Choice Based Credit Based System

Scheme & Syllabus of

Master of Technology- Process and Food Engineering

(M. Tech of Process and Food Engineering)

(Batch 2022)



By

Board of Study (Food Science and Engineering)(Main Campus)

Department of Food Science and Technology IK Gujral Punjab Technical University **Master of Technology in Food Technology (M. Tech of Process and Food Engineering)**/ It is a Post Graduate (PG) Programme of 2 years duration (4 semesters)

Eligibility criteria for Admission: B.Tech. / B.E. (Food Engineering / Food Technology / Food Engineering & Technology / Food Process Engineering / Food Process Technology / Dairy Technology / Dairy Engineering / Food Biotechnology / Agri. Process Engineering / Agri. Engineering / Biotechnology)

or

B.Sc. (Hons) in Food Technology, B.Sc. (Hons.) Agriculture (with elective / hons in Food Technology / Food Process Engineering) or any equivalent degree with atleast 50% (45% in case of candidate belonging to reserved category) marks in aggregate.

Semester First

Corse Code	Course Title	Туре	Load Allocation			Marks Distribution		Total	Credits
			L	Т	Р	Inter nal	Extern al	10ta1	CICUIts
MTPFE-511-22	Food Engineering	PC	4	0	0	40	60	100	4
MTPFE -512-22	Process Engineering of cereals, pulses & oil seeds	PC	4	0	0	40	60	100	4
MTPFE -513-22	Energy Management	PC	4	0	0	40	60	100	4
MTPFE -514-22	Advances in Post- harvest Technology of Fruits and Vegetable	РС	4	0	0	40	60	100	4
MTPFE -515-22	Lab-I Food Process Engineering	PC	0	0	4	30	20	50	2
MTPFE -516-22	Lab-II Technology of cereals, pulses & oil seeds	PC	0	0	4	30	20	50	2
MTPFE -517-22	Lab-III Advances in Post- harvest Technology of Fruits andVegetable	PC	0	0	4	30	20	50	2
	Total		16	0	12	250	300	550	22

SEMESTER FIRST

MTPFE-511-22: Food Engineering

Unit-1

Engineering Properties of foods, their significance and importance in equipment and process design. Material and energy balances, types and Properties of fluids Flow rate, friction losses and pressure drop relationships for Newtonian fluids through pipe. Steady state and unsteady state heat transfer. Numerical, graphical methods in the analysis of heat transfer. Solutions of unsteady state equations.

Unit-2

Kinetics of biological reactions-order of reaction, quality changes during storage of foods. Application of Arrhenius equations to biological reactions. Food quality modelling. Principles of Refrigeration. Natural refrigeration, Vapour compression refrigeration. Mollier Chart, Rating of Systems, Compressors, evaporators, Condensers, Expansion valve. Hear Pump, Absorption refrigeration.

Unit-3

Freezing of foods, prediction of freezing time. Thermal Processing foods. Pasteurization and sterilization, D value, F value, Z value. Process time calculation. Cook value and quality retention.Time temperature integrators (TTI). Microbial survival curve. Lethality, Ball method. Process calculation by graphical method.

UNIT-4

Mixing - Terminology (agitating, kneading, blending, and homogenizing), equipments - mixers for liquids of low or moderate viscosity (Paddle agitators, turbine agitators and propeller agitators), mixers for high viscosity pastes (Pan mixer, horizontal mixer and dough mixer), mixers for dry solids (tumbler mixer and vertical screw mixer), effect of mixing on foods. Power consumption and efficiencies.

Suggested Readings:

- 1. Geankoplis J Christie. (1999). Transport Process and Unit Operations. Allyn & Bacon.
- 2. Earle R. L. and Earle M.D.. Unit Operations in Food Processing
- 3. McCabe WL & Smith JC. (1999).Unit Operations of Chemical Engineering. McGraw Hill.
- 4. Sahay KM & Singh KK. (1994). Unit Operation of Agricultural Processing. Vikas Publ. House.
- 5. Singh RP and Heldman DR. (1993).Introduction to Food Engineering. Academic Press

MTPFE -512-22: Process Engineering of cereals, pulses & oil seeds

UNIT - 1

Utilization of cereals, pulses and oilseeds, Grain structure of cereals, Pulses and oilseeds and their milling fractions, Grain quality standards and physico-chemical methods for evaluation of quality of flours.

UNIT - 2

Sieving, Particle size analysis, Grinding and cutting, Energy used in grinding, Grinding equipment. By-products and effluents from different cereal processing industries and various techniques for their utilization and management.

UNIT – 3

Pre-milling treatments and their effects on milling quality. Parboiling, conventional, modern and integrated rice milling operations. Wheat flour milling operation. Processes for milling of corn, oats, barley. Dhal milling operation. Expeller and solvent extraction processing of oilseeds. Refining of oil.

UNIT - 4

Grain storage structures - location and material selection for storage building, Types - traditional, modern; temporary and permanent storage structures; design considerations. Air tight, controlled atmosphere and modified atmospheric storage. Infestation control/sanitation-in-process and post process. Fumigation and aeration.

Suggested Readings:

- 1. Asiedu J.J.1990. Processing Tropical Crops. ELBS/MacMillan. Chakraverty A. 1995. Post-harvest Technology of Cereals, Pulses and Oilseeds. Oxford & IBH
- 2. Morris Lieberman. 1983. Post-harvest Physiology and Crop Preservation. Plenum Press.
- 3. Pandey P.H. 1994. Principles of Agricultural Processing. Kalyani.
- 4. Pillaiyar P. 1988.Rice Post Production Manual. Wiley Eastern.
- 5. Sahay K.M and Singh K.K. 1994. Unit Operations in Agricultural Processing. Vikas Publ. House.

MTPFE -513-22: Energy Management

UNIT-1 Energy forms and units, energy perspective, norms and scenario; energy auditing, data collection and analysis for energy conservation in food processing industries. Classification of energy sources; Introduction to renewable energy sources; characterization of biomass; types, construction, working principle, uses and safety/environmental aspects of different renewable energy devices like gasifiers, biogas plants.

UNIT-2 Solar passive heating devices, photovoltaic cells and arrays, Phase Changing Materials; Brief introduction to wind energy, hydroelectric energy, ocean energy, briquetting and baling of biomass, biomass combustion, biodiesel preparation and energy conservation in agriculture.

UNIT-3 Energy forms and units, energy perspective, norms and scenario; energy audit and management in agro-processing units, data collection and analysis for energy conservation in food processing industries. non-conventional energy sources in agro-processing industries.

UNIT-4 Reuse and calculation of used steam, hot water, chimney gases and cascading of energy sources. Energy accounting methods, measurement of energy, design of computer-based energy management systems, economics of energy use.

SUGGESTED READINGS:

1. Garg HP & Prakash J.1997. Solar Energy - Fundamental and Application. Tata McGraw Hill Rai GD. 1998. Non-conventional Sources of Energy. Khanna Publ.

2. Twindal JW & Anthony D Wier 1986. Renwable Energy Sources. E & F.N. Spon Ltd.

3. Culp AW. 1991. Principles of Energy Conservation. Tata McGraw Hill.

- 4. Duffle JA & Beckman WA. 1991. Solar Engineering of Thermal Processes. John Wiley.
- 5. Mittal KM. 1985. Biomass Systems: Principles & Applications. New Age International.

MTPFE -514-22: Advances in Post-harvest Technology of Fruits and Vegetables

Unit-1

Importance of post harvest technology of fruits and vegetables, structure, cellular components, composition and nutritive value of fruits and vegetables, Post harvest technology and its significance, pre-harvest factors affecting post-harvest quality of fruits and vegetables, fruit ripening, spoilage of fruits and vegetables.

Unit-2

Harvesting and washing, pre-cooling, preservation of fruits and vegetables, blanching, commercial canning of fruits and vegetables, minimal processing of fruits and vegetables. Cold storage, controlled atmosphere packaging of fruits and vegetables, Modified Atmospheric storage.

Unit-3

Dehydration of fruits and vegetables, methods, osmotic dehydration, foam mat drying, freeze drying, microwave heating, applications, radiation preservation of fruits and vegetables, irradiation sources.

Unit-4

Intermediate moisture foods, ohmic heating principle, high pressure processing of fruits and vegetables, applications, packaging technology for fruits and vegetables, general principles of quality standards and control, FPO, quality attributes.

Suggested readings:

1. Somogyi, L.P., Ramaswamy, H. S. and Hui, Y.H., eds. 1996. Processing Fruits: Science and Technology. Vol. 1. Biology, Principles and Applications. Technomic Publishing Co., Lancaster PA.

2. Salunkhe and Kadam. 1998. Handbook of vegetable science and technology: Production, composition, storage, and processing, Marcel Dekker, USA.

3. Barrett, D.M., L. Somogyi, and H. Ramaswamy. 2005. Processing Fruits, Second Edition: Science and Technology. CRC Press, Boca Raton, FL.

4. Hui, Y.H. 2006. Handbook of Fruits and Fruit Processing, Blackwell Publishing, Ames, IA, USA.

5. Salunkhe, D.K. and Kadam, S.S. 1995. Handbook of Fruit Science and Technology: Production, Composition and Processing. Marcel Dekker, New York.

6. Chakraverty, A., Mujumdar A.S., Raghavan G.S.V and Ramaswamy H.S. 2001. Handbook of Post-harvest Technology: Marcel Dekker Press, USA

MTPFE -515-22 LAB II (Food Process Engineering)

Determination of the physical properties size, shape, sphericity of food products.

Determination of average particle size and distribution of powdered material.

Determination of moisture content and water activity of food product.

Determination of bulk density, true density and porosity of food grains.

Determination of colour for various food grains, fruits, vegetables, spices and processed foods by hunter colour lab.

Determination of density and specific gravity of various liquids food.

Study the rheological properties of food material by viscometer.

Study of frictional properties; angle of repose and coefficient of friction of food grain material. To determine the mixing index of food material by ribbon blender and cone blender.

Solving problems on: single and multiple effect evaporator, distillation, extraction, membrane separation and mixing;

Experiments on rotary flash evaporator, humidifiers, reverse osmosis and ultra filtration; Visit to related food industry.

MTPFE -516-22 Lab II (Technology of cereals, pulses & oil seeds)

Physical properties of cereals.

Conditioning of wheat. Gluten content of wheat flour.

Cooking quality of rice.

Determination of Gelatinization Temp.

Study on production technology of puffed and flaked rice Physical properties of Legumes and Oil seeds.

Principles of dehulling: Dal Milling Process.

Particle size analysis and energy requirement in communition.

Milling of rice, wheat and pulses.

Estimation of milling yield and performance characteristics of equipment used.

Physical properties of cereals and pulses, raw and milled products quality evaluations;

Parboiling and drying; terminal velocities of grains and their fractions; study of paddy, wheat, pulses and oilseeds milling equipments;

Planning and layout of various milling plants,

Visit to related agro-processing industry.

MTPFE -517-22 Lab III (Advances in Post-harvest Technology of Fruits and Vegetables)

Kinetics of enzyme inactivation. Drying of vegetables. Blanching process. Heat. Pectin determination in fruits and vegetable. Calculation and mixing of sugar syrup. Recipe calculation and preparation of fruit juices/squash. Recipe calculation for and preparation of fruit Jam/jellies. Thermal processing and preservation of fruits/vegetables (Canning/ bottling). Preparation of pickles. Preparation of tomato product (Puree/ketchup).

SEMESTER II

Corse Code	Course Title	Туре	Load Allocation			Marks Distribution		Total	Credits
			L	Т	Р	Inter nal	Extern al	Totai	Creuits
MTPFE-521-22	Food Rheology	PC	4	0	0	40	60	100	4
MTPFE -522-22	Drying and Storage Engineering	PC	4	0	0	40	60	100	4
MTPFE -523-22	Research Methodology	PC	4	0	0	40	60	100	4
MTPFE -524-22	Food Rheology Lab	PC	0	0	4	30	20	50	2
MTPFE -525-22	Drying and Storage Engineering Lab	PC	0	0	4	30	20	50	2
MTPFE -526-22	Program Elective-1 (Theory)	PE	4	0	0	40	60	100	4
MTPFE -528-22	Program Elective-1 (Lab)	PE	0	0	4	30	20	50	2
	Total		16	0	12	250	300	550	22

PROGRAMME ELECTIVE -I*

Corse Code	Course Title	Туре	Load Allocation			Marks Distribution		Total	Credits
			L	Т	Р	Inter nal	Externa l	TUtar	Creates
MTPFE-526-22	Advances in Food Packaging Technology	PE	4	0	0	40	60	100	4
MTPFE -527-22	Food quality and Analytical Techniques	PE	4	0	0	40	60	100	4
MTPFE -528-22	Lab (Advances in Food Packaging Technology)	PE	0	0	4	30	20	50	2
MTPFE -529-22	Lab Food quality and Analytical Techniques	PE	0	0	4	30	20	50	2

Note: *Select any one subject from Elective-I. The elective subject for theory & practical will be same.

Course Code: MTPFE-521-22

Course Title: Food Rheology

Hours per week: 4+0+0

Credits: 4

Unit -I

Food rheology concept, scope of food rheology, texture of foods – type of stress, types of strain, types of viscosity, modulus (young, shear, bulk), poisson's ratio, definition and importance of texture, texture related concepts.

Unit-II

Rheological properties of fluid food: viscosity, factors affecting viscosity, flow of material-Newton's law of viscosity, viscous fluids (Newtonian fluids, non-Newtonian fluids), plastic fluids (Bingham plastic, non-Bingham plastic fluids), fluid behavior in steady- shear flow: time dependent and time independent material function.

Unit-III

Viscometry: viscosity measurement- capillary flow viscometers, orifice type viscometers, falling ball viscometers, rotational viscometers- concentric cylinder (coaxial rotational) viscometers, cone and plate viscometers, parallel plate viscometers, single-spindle viscometers (brookfield viscometer).

Unit-IV

Texture of foods: basic concept, Principles of determining food texture, Texture measurement instruments compression, snapping bending, cutting shear, puncture, penetration, texture profile analysis, dough testing instruments- farinograph and mixograph, extensograph and alveograph, amylograph.

Recommended readings:

1. Rao, M. A., Rizvi, S. S. H. and Datta A. K. 2005. Engineering Properties of Foods: CRC Press.

2. Heldman, D. R. (2007). Food Process Engineering: AVI Publications.

3. Faridi, H. and Faubion, J. M. (1997). Dough Rheology and Baked Products: CBS Publications, New Delhi.

4. Rao, M. A. (2007). Rheology of Fluid and Semisolid Foods: Principles and Applications (2 ed.): Springer, USA.

Course Code: MTPFE-522-22

Course Title: Drying and Storage Engineering

Hours per week: 4+0+0

Credits:4

Unit-I

Introduction: Introduction to drying of agricultural products, utilities of drying, Thermal properties, Moisture content representation, Moisture content determination methods, EMC and methods of their determination, EMC curve and models, principle of drying, periods of drying, thin layer, deep bed and their analysis, critical moisture content, drying models.

Unit-II

Grain Dryers: Storage Unit, Aeration system, Air distribution system, Heated air Dryers- Flat bed type Batch drier, Re-circulatory batch driers, Louisiana state University drier, Baffle drier and Rotary drier, Testing of grain driers.

Unit-III

Food Grain Storage: Grain storage principle, Changes occurring in food grains during storage, Types and causes of spoilage in storage, Direct indirect damages, storage of perishable products, functional requirements of storage, control of temperature and relative humidity inside storage, Modern storage structures.

Unit-IV

Grain storage pest and control: destruction of insect infestation, grain storage pest, important insect species, Fumigation: principle of fumigation, Properties and application of fumigants, Rodent control: Rodenticides for rats and mice.

Recommended Books

1. Giridhari Lal : Preservation of Fruits & Vegetables, ICAR Publication, India.

- 2. Ranganna : Analysis of Fruits land Vegetables, Tata MacGraw Hill, India.
- 3. Luh&Woodroof : Commercial Vegetable Processing, AVI Publishing, USA.
- 4. KM Sahay and KK Singh: Unit operations of agricultural processing, India.

Course Code: MTPFE-523-22

Course Title: Research Methodology

Hours per week: 4+0+0

Credits:4

Unit-I

Introduction: Nature and objective of research, criteria of good research, scientific approach to research, limitations of applying scientific methods, Ethical issues in research, IPR.

Unit-II

Research: Types, Research process and steps in it, Hypothesis, Research proposals and aspects; Research Design: Need, Problem Definition, variables, research design concepts, Literature survey and review, Research design process, Errors in research; Research Modeling: Types of Models, Model building and stages, Data consideration and testing. Report Writing: Pre writing considerations, Thesis writing, Formats of report writing, Formats of publications in Research journals.

Unit-III

Data and data types, Data collection Methods: Observations, Survey, Interview and Questionnaire. Data Presentation and Analysis: diagrams and graphs, measures of central tendency, dispersion, skewness and kurtosis. Inferential Statistics – estimation, type-I and type-II error, testing of hypothesis, test of significance, t-test, Z-test, F-test, Chi-Square test, ANOVA.

Unit-IV

Statistical Quality Control: Quality control charts- p-chart, c-chart, X bar charts, R charts, σ charts, process under control and specification limits, process out of control, control limits. Benefits & Limitations of Statistical Quality Control. Acceptance Sampling.

Recommended Readings

- 1. Cramer Michael M (2016) Food plant sanitation: Design, maintenance, and Good Manufacturing Practices.
- 2. S Ranganna (2001) Handbook of analysis and Quality control for fruit and vegetable products.
- 3. C R Kothari (2004) Research methodology- methods and techniques.
- 4. William J. Stevenson (2011), Operations Management.
- 5. Andrew Greasley (2007), Operations Management.
- 6. Scott T. Young (2009), Essentials of Operations Management Paul R. Dittmer, J.
- 7. Desmond Keefe (2008), Principles of Food, Beverage, and Labour Cost Controls.

Course Code: MTPFE-524-22

Course Title: Food Rheology Lab

Hours per week: 0+0+4

Credits:2

List of Practicals

- 1. Effect of fat type on cookie dough rheology
- 2. Determination of viscosity of oil by viscometer
- 3. Study of textural attributes of food products
- 4. Texture analysis of fruit using texture analyzer
- 5. Viscosity measurements of fruit juices using viscometer
- 6. Viscosity measurements of liquid food products using viscometer
- 7. To study the effect of temperature on viscosity of liquid foods
- 8. Development of stress and strain curve for Newtonian fluids
- 9. Development of stress and strain curve for Non Newtonian fluids
- 10. Determination of thermal conductivity of selected food products
- 11. Texture analysis of baked products (bread/ biscuit)
- 12. Preparation of food emulsions and their stability study
- 13. Preparation of food gels and their characteristics
- 14. To correlate subjective sensory evaluation with textural analyzer

Course Code: MTPFE-525-22

Course Title: Drying and Storage Engineering LAB

Hours per week: 0+0+4

Credits:2

List of Practicals

- 1. Study of mechanics of bulk solids affecting cleaning, drying and storage of grains;
- 2. Measurement of moisture content, relative humidity and air velocity during drying and aeration;
- 3. Drying characteristic and determination of drying constant;
- 4. Determination of EMC and ERH; Study of various types of dryers;
- 5. To study the effect of relative humidity and temperature on grains stored in gunny bags;
- 6. Design and layout of commercial bag and bulk storage facilities;
- 7. Study of different domestic storage structures;
- 8. Visits to commercial handling and storage facilities for grains.

Course Code: MTPFE-526-22

Course Title: Advances in Food Packaging Technology Hours per week: 4+0+0

Credits:4

Unit-I

Introduction: Introduction to Food Packaging, History, Definitions, importance and scope of packaging of foods; Systems and Regulations, package components. Types of packaging: Forms of packaging – box, bottle, tetra, pouch, shrink, vacuum, gas, CAP, MAP, asceptic etc.

Unit-II

Advances in Active packaging techniques and Intelligent packaging techniques, Current use of novel packaging techniques in different food products, consumers acceptance of novel food packaging, Edible films, Antioxidant and anti microbial packaging.

Unit-III

Scavengers for food packaging- oxygen, ethylene, Carbon dioxide, odor and flavour absorber and other scavengers, concept and its food applications. Ethanol emitters and preservative releaser, and their food packaging uses. Antimicrobial food packaging: concept and mechanism, Factors affecting the effectiveness of antimicrobial packaging.

Unit-IV

Testing & Packaging Machinery: Bottling, can former, form fill and seal machines, bags – their manufacturing and closing, vacuum packs unit, shrink pack unit, tetra pack unit. WVTR, GTR, bursting strength, tensile strength, tearing strength, drop test, puncture test, impact test etc.

Recommended readings:

1. Jung H. Han. Innovations in Food Packaging. Elsevier Science Ltd.

2. Gordon L. Robertson. Food Packaging: Principles and Practice. CRC press

3. Dong Sun Lee, Kit L. Yam , Luciano Piergiovanni. Food Packaging Science and Technology. CRC press

4. Raija Ahvenainen. Novel Food Packaging Techniques. Woodhead Publishing

5. M. L. Rooney. Active Food Packaging. Blackie Academic & Professional

6. Aaron L. Brody, E. P. Strupinsky, Lauri R. Kline. Active Packaging for Food Applications. Taylor & Francis

7. Charles L. Wilson. Intelligent and Active Packaging for Fruits and Vegetables. Taylor & Francis.

8. Aaron L. Brody, PhD, Hong Zhuang, PhD, Jung H. Han. Modified Atmosphere Packaging for Fresh-Cut Fruits and

Vegetables. John Wiley & Sons.

Course Code: MTPFE-527-22

Course Title: Food quality and Analytical Techniques

Hours per week: 4+0+0

Credits:4

Unit-I

Introduction to Food Quality & Analysis: Introduction to food and its components, Sampling, Sample preservation, Extraction, Proximate analysis. Quality Control, Evaluation of food quality; concept of total quality control (TQM).

Unit-II

Spectroscopic Techniques: Introduction & theory of spectroscopic techniques, UV-Visible NIR spectroscopy, X-ray, CT, NMR, Fluorescence machine spectroscopy – Principle, Instrumentation, application of each technique, destructive and non-destructive quality Evaluation.

Unit-III

Chromatographic Techniques: Introduction, HPLC, GC, Paper chromatography, TLC/HPTLC, Ion chromatography, Flash chromatography – Principle, Instrumentation, applications of each technique.

Unit-IV

Food standards: FSSAI, Use of hazard analysis critical control Point (HACCP) and its implication in food industries. Agmark, FPO, PFA, BIS, consumer protection act, Vanaspati control order, MMPO, export quality control and inspection act.

Recommended Readings

- 1. Food Analysis: Theory and Practice, 1994. Y. Pomeranz and C.E. Meloan. 3rd edn., Conn. (USA): AVI Publ. Co.
- Stewart, K.K. and Whitaker, J.R. (1984). Modern Methods of Food Analysis. Conn: AVI Publ. Co.
- 3. James, CS. (1995). Analytical Chemistry of Foods. Blackie Academic and Professional, UK
- 4. Methods of analysis of food components and additives by Semih Otle, Published in 2005 by CRC Press
- 5. Singal RS, Handbook of indices of food quality and authenticity; Woodhead Publ. Cambridge, UK.

Course Code: MTPFE-528-22

Hours per week: 0+0+4

Course Title: Advances in Food Packaging Technology LAB

Credits:2

List of Practicals

- 1. Identification of different types of packaging and packaging materials
- 2. Determination of WVTR in different packaging materials
- 3. Determination of GTR in different packaging materials.
- 4. Development of ethylene scavengers for fresh fruits and vegetables
- 5. Study of time temperature indicators
- 6. Determination of oxidative changes in packaged foods
- 7. Determination of wax weight
- 8. Determination of tearing strength of paper
- 9. Measurement of thickness of packaging materials
- 10. To perform grease-resistance test in plastic pouches
- 11. Determination of bursting strength of packaging material
- 12. Determination of drop test of food package

Course Code: MTPFE-529-22

Hours per week: 0+0+4

Course Title: Food quality and Analytical Techniques LAB

Credits:2

- 1. Determination of acid soluble, water soluble, insoluble acid, ash fractions.
- 2. Determination of carotenoids.
- 3. Determination of ascorbic acid by titrimetric and photometric methods.
- 4. Determination of lycopene content of tomato & its products.
- 5. Determination of iron, phosphorous & sulphur in foods.
- 6. Determination of pigment in food sample.
- 7. Determination of lead, arsenic, and tin content in food.
- 8. Analysis of canned and processed products available in the market
- 9. Cut out analysis of canned product.
- 10. Estimation of Vit A, D in desi ghee
- 11. Determination of viscosity liquid food
- 12. Determination of FFA and Acid value of given sample
- 13. Analysis of ice cream for fat, acidity, total solids, foreign fat
- 14. Evaluate the given food sample using different sensory test methods.
- 15. Study of pH meter, conductivity meter, spectrophotometer.
- 16. Study of HPLC, GLC, and TLC for analysis of different food constituents.