Weight\ before\ ashing} \text{x} 100$$

RESULT:

The amount of mineral content present in the given curry leaf sample is

SELF-ASSESSMENT QUESTIONS:

1) Write about the procedure for estimation of mineral content?
2) Give the principle for estimation of mineral content?

REFERENCE BOOK:

1) A Textbook on Food Analysis by Suzanne neilson, 2010

EXPERIMENT-1.6

ESTIMATION OF VITAMIN C

OBJECTIVES:

After going through this lesson, students will understand the procedure for estimating Vitamin C

PRINCIPLE:

Ascorbic acid reduces the 2,6-dichlorophenol indophenol dye to a colorless leuco base. The ascorbic acid gets oxidized to dehydroascorbic acid. Though the dye is a blue-colored compound, the end point is the appearance of pink color. The dye is pink-colored in an acid medium. Oxalic acid is used as the titrating medium.

INTRODUCTION:

Ascorbic acid is also known as vitamin C and is an antiscorbutic. It is present in gooseberry, bitter gourd, etc., in high amounts. Generally, it is present in all fresh vegetables and fruits. It is a water-soluble and heat-labile vitamin. The method described below is easy and rapid. A large number of samples can be analyzed in a short time

REAGENTS:

- Oxalic acid 4%
- Dye solution: Weigh 42 mg sodium bicarbonate into a small volume of distilled water. Dissolve 52 mg 2,6-dichlorophenol indophenol and make up to 200mL with distilled water
- Stock standard solution: Dissolve 100 mg ascorbic acid in 100mL of 4% oxalic acid solution in a standard flask (1mg/mL)
- Working standard: Dilute 10 mL of stock solution to 100 mL with 4% oxalic acid. The concentration of working standard is 100 µg/mL

METHOD:

1) Pipette out 5mL working standard solution in to a 100mL conical flask
2) Add 10 mL of 45% oxalic acid and titrate against the dye (V1 mL). The endpoint is the appearance of pink color, which persists for a few minutes. The amount of dye consumed is equivalent to the amount of ascorbic acid.
3) Extract the sample (0.5 to 5 g depending on the sample) in 4% oxalic acid and make up to a known volume (100 mL) in a centrifuge.
4) Pipette out 5mL of the supernatant, add 10mL of 4% oxalic acid and titrate against the dye (V2mL)

CALCULATION:

Amount of Ascorbic Acid (mg/100 g sample)

$$= \frac{0.5mg}{V1mL} \text{x} \frac{V2}{5mL} \text{x} \frac{100mL}{weight\ of\ the\ sample} \text{ x100}$$

SELF-ASSESSMENT QUESTIONS:

1) Write about the procedure for estimation of Vitamin C
2) Give the principle for estimation of Vitamin C

REFERENCE BOOK:

1) A Textbook on Biochemical Methods, Second edition by S.Sadasivam and A.Manickam.

EXPERIMENT-1.7

ESTIMATION OF CALCIUM

OBJECTIVES:

After going through this lesson, students will understand the procedure for estimating calcium.

PRINCIPLE:

Calcium ions (Ca2+) react with EDTA to form a stable, colorless, water-soluble complex. The endpoint of the titration is determined using a mental ions indicator such as erichrome BlackT, which changes color when all calcium ions are complexed.

REAGENTS

- Sample
- EDTA
- Erichrome Black T
- Buffer solution: ammonia/ammonium chloride weighs 0.53 g of ammonium chloride (NH_4Cl) and dissolves it in 5 mL of distilled water. Slowly add 3.5 mL of concentrated ammonia to the NH_4Cl solution. Make it up to 10 mL using distilled water.

PROCEDURE

1) Take the weight of the sample and incinerate it in a muffle furnace at 550 to 600°C until only ash remains.
2) Record the ash weight
3) Dissolve the ash in 10 ml diluted in hydrochloric acid.
4) Filter the solution and collect the filtrate.
5) Make up the filtration to know the volume with distilled water.
6) Take 25 ml of the solution into a conical flask.
7) Take 2 mL of the buffer solution to the sample.
8) Add 2to 3 of erichrome Black T to the mixture; a wine red colour iis observed
9) Titrate the solution with EDTA until the blue color appears.
10) Note the endpoint.

CALCULATION:

$$\text{Calcium (mg/L)} = \frac{volume\ of\ molarity\ of\ EDTA \times molar\ mass\ of\ Ca}{volume\ of\ sample\ (L)}$$

SELF-ASSESSMENT QUESTIONS:

1) Write about the procedure for estimation of calcium content
2) Give the principle for estimation of calcium content

REFERENCE BOOK:

1) AOAC Official Method 2011.14

EXPERIMENT-1.8

QUALITATIVE ANALYSIS OF ENZYMES IN PLANT FOODS

OBJECTIVES:

After going through this lesson students will understand the procedure for Qualitative analysis of enzymes in plant foods

INTRODUCTION:

The following method is used to analyze the plant enzyme presence in plant foods. Sample is prepared and analyzed for their presence especially potato oxidase

PRINCIPLES:

The potato oxidase extract is prepared and is reacted with phenol, catechol, guaiac solution, pyrogallol and naphthol for checking the presence

PROCEDURE:

1. Wash and peel a medium sized potato.
2. Grate rapidly and transfer that to cheese cloth which is suspended in beaker of 200mL of distilled water
3. Work gently with the hand to get out as much of the starch as possible.
4. Keep this extract (enter extract no 1)
5. Make a second extraction using 200 ml of distilled water (extract 2)
6. Make a third extraction and if this does not contain apreciable amount of starch, discard it
7. Work the pulp until it is practically starch free
8. Into each series of 5 clean test tubes introduce 5mL of potato extract. If the extract is kept overnight it must be preserved with toluene
9. Introduce other reagents with the following series

   Potato extract +10 drops of 1% phenol

   Potato extract +10 drops of 1% catechol

   Potato extract +10 drops of 1% Guaiac solution

   Potato extract +10 drops of 1% pyrogallol

   Potato extract +10 drops of 1% Napthol
10. Solution 5 drops of phenylin diamide hydrochloride solution
11. Mix the contents of the tubes by shaking

12. Watch for colour changes
13. If necessary let stand till the next lab and examine again

SELF ASSESSMENT QUESTIONS:

1) Write about the procedure for estimation of qualitative analysis of plant enzymes
2) Give the principle for estimation of qualitative analysis of plant enzymes

REFERENCE BOOK:

1) Hawk, P B., D.L. Oser and W H Bummersion, "Practical Physiological Chemistry", Chapter 12, P 323, 13^{th} Edition.

EXPERIMENT-1.9

QUALITATIVE ANALYSIS OF ENZYMES IN ANIMAL FOODS

OBJECTIVES:

After going through this lesson students will understand the procedures for Qualitative analysis of enzymes in animal foods

PRINCIPLE:

With the hide powder-barium sulfate a positive test is given by 1 mg. of 1:3000 trypsin at pH 7.0 at room temperature in 1 minute. As little as 0.001 mg. of trypsin gave a positive though faint test after incubation with the hide powder at 37 degree centigrade overnight.

INTRODUCTION:

Hide powder containing barium sulfate precipitated within its pores can be used to test trypsin in animal foods. When this material is acted upon by proteases, the barium sulfate is liberated and goes into suspension upon shaking. The reagent can be employed for the detection of all proteases thus far tested which attack the high molecular proteins, but is not suitable for pepsin. The reagent is easy to prepare and inexpensive. This method is a qualitative test for trypsin.

REAGENTS PREPARATION

1) Place 1000 cc. of 5 per cent barium chloride in a 2 liter beaker and bring to boiling. Add 100 gm. of hide powder and at once turn off the flame heating the beaker. Stir for 10 minutes.
2) Now pour the material upon a cheese-cloth sack resting in a filter funnel and squeeze out the excess of liquid.
3) Then dump the moist hide powder into a 2 liter beaker containing about 1000 cc. of 10 percent ammonium sulfate and stir for 5 to 10 minutes.
4) Pour the material into the cheesecloth sack and press out the liquid.
5) Transfer the moist hide powder to the beaker again and stir with 1000 cc. of distilled water.
6) Repeat this washing process about nine times.
7) Finally, spread the hide powder-barium sulfate out in a thin layer upon towels or several layers of cheese-cloth.
8) Break up all the lumps.
9) Allow to remain until perfectly dry.

10) The material should not be employed as a reagent until it has dried thoroughly.

METHOD:

1) Place about 0.3 gm. of dry hide powder-barium sulfate in two 17 X 155 mm. test-tubes and cover with a little distilled water.
2) After 5 or 10 minutes add the desired buffer solution and enough water to make a total volume of 5 to 10 cc.
3) Now add about 1 cc. of clear enzyme solution to one of the tubes and shake both tubes for 30 to 60 seconds.
4) Allow the powder to settle and observe whether the tube containing the enzyme shows turbidity.
5) It will help to make a comparison with the blank.
6) If there is no turbidity to be seen, allow some time to elapse and later shake again and make other observations.
7) Sometimes enzyme solutions themselves become turbid upon being added to buffers, or simply upon standing.
8) It is therefore advisable to have a third tube containing only enzyme, buffer, and water.
9) It is, of course, necessary to employ enzyme solutions which are water-clear. In testing for bromelin we used fresh pineapple juice. This was difficult to filter unless diluted first with 2 volumes of water.
10) The control tube will not give off any barium sulfate at pH 5.0 or 7.0 upon incubation overnight.
11) However, barium sulfate will be released if the material is boiled, or if the solid is pounded with a glass rod.
12) In the presence of 0.1 N hydrochloric acid barium sulfate is given off slowly.

SELF ASSESSMENT QUESTIONS:

1) Write about the procedure for estimation of qualitative analysis of animal enzymes?
2) Give the principle for estimation of qualitative analysis of animal enzymes?

REFERENCE BOOKS:

1) Gritzner, P., Arch. ges. Physiol., 8, 452 (1874).
2) Roaf, H. E., Biochem. J., 3, 188 (1908).
3) Palladin, A., Arch. ges. Physiol., 134, 337 (1910). Smorodinzew, J. A., and Adowa, A.N., Biochem. Z., 163, 14 (1924).

EXPERIMENT-2.1

STANDARDIZATION OF WEIGHTS AND MEASURES OF VARIOUS FOODS

OBJECTIVES:

To know the standardization of weights and measures of various foods

INTRODUCTION:

The standardization of weights and measures is essential in the food industry, dietary assessments, and food labelling. Accurate measurements ensure consistency in nutrient intake, improve quality control, and facilitate trade compliance. This study focuses on the standardization processes, the need for such measures, and their impact on food safety, consumer trust, and international trade.

RECIPE ABBREVIATIONS:

1) Approx=Approximate
2) Tsp(or)=Teaspoon
3) Tbsp (or)=Tablespoon
4) C=cup
5) P =pint
6) Qt=quart
7) Gal=gallon
8) Wt=weight
9) Oz=ounce
10) Lb (or)=pound
11) G=grams
12) Kg=kilogram
13) Vol=volume
14) Ml=millilitre
15) L=litre
16) Floz= fluid ounce
17) No (or)=number
18) In (or)=inches
19) F°=degree Fahrenheit
20) C°=degree Celsius (or) centigrade

TABLE: MEASUREMENTS OF DIFFERENT SERVING VESSELS

S.No.	HH measure	Size (or) dimension	Volume in ml
1	Katori Medium	3”dia ½”ht	125ml
2	Glass Large	2 ½”×4 ½”×1 ½ bottom	240ml
3	Glass Medium	2 ¼”×4”htx×1 ¾”	200ml
4	Cup Large	2 ¾”dia×3 ½”ht	250ml
5	Cup Medium	2 ½”dia×3”ht	200ml
6	Serving Spoon (or) Karhi Large	2 ¾”dia,5/8”	50ml
7	Serving Spoon (or) Karchi Medium	17/8”dia,5/8”	25ml
8	Serving Spoon (or) Karchi Medium		15ml
9	1 tea Spoon		5ml
10	1 table Spoon		15ml

Examples of Standardisation:

1) Bread slice = 25grams
2) A thumb = 10z of cheese
3) Handful = 1-2 z of cheese
4) Thumb tip = 1 tbsp
5) Palm = 30z od meat,fish and poultry
6) I tennis ball = ½ cup fruit and vegetable

7) ½ cup = a first or cupped band

8) 1 cup = 80 z of milk or yogurt

9) Chapathi (medium) = 30 grams

10) Idly (1) = 40 grams

11) Egg (large) = 50 grams

12) 1 cup cooked ,mashed dal = 140 grams

13) ¾ cup = 10.5 grams

14) 8 Almonds (larged cooked) = 10 grams

15) Rice ,brown (cooked) = 1 serving (150 grams)

16) Oat meal (cooked)

17) Potato peeled, boiled (large) = 185 grams

REFERENCES:

1) Codex Alimentarius Commission. (2023). Food Standards Programme.

2) WHO. (2022). Guidelines on Measuring Food Consumption.

3) USDA. (2021). Food Data Central Guidelines.

4) International Organization for Standardization (ISO). (2023). Standards for Food Measurement.

EXPERIMENT-2.2

STARCH COOKERY

OBJECTIVES:

To analyse the structure of the starch molecule.

- To study the process of gelatinization.
- To identify the factors affecting gelatinization.
- To understand the structure and behaviour of starch.

Principle:

Starch cookery is that starch thickens when heated in water or other liquids, a process called gelatinization. The starch absorbs the liquid and swells, increasing the viscosity and clarity of the food.

Explanation:

Gelatinization:

- When starch is heated in water, the starch granules swell and absorb water irreversibly. This process disrupts the molecular order within the starch granule.

Retrogradation:

- As the starch cools, it can undergo retrogradation, which changes the texture. During retrogradation, the cells move apart and the viscosity decreases.

Starch in food:

- Starch is used as a thickener, binder, stabilizer, and bulking agent in many foods.
- It's used in soups, sauces, gravies, ice cream, pie fillings, custard powders, and more.
- It's also used in bakery products, processed meats, and baby foods.

INTRODUCTION:

Starch is a carbohydrate and an essential component in many food preparations, known for its ability to thicken, gel, and provide structure to various dishes. Found in cereals, roots, tubers, and legumes, starch plays a vital role in culinary practices worldwide. Its unique behavior during cooking, particularly gelatinization and pasting, forms the foundation of starch cookery.

In the presence of heat and moisture, starch granules undergo physical and chemical changes that result in thickening and gel formation, making it indispensable in the preparation of sauces, soups, gravies, puddings, and baked goods. Understanding the principles of starch cookery helps in achieving the desired texture, consistency, and quality in food products.

METHODS:

Examine the cereal under the microscope and make starches moist, the given flour with a small amount of water to gel sticky and add the remaining water gradually stir all the substances. Make it over a direct flame untill the bubbles (or) lumps disappear into the paste at various temperatures.

1) Raw flour temperature
2) 50°c
3) 70°c
4) 85°c

The clarity of the base after attaining no 95°c pour the paste into the aluminium mould and allow it to stand for some time. Then place one mould at room temperature and another one at refrigerator temperature.

FLOUR:

In a vessel take 50 grams of flour then add water accordingly and mix well so that no lumps are formed. Now put it on a suitable flame while stirring continuously. Then take a thermometer reading at different temperatures like 50°C, 70°C, 80°C and 90°C.

Finally, take the paste into a small cup and allow it to stand at room temperature and let the other one settle at refrigerated temperature. A clear strong gel is formed as it contains good amylase content. The flour needs 400 ml of water.

S.No.	Source of starch	Temperature of thickening	Clearness of paste	Comparative thickness paste
1	Corn starch			
2	Wheat flour			
3	Rice flour			
4	Arrowroot flour			

GELATINIZATION

ASSESSMENT QUESTIONS:

1) What are the two main polysaccharides found in starch, and how do they differ in structure?
2) What is gelatinization, and at what temperature does it typically occurs for most starches?
3) How does the type of starch (eg; corn starch vs rice starch) influence the gelatinization process?

REFERENCE:

1) Food Science, B. Sri lakshmi , 8th Edition New Age International Publications.

EXPERIMENT-2.3

BAKING

OBJECTIVES:

- To observe the effect of concentration, temperature, sugar and acid on gelatinisation of starch.
- To observe the texture of Cake.
- To observe the texture, appearance of Bread.

PRINCIPLE:

Gluten is that it forms when glutenin and gliadin proteins in flour are combined with water. The gluten network is a stretchy, springy structure that gives bread, pasta, and pizza crusts their unique texture. The principles of baking cakes and breads include using the right ingredients, measuring ingredients accurately, and controlling the temperature.

INTRODUCTION:

Baking is a cooking method that uses dry heat to transform dough and batter into baked goods. It's a culinary art form that's been practiced for thousands of years. Baking is a method of preparing food that uses dry heat, typically in an oven, but can also be done in hot ashes, or on hot stones. The most common baked item is bread, but many other types of foods can be baked. Heat is gradually transferred "from the surface of cakes, cookies, and pieces of bread to their centre, typically conducted at elevated temperatures surpassing 300°F.

METHODS:

Experiment-1

Gluten is a protein found in wheat and other grains that are prepared by mixing flour with water and washing out the starch.

STEPS FOR PREPARING GLUTEN

1) Mix flour and water to form a dough
2) Let the dough rest so the proteins can absorb water
3) Submerge the dough in cold water for a few hours
4) Rinse the dough until the water runs clear
5) Apply shear to the dough

Experiment-2

BAKING PROCEDURE OF CAKE:

Cake baking is very simple process. There is a process of mixing wet ingredients and dry ingredients here. Mix all purpose flour with powdered sugar, Baking powder, and Baking soda. Now take another bowl with butter, oil, eggs, and flavoured essence together. Now mix both wet and dry ingredients together like cut and fold method. Now cake batter is ready to bake. Take a cake pan and add cake batter to it and bake this in the 10 minutes pre – heated oven at 160^{o}C for 45 minutes. After the time out remove from oven and keep it to cool.

Experiment-3

BAKING PROCEDURE OF BREAD:

The bread baking procedure involves mixing, kneading, proofing, and baking the dough.

- Mixing: Combine the dry ingredients at room temperature. Add the liquid ingredients, depending on the recipe. Mix to evenly distribute the ingredients and develop gluten
- Kneading: Incorporate the flour and liquid ingredients. Knead by hand or with a dough hook in a mixer. Knead until the dough has strength and a gluten structure
- Proofing: Let the dough rest so the yeast can grow. The yeast produces carbon dioxide and ethanol, which causes the dough to rise
- Baking: Bake the dough in an oven. The bread's internal temperature will reach 140°F, which kills the yeast and stops fermentation

Tips Use room temperature ingredients, Measure ingredients accurately, and don't over knead the dough.

SELF ASSESSMENT QUESTIONS:

1) What were the enzymes involved in the preparation of Gluten?
2) Explain the preparation of Gluten?
3) Determine the preparation of baking procedure of Cake?
4) Write the summary of Baking?
5) What were the steps involved in the preparation of Bread?

REFERENCE:

1) B. Sri Lakshmi, Food Science 8th edition, New Age International Publishers.

EXPERIMENT-2.4

PULSE COOKERY

OBJECTIVES:

- To know the effect of soaking time on pulse cooking
- To know the effect of ordinary and distilled water on cooking of pulse
- To know the effect of acid and alkali on cooking of pulses

PRINCIPLE:

Cooking pulses involves hydration, softening of cell walls, and gelatinization of starch through the application of heat and water. Soaking pulses prior to cooking reduces cooking time and improves texture by rehydrating the seeds and softening their outer coat. Cooking denatures proteins, enhances digestibility, and reduces anti-nutritional factors like phytic acid, making pulses more palatable and nutritious.

METHOD:

Experiment I:

EFFECT OF SOAKING ON PULSE COOKERY:

Overnight Soaking:

Weigh about 80gm of red gram dhal and it is soaked for overnight later it is divided into four parts each of it about 20 gm. Then these 20 gm of dhal is cook with tap water, distilled water, alkali (baking soda) and in acid (citric acid or lemon juice).

Note the weight of dhal before and after soaking and cooking. Tabulate the results on texture, colour and time of cooking.

Experiment II:

EFFECT OF 2 HOURS SOAKING ON PULSE COOKERY:

Weigh about 80gm of red gram dhal and it is soaked for two hours later it is divided into four parts each of it about 20 gm. Then these 20 gm of dhal is cook with tap water, distilled water, alkali (baking soda) and in acid (citric acid or lemon juice).

Note the weight of dhal before and after soaking and cooking. Tabulate the results on texture. colour and time of cooking.

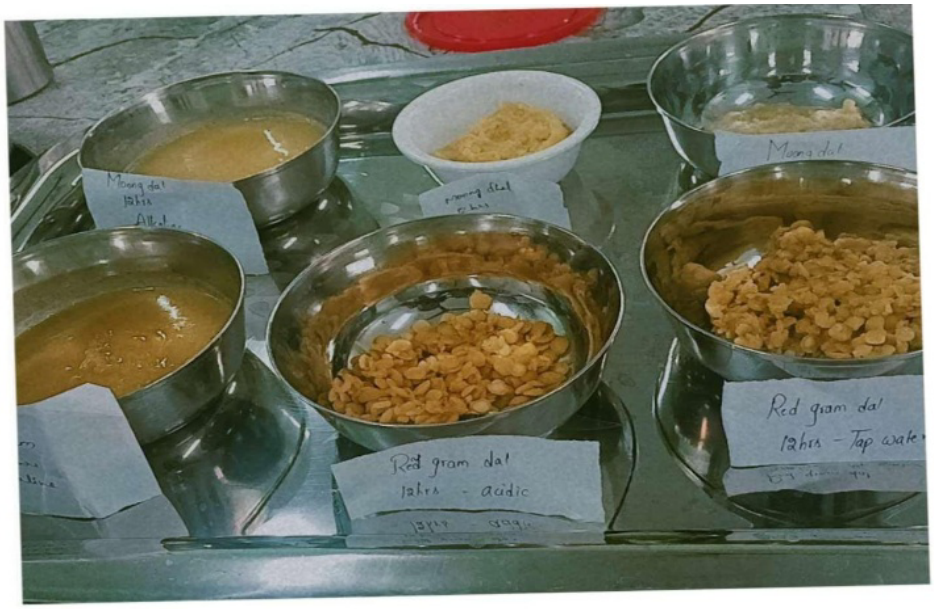
Experiment III:

EFFECT OF WITHOUT PRIOR SOAKING:

Weigh about 80gm of red gram dhal and it is not soaked later it is divided into four parts each of it about 20 gm. Then these 20 gm of dhal is cook with tap water, distilled water, alkali (baking soda) and in acid (citric acid or lemon juice).

Note the weight of dhal before and after cooking. Tabulate the results on texture, colour and time of cooking.

All the variations are repeated with green gram dhal, peas, soya bean, and whole bengal gram dhal.



PULSE COOKERY IN ACIDIC BASIC AND TAP WATER.

TABLE:

S.No.	Types of Pulses	Cooking Time	Texture	Colour
1.	Black Gram			
2.	Chickpeas			
3.	Red Kidney Beans			
4.	Bengal Gram			

SELF ASSESSMENT QUESTIONS:

1) How does soaking affect the colour, texture and flavour of pulses?
2) Write the effect of acid and alkali on the texture of pulses?

REFERENCES:

1) Charley, H. Food Science. 1982

EXPERIMENT-2.5

VEGETABLE COOKERY

OBJECTIVES:

- To demonstrate the effect of cooking time on the colour, texture of vegetables.
- Effect of cooking time of vegetables with strong flavour and odour.
- Effect of cooking medium like baking soda, lime and milk.
- Effect of cooking methods on vegetables containing various pigments and flavours.

INTRODUCTION:

Vegetables are much more varied in the form than the fruits they are edible parts of the plants. Vegetables cookery is a better test of a good cook than fancy desserts. Excess water and oven cooking eliminates flavour, texture, vitamins and minerals present in fruits and vegetables various methods of cooking involves boiling, steaming, braising, baking, grilling and frying.

PROCEDURE:

Experiment-1:

EFFECT OF COOKING TIME ON VEGETABLES:

Take four 30 grams portion of vegetables, green leafy vegetables, beans, carrots, beetroots.

Add cup of water of each vegetables; cook the vegetables for 5-15Min and 30-60Min. Cover the vessel with a suitable lid. Remove 10 ml of water from each vessel in a test tube and ¼ cup of the vegetables to a plate. Note the intensity of axon of extract in a test tube at each time interval. Note the colour and texture of vegetable each time and discuss the results noted.

Experiment-2:

EFFECT OF COOKING TIME OF STRONG FLAVOURED VEGETABLES:

Cook 100 gm of cabbage in water sufficient to cover, in distilled flask, catch the distillates into the flask receives and into water. After the water begins to boil count the time wheat flour portion charging the flask containing the dilute smell the distillates at the end of the glass. Test for sulphides by adding few drops of lead acetate. Note the types of flavours.

Experiment-3:

EFFECT OF COOKING MEDIUM ON THE COLOUR AND TEXTURE OF COLOURED VEGETABLES:

Wash 125 gm of beans cut into pieces and divide into two equals and cook as follows:

Take 100ml of tap water, bring it to boil and add the cut parts and cook for 20min, repeat it with distilled water and cook for 20min in a covered vessel.

EFFECT OF ACID MEDIUM:

Boil 100 ml of tap water and add 1 tsp of lime juice in a vessel. Bring it to boil and add ¼th portion.

Boil 20 gm with peeled potato in 100 ml water.

Repeat 20 gm with 200 ml of water for 20 min cook the vegetables evaporates 25 ml of this water in dishes and weigh make up the residue for 100 ml with distilled water.

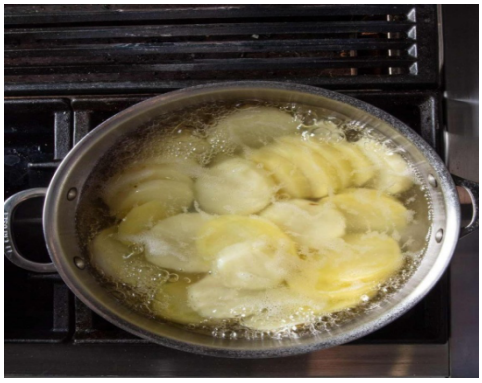
EFFECT OF BASE MEDIUM:

Boil 100 ml of tap water to 1 tsp of baking soda is added. Now add the 3^{rd} portion of the cut vegetables and cook for 20 min in a covered vessel. Drain the water and put the vegetables on a plate.

TABLE: EFFECT OF COOKING ON VEGETABLES

Vegetable	Medium	Weight before cooking	Weight after cooking	Time	Colour	Texture	Inference
Brinjal **Potato** **Carrot** **Bitter guard** **Cabbage** **Tomato** **Onion** **Beetroot** **Spinach** **Mint** **Amaranthus** **Colacassia**	Tap water Alkaline medium Acid medium						

POTATO IS BOILING IN TAP WATER



SELF-ASSESSMENT QUESTIONS:

1) How does the cooking medium can affect the colour, texture and flavour of vegetables?
2) How does the alkaline medium affect the texture of green leafy vegetables?

REFERENCE:

1) Food Science B.Sri Lakshmi 8th edition New Age International Publications. .

EXPERIMENT-2.6

ENZYMATIC BROWNING

OBJECTIVES:

- To study the different properties of various fruits and vegetables.
- To acknowledge the reactions that takes place in various fruits and vegetables.
- To understand the principle behind browning of the foods.
- To acknowledge the nutritive quality of foods.

PRINCIPLE:

Enzymatic browning is a widespread colour reaction occurring in fresh-cut fruits and vegetables, which is usually initiated by the enzymatic oxidation of monophenols into o-diphenols and o-diphenols into quinines, which undergo further non-enzymatic polymerization leading to the formation of pigments.

INTRODUCTION:

Fruits are values for their attractive colour, aroma, mainly due to aldehydes, alcohols and ethers. When the cut surface of fruits and vegetables are exposed to air, brown pigments are formed. This is known as browning. Browning involves two types; enzymatic and non enzymatic. The browning reactions occuring between carbohydrates result in materials from reacting when tissues of cut surface exposed to air. The phenyl oxidase, enzyme is released at the surface, and act on the phenyl present oxidising them to orthoquinone. The orthoquinones rapidly polymerise to form brown pigments.

METHODS:

Browning Reactions:

1. **Effect of sugar:**
   - Sprinkle sugar on one piece of apple, banana, potato and brinjal. Note the observation to find the changes by enzymatic browning.
2. **Effect of baking soda:**
   - Cut the fruits and vegetables and sprinkle the baking soda on the surface of fruits and vegetables and keep a side and they change in colour then note it.
3. **Effect of air:**
   - Peel the fruits and cut the vegetables with the pieces put them on a plate and let them expose to air. Note the observation after browning occurs.
4. **Effect of cooking:**
   - Cut the fruits and vegetables and boil them on a hot water and after boiling for 3 minutes, keep the vegetables and fruits in the atmosphere and note the observation.

Fruits and vegetables	Medium	Time	Time taken	Time	Browning inference
Apple	Air Basic Sugar Boiling				
Banana	Air Basic Sugar Boiling				
Potato	Air Basic Sugar Boiling				
Brinjal	Air Basic Sugar Boiling				

ENZYMATIC BROWNING IN APPLE

SELF ASSESSMENT QUESTIONS:

1) How does the activity of polyphenol oxidase (PPO) contribute to enzymatic browning in fruits and vegetables?
2) What methods can be used to prevent or reduce enzymatic browning in fruits and vegetables, and how do they work?

REFERENCE:

1) Food science B. Sri Lakshmi 8th edition New age International publishers.

EXPERIMENT-2.7

SUGAR COOKERY

OBJECTIVES:

- To observe the consistency of sugar when applying the heat.
- Analyzing the effecting time and temperature of sugar during cooking.

PRINCIPLE:

Caramelization: sugar breaks down into simple compounds, turning golden brown and developing a rich flavor.

Crystallization: sugar dissolves and then recrystallizes, forming a smooth, creamy texture.

Materials Required: Thermometer, cooking equipment, plate of cold water, tartaric acid, glucose and jaggery.

METHODS:

1. **Thread:** syrup spins a 2 inch thread between thumb and first finger at 110 - 112°C, (230 - 240°F).
    - Used in making of syrups of fulab jamun and jalebi.
2. **Soft ball:** syrup when dropped in cold water forms ball that flattens at 112 - 115°C, (234 - 240°F).
    - Used to make barfi and fondant on fudge.
3. **Firm ball:** removal from water. Syrup when drpped into cold water, forms a ball that does not flatten on from water at 118 - 120°C (244 - 248°F).
    - Used to make boondi and laddu.
4. **Hard ball:** syrup when dropped into cold water, forms a ball that hard enough to hold it at 121 - 130°C (250 - 256°F).
    - Used to make marshmallows.
5. **Soft crack:** syrup when dropped into cold water, thread that are hard but not brittle at 132 - 143°C (270°F).
    - Used to make butterscotch and toffies.
6. **Hard crack:** syrup when dropped into cold water threads that are brittle at 149 - 154°C (300 - 310°F) temperatures.
    - Used to make glace hard chikki

7. **Clear liquid:** sugar liquefies, liquid becomes brown at 160 - 170°C (320 - 338°F) temperatures.
    - Used to make barley sugar caramel.

REFERENCE:

1) B.Srilakshmi, Foodscience 8th multicolor edition, Newage International Publisher.

EXPERIMENT-2.8

FATS AND OILS

OBJECTIVES:

- To study the different methods of fats and oils
- To the physical characteristics of fats and oil in the effect of temperature and time in different methods

PRINCEPLE:

The principle for fats and oils in various contexts revolves around their physical and chemical properties.

INTRODUCTION:

Fat is present naturally in many foods. This fat is often referred to as to as initial invisible fat.

Example of foods containing appreciate quantities of invisible fat include meat, poultry; fish are made from these products. They are lard, cooling oils, salad oils, margarine and butter. Fats play a varity of roles in both food preparation and nutrition. In common usage, fats, that have a relatively high melting point and are room temperature are called fats, where as those that have lower melting points and are liquid at room temperature are called oils.

METHODS:

GHEE:

330 gm of ghee is taken and kept for heating weight of the ghee to heat, the smoking point is noted ,whereas the temperature at which also noted. The colour and taste of the food item that is fired in the ghee is also observed.

Firstly, ghee of 330gm is put to heat as it usa saturated fat, it is in the form of solid, in room temperature. it started melting after being saturated heating for 8sec at 10c.The smoking point is observed after heating ghee for 45sec at 90c.after nothing the melting and smoking points, poori made from wheat flour of 50gms is fried in the heated ghee, which is formed crispy and changed its colour, due to heating after frying the amount of oil absorbed by the poori is calculated.

The amount of ghee taken to fry the poori is 300gms.Thus the ghee remained after the poori is fried the poori is 300gms to get fired the colour of the poori changed to golden brown colour and taste is good and the poori is crispy.

PALMOIL:

250gms of palm oil is taken and kept for heating to know the mealting point, smoking point, weight of oil absorbed by food samples after frying, colour and taste of food sample. it takes upto 6min 2sec to get melting point is fried in 250gms oil for 5sec.the amount of oil

absorbed is 40ml by the food sample. It weights 210gms after frying the poori by heating the poori in palm oil it is golden brown colour and tastes good.

COCONUT OIL:

250gms of coconut oil is taken and kept for heating to know the melting point, smoking point, weight of oil absorbed by food samples after frying, colour and taste of food sample. it takes upto1min 37sec to get melting point on 80°C and 2min 57sec to get smoking.

After melting and smoking point poori is fried on 250gms of 5sec we observed that 26gms of oil is absorbed by the food sample. So, it weights 224gms after frying the poori by heating the poori in coconut oil it is golden brown colour and tastes good.

SUNFLOWER OIL:

250 gms of sunflower oil is taken, and kept for heating also we need to note the melting point, smoking point of oil, also weight of oil absorbed by food item after frying is also observed colour and taste is discussed.

Firstly took the oil weighed 250gm heated for 2min at 110°C. It can be observed the smoking point at 210°C after noting this poori is fried in 250 gm of oil until its golden brown, crispy. It is fried in sunflower oil after frying the amount of oil is 232gm.The pouri is crispy and tasty.

GROUND NUT OIL*:*

250gms of ground nut oil is taken and kept for heating and also to note the melting point, Smoking point of oil and weight of oil absorbed by food item after frying Colour and taste enhanced by the type of oil is discussed.

First weigh 250gm of oil and heat for 2 min at 180 °C. Observe the melting point; later at 6min observe the smoking point of oil at 120°c. After noting these point poori is fried it nut is in 250g of oil until golden brown, Crispy. It is fried in ground nut oil after frying the amount of oil absorbed by poori is calculated. After cooking weight is of oil absorbed by poori is 24gm and the poori is crispy and tasty.

MAYONNAISE

Ingredients:

Egg-2

Garlic-2gm

pepper-29

Salt-2g

Sugar-ig

Vinegar-2ml

vegetable Oil 2 Cups (Neutral Oil Such As Sunflower)

PROCEDURE:

- Crack the eggs and add yolks and whites for the
- Measure out all the other ingredients accurately for Consistency.
- Place the eggs in a mixing bowl.
- Add garlic, salt, sugar, and pepper. Wisk until smooth. Gradually add the vegetable oil drop by drop while whisking vigorously to start the emulsion.
- Once the mixture starts thickening, increase the oil addition in a slow and steady stream while maintaining constant whisking.
- Check the consistency of the emulsion. If too thick, thin it with a few drops of water or vinegar Transfer the prepared emulsion into a clean, airtight Container and refrigerate

REFERENCE:

1) B. Srilakshmi, Food Science, 8th Edition. New Age International Publications.

EXPERIMENT-2.9

MILK COOKERY

OBJECTIVES:

- To learn about milk cookery

PRINCIPLE:

When milk is heated, some of its protein tends to settle out (coagulate) on the sides and bottom of the pan and can scorch easily unless the milk is heated on a very low heat.

INTRODUCTION:

All mammals produce milk after birth of young one and may cause many mammals as food milk complex mixture of carbohydrates, protein and many other organic compounds. These are two parts: caesin and whey.

Caesin classified as phospho protein due to phosphoric acid contained in molecular structure. Whey protein made up of alfa-lacto albumin and beta-lactoglobulin and protein peptones.

METHODS:

Experiment-1

BOILING POINT OF PH:

Note the charectaristics of milk by putting a drop of water on pit paper of 6 and observe above. Observe colloid milk. Record boiling point of milk and ph changes of milk on boiling point.

Experiment-2

FORMATION OF SCUM &CHARECTARISTICS OF COMPONENTS:

Boil 100ml of milk often vessel and yellow. Cool without disturbances. Note carefully colour of scum. Remove from milk add ammonium oxalate to solution. After neutralizing note precipitate formed. Give interference and identify nutrients of scum from test.

Experiment-3

COAGULATION OF MILK PROTEIN BY ACID:

Coagulation milk protein by acid and treat boil 100ml of macro milk and rate ph. A fresh extract time add stop add by time. When thick precipitate from measure ph and observe changes and reference.

Experiment-4

COAGULATION OF MILK BY BASE:

100ml of raw milk and note ph. Add a spoon of boiling soda (NaHCo3) watch until the thick precipitate formed. Measure the ph and observe changes.

Experiment-5

COAGULATION OF MILK PROTEIN BY VEGETABLES:

Boil 100ml of raw milk and note phrate. Divide it into two parts. Cool one part with beans and another part with vegetables (carrot). Measure the ph and observe the changes and note the ph.

Medium	**PH**	**Time**	**Colour**	**Texture**	**Changes**
1.Boiling of milk.					
2.Acid					
3.Alkaline					
4.Carrot					
5.Beans					

SELF-ASSESSMENT QUESTIONS:

1) What is the ph range of the boiling point of milk?
2) What type of changes is occurred when milk is boiled in acidic medium?
3) What is the ph range of the milk in alkaline medium?
4) How much time it takes to coagulate of milk in the medium of beans?
5) What is the colour and texture of milk in alkaline medium?

REFERENCE:

1) B. Srilakshmi, Food Science, 8th edition. New Age International Publications.

EXPERIMENT-2.10

EGG COOKERY

OBJECTIVES:

- To observe the pH of egg
- To know the index of egg
- To observe the quality of egg
- To observe the effect of time and temperature of the egg
- Observe the formation of green ring
- Preparation of poached egg
- Preparation of scrambled egg

PRINCIPLES:

Egg cookery is to avoid overcooking eggs. Overcooking can make eggs tough, discoloured and unpleasant to taste. The most important rule of egg cookery is a very simple one. Avoid high temperature and long cooking times. In other words, do not overcook. Eggs are largely proteins, so the principle of coagulation is important to consider.

INTRODUCTION:

Egg cookery is the art of preparing eggs using a variety of techniques. Eggs can be prepared in many ways including boiling, scrambling, frying, poaching and baking.

Eggs boiled in the shell, baked beans eggs, poached eggs, fried eggs, scrambled eggs, three styles of omelettes, and souffles. The word boiling although commonly used, does not correctly explain the technique; simmering is more accurate.

METHODS:

Experiment 1:

pH As Determinant Of Egg Quality

Broken the fresh eggs are started to change the colour for more than 3 days. Break on egg into the plate and note the pH of both yolk and albumin with pH indicator.

Experiment 2:

TO KNOW THE YOLK & ALBUMIN INDEX

Take an egg and break it carefully and pour into a flat glass plate, measure the width of yolk by a thin brown stick from centre, carefully & also measure the weight of yolk.

Calculate the weight & height of egg for yolk index

Yolk Index= Height of yolk/ width of yolk

Experiment 3:

QUALITY OF EGG

Quality of egg is determined by various characteristics of pH, weight, width, height. Weight of whole egg is 58 g.

Experiment 4:

EFFECT OF TIME & TEMPERATURE

When egg is boiled in water at 100°c for 15 minutes, the egg is completely cooked; due to the complete coagulation of egg protein when egg is boiled in water at 80°c it is hot completely cooked and result in slippery& runny consistency.

When egg is boiled in water at 90°c, egg is not coagulated and resulted in liquid yolk and albumin when egg is boiled in water at 100 °c for 5 minutes egg is slightly cooked and yolk is little tough

Experiment 5:

POACHED EGG

Egg is cooked in boiled water for 30 minutes by directly breaking into the water which is known as poaching. Egg white, egg yolk is cooked in water.

Experiment 6:

SCRAMBLED EGG

Scrambled egg is made from mixing the egg contents along with salt and pepper and scrambling them over butter applied pan. It is a dry heat method of cooking.

SELF ASSESSMENT:

1) How to determine the quality egg?
2) Explain briefly about egg cookery?
3) Write about egg proteins? Which protein is responsible for foaming in egg?
4) Explain poaching of egg and scrambling of egg?

REFERENCE:

1) B. Srilakshmi , food science, 8th edition. New Age International Publications.

EXPERIMENT-2.11

MEAT AND FISH COOKERY

OBJECTIVES:

- To study the different cooking methods and tenderizers.
- To study the physical characteristics of fresh meat and fish effect of temperature and time of cooking development and procedure adopted in meat.

PRINCIPLE:

Meat cookery involves the physical and chemicals changes that occur during cooking of the meat. Cooking meat improves its flavour, changes its colour, tenderizes it, and destroy the harmful organisms.

INTRODUCTION:

The flesh or other edible parts of animally (usually domesticated) cattle, swine and sheep used for food including not only the muscles and fat but also tendons and ligaments. Meat is valued as "Complete protein" food containing all amino acids necessary for human body. Mostly animal muscle roughly contains 75% of water, 20% protein, 5% fats, and carbohydrates, whereas, the fish is second most important source of protein and fat especially omega- 3-fatty acids. Preparation of meat and fish with different methods of cooking as follows

METHODS OF COOKING:

- **DRY HEAT METHOD:** Roasting, Frying, Grilling.
- **MOIST HEAT METHOD:** Stewing, Boiling, Shallow frying, Pressure cooking.
- **SHALLOW FAT FRYING :**

  Shallow fat frying is hot oil based cooking technique. It is typically used to prepare portion sized cuts of meats, fish, potatoes and patties such as fritters. Shallow fat frying can also be used to cook vegetables. It is medium high to high cooking process temperature between 160^{o}C-190^{o}C (320^{o}F–374^{o}F) are typically but shallow frying may be performed of temperature low at 150^{o}C (302^{o}F) for a long period of time the high temperature promotes protein denaturation on browning and in some cases a millard reaction.

RECIPE: CHICKEN NUGGETS:

INGREDIENTS:

- Minced chicken -100g.

- Ginger garlic paste – 1tsp.
- Turmeric – 1/2 tsp.
- Salt -1/2 tsp.
- Bread crumbs -2tbsp.
- Red chilli powder – 1/2 tsp.
- Besan flour -1tsp.
- Rice flour -1 tsp.
- Oil - for deep frying.

FOR COATING:

- Bread crumbs – 1/2 cup.
- Egg – 1 (beaten).

PROCEDURE:

- In a mixing bowl combine cooked chicken, salt, turmeric, red chilli powder, ginger garlic paste, besan flour, rice flour and bread crumbs.
- Take small portion of the chicken mixture and shape them into nuggets.
- Dip the nuggets into the beaten egg and finally coat it with bread crumbs.
- Heat oil in a deep pan for frying.
- Fry the nuggets in batches until golden brown and crispy about 4 -5 minutes.
- Remove and place them on a paper towel to drain off the excess oil.

CHICKEN NUGGETS

RECIPE: MUTTON CUTLETS:

INGREDIENTS:

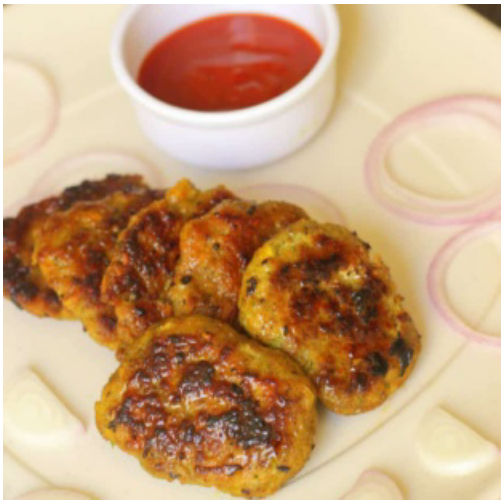
- Minced boiled mutton -100gm.
- Ginger garlic paste -1tsp.
- Garam masala powder -1 tsp.
- Salt -1/2 tsp.
- Red chilli powder – 1/2 tsp.
- Rice flour -1/2 tsp.
- Turmeric -1/2 tsp.
- Coriander powder -1/2 tsp.
- Bread crumbs -1 tsp.
- Gram flour -1 tsp.
- Oil – for shallow frying.

FOR COATING:

- Bread crumbs – 1/2 cup.
- Egg – 1(beaten).

PROCEDURE:

- In a mixing bowl combine the shredded boiled mutton, ginger garlic paste, bread crumbs, all the spices (i.e., salt, turmeric, red chilli powder, garam masala powder).
- Mix thoroughly until the mixture holds together.
- Divide the mixture into equal portions. Shape the each portion into flat or round cutlets.
- Dip each cutlet in the beaten eggs. Ensuring it is fully coated.
- Roll it in bread crumbs pressing gently to ensure the crumbs coat well.
- Shallow frying the cutlets in batches until golden brown and crispy about 3-4 minutes per side.
- Remove and drain off on a paper towel to remove excess oil.



MUTTON CUTLET

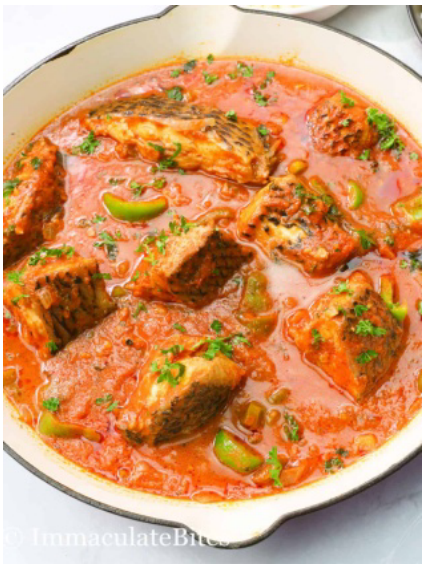
RECIPE: STEWED FISH CURRY:

INGRIDIENTS:

- Fish slices- 3-4.
- Medium florets or cauliflower- 10-12g.
- Potato- 50g.
- Carrot -30g.
- Chopped cabbage- 1/4 cup.
- Chopped spinach- 1/2 cup.
- Green peas- 1/4 cup.
- Milk -1/2 cup.
- Tomato puree- 30g.
- Onion-30g.
- Ginger garlic paste-2tsp.
- Bay leaves- 2-3.
- Green cardamom-2.
- Black pepper -1tsp.
- Oil -10ml.
- Butter-1/2tsp.

PROCEDURE:

- Marinate the fish slices with salt and black pepper powder.
- Heat oil in a pan Shallow fry the marinated fish slices.
- In the same pan add the remaining oil when smoking hot throw in the black pepper, green crushed cardamom and bay leaves, sauté for a min to release their aroma.
- Now add the onions, sauté till light brown. Stir in the tomato puree and ginger garlic paste sauté for 5-7mins till the raw smell of the tomato is gone.
- Now add the potatoes, cauliflower, carrots, and green peas sprinkle in the salt, black pepper continue to cook till the vegetables turn light brown.
- Add 2 cups of warm water bring to a simmer when the vegetables are almost tender gently add the fried fish. Cook for further 3-4 mins over a high flame.
- Pour in the milk while stirring continuously and cook for 5-7 mins.
- Fish with black pepper and butter.



STEWED FISH CURRY

SELF ASSESSMENT QUESTIONS:

1) What is the temperature for method of cooking for shallow frying?
2) Which method of cooking is employeed for meat and fisk cookery?

REFERENCE:

1) Food Science, By- Sri Lakshmi, 8th Edition. New Age International Publishers.

EXPERIMENT-2.12

SENSORY EVALUATION OF FOODS

OBJECTIVE:

- To evaluate the food samples using sensory tests.

TYPES OF TESTS:

Different sensory tests are employed for food evaluation. The tests are grouped into four types.

- Difference tests.
- Rating tests.
- Sensitivity tests.
- Descriptive tests.

The selection of a particular test method will depend on the defined objective of the test, accuracy desired and personnel available for conducting the evaluation.

DIFFERENCE TESTS:

Paired Comparison Test:

Test of difference in which a specific characteristic is designated to be evaluated in two samples. The sample with the greater level of the characteristic is to be identified. Judge has a 50% chance of being right by chance alone.

a) Paired comparison Test:

PAIRED COMPARISON TEST

Name: **Date:**

Product:

You are given one or several pairs of samples. Evaluate the two samples in the pair for …… Is there any difference between the two samples in the pair?

Code No.of Pairs	Yes	No

Signature

Duo-Trio Test:

Difference test in which two samples are judged against a control to determine which or the two is different from the control. Judge has a 50% chance of being right by chance alone.

b) Duo-trio test:

DUO-TRIO TEST

Name: Date:

Product:

The first sample R given is the reference sample.

Taste it carefully

From the pair of coded samples next given, judge which sample is the same as R.

Set No.	Code no. of pairs	same as 'R'
I.		

Signature

Triangle Test:

Difference test in which 3 samples are presented (two of the samples are the same).

Panellists are asked to identify the odd sample. Judge has a 33.3% chance of guessing the right answer due to method of presentation.

C) Triangle Test:

TRIANGLE TEST

Name: Date:

Product:

Two of the three samples are identical. Determine the odd sample.

Set No.	Code no. of samples	Code no. of odd samples	Comment on odd samples
I.			

Signature

RATING TESTS

Rank Order:

Samples are ranked in order of intensity of a specific characteristic. Valuable when several samples need to evaluated for a single characteristic.

a) RANKING TEST:

RANKING TEST

Name: Date:

Product:

Please rank the samples in numerical order according to your preference or intensity of aroma/taste characteristic of the product.

Intensity/preference Sample code

I.

Signature

b) SINGLE SAMPLE (MONADIC) TEST:

SINGLE SAMPLE (MONADIC) TEST

Name: Date:

Product:

Please taste and rank the sample carefully. Can you detect any off-flavour in the product?

Circle one

Yes No

If you detect any off-flavour please describe it below:

Intensity (circle one)	Comments
Trace	Off-flavour is due to
Moderate	Off-odour
Strong	Off-taste
	Residual taste
	Other defects

Signature

c) Two-Sample Difference Test:

TWO-SAMPLE DIFFERENCE TEST

Name: Date:

Product:

1. Compare the coded sample to the reference sample independently in each of the four pairs given. Test sample may or may not be different from the reference sample.

2. Determine the degree and direction of difference on the following scale.

Degree		**Direction**	
No difference	0	Superior to standard	S
Very slight difference	1	Equal to standard	E
Moderate difference	2	Inferior to standard	I
Lage difference	3		

3. Comment on what the difference is based on odour, taste or both.

Sample code No.	Degree of difference	Direction	Comment

(Note: If there is no difference, there is no degree or direction)

Signature

e) Multiple Sample Difference Test:

MULTIPLE SAMPLE DIFFERENCE TEST

Name: Date:

Product:

You are given a standard or reference sample marked "R" .Taste it carefully for the quality characters to be evaluated. You are next given a number of samples which are to be compared to the reference sample for odour and flavour. Rate in each sample degree of difference and direction of quality according to the following scale.

Degree of difference Direction of quality

Rating	Difference from standard	
0	None	E Equal
1	Slight	I Inferior
2	Moderate	S Superior
3	Large	

Sample	Odour		Flavour	
Code No	Degree	Direction Comments	Degree	direction comments

Signature

Hedonic Rating Test:

Hedonic rating relates to pleasurable or unpleasant experiences. The hedonic rating test is used to measure the consumer acceptability of food products. From one to four samples are served to the panellist at one session. He is asked to rate the acceptability of the product on a scale, usually of 9 points, ranging from 'like extremely' to dislike extremely'. Scales with different ranges and other experience phrases could also be used. The results are analysed for preference with data from large untrained panels.

a) Hedonic Rating Test:

HEDONIC RATING TEST

Name: Date:

Product:

Taste these samples and check how much you like or dislike each one. Use the appropriate scale to show your attitude by checking at the point that best describes your feelings about the sample. Please give a reason for this attitude. Remember you are the only one who can tell what you like. An honest expression of your personal feeling will help us.

Code	Code	Code
Like extremely		
Like very much		
Like moderately		
Like slightly		
Neither like nor dislike		
Dislike slightly		
Dislike moderately		
Dislike very much		
Dislike extremely		
Reason		

Signature

b) Numerical Scoring Test:

NUMERICAL SCORING TEST

Name: Date:

Product:

Please rate these samples according to the following descriptions:

Score	Quality description
90	Excellent
80	Good
70	Fair
60	Poor

Sample	Score	Comments

Signature

c) Composite Scoring Test:

COMPOSITE SCORING TEST

Name: Date:

Product: Orange Marmalade

Quality	Possible score	Sample Scores
Colour	20	
Consistency	20	
Flavour	40	
Absence of defects	20	
Total score	100	

Comments:

Signature

SENSITIVITY TESTS:

Sensitivity tests are done to assess the ability of individual to detect different tastes, odours and feel the presence of specific factors like astringency or hotness (pepper). These tests are used to select and train panel members for evaluating the quality of products containing spices, salt and sugar, e.g. tomato ketchup or sauce. For this purpose, threshold tests for the recognition of basic tastes (sweet, sour, bitter and acid) are employed for selecting the panel members.

SENSITIVITY THRESHOLD TEST:

Sensitivity tests are to measure the ability of an individual to smell, taste or feel specific characteristics in food or beverages or pure substances are used frequently in selecting for evaluations in product research and development. Also, they are used to establish intensity of sensory response of a food.

SENSITIVITY-THRESHOLD TEST

Name: Date:

You receive a series of beakers with increasing concentrations of one of the four taste qualities (sweet, salt, sour and bitter). Start with beaker no. 1 and continue with beaker no. 2, no. 3, etc. Retesting of already tasted solutions is not allowed. Describe the taste or give intensity scores.

Use the following intensity scale.

0= None or the taste of pure water 1 = Weak

? = Different from water, but taste 2 = Medium

quality not identifiable 3 = Strong

X = Threshold very weak (taste identifiable) 4 = Very strong

5 = Extremely strong

Set No.	Description of taste and feeling a factors
1	
2	
3	
4	

Signature

THRESHOLD TEST:

Threshold is defined as a statistically determined point on the stimulus scale at which a transition in a series of sensations or judgements occurs. There are mainly three types of thresholds as described below:

a) Stimulus detection threshold is that magnitude of the stimulus at which a transition occurs from no sensation to sensation.

b) Recognition identification threshold is the minimum concentration at which a stimulus is correctly identified.

c) Terminal saturation threshold is the magnitude of a stimulus above which there is no increase in the perceived intensity of the stimulus.

d) The recognition threshold tests with basic tastes or odour are most frequently employed for panel selection and with materials such as species for assessing the intensity of odour or flavour as the main threshold value by a trained panel. The threshold value is given as a mere number which is the denominator of the dilution where the odour or flavour is recognized. These tests are also used where a minimum detectable difference of an additive or of an off-flavour are to be established.

Dilution Test: Dilution tests are designated to establish the smallest amount of an unknown material, developed as a substitute for a standard product that can be detected when it is mixed with the standard product, e.g., margarine in butter, dried whole milk in fresh milk, synthetic orange flavour ingredients with natural flavour and so on. The quality of the test material is represented by the dilution number which is the percent of the test material in the mixture of the standard product such that, there exists a just identifiable difference in odour and taste between them. The bigger the dilution number the better is the quality of the test material.

Descriptive flavour profile method: This is both qualitative and quantitative description method for flavour analysis in products containing different tastes and odour.

Aroma		**Taste**		**Mouth feel**		**Texture**	
Garlic	1	Sour (Tomato)	1	Chillies	1	Smoothness	3
Pepper	2	Sweet (Sugar)	2				
Onion	3	Salt	1				
Cinnamon	2						
Cloves	1						

REFERENCE:

1) Food Science, B. Sri Lakshmi Eight Edition.