

PAPER I: NUTRACEUTICAL

Code: BTFS – NFP 01

52 HOURS

Unit 1: Introduction to Nutraceutical Industry

Organizational elements, classification of nutraceuticals, dietary supplements, fortified foods, functional foods and phytonutraceuticals. Scope involved in the industry, Indian and global scenario.

4 Hours

Unit 2: Concept, Biochemistry of nutrition and dietetics

Classification of food components based on nutritional value, nutritional assessment of carbohydrates, proteins and fats, recommended dietary intake, acceptable dietary intake, nitrogen balance, protein efficiency ratio, net protein utilisation. Basics of energy balance - Basal Metabolic Rate (BMR), Body Mass Index (BMI) and Standard Dynamic Action (SDA) with special reference to nutraceutical industry.

10 Hours

Unit 3: Nutrition related diseases and disorders

Malnutrition and factors responsible for nutritional disorders and anti-nutritional factors (cyanogens, lectins, enzyme inhibitors, phytoalexins and phytates); Metabolic disorders - types, nutritional factors, prevention and treatment using nutraceuticals with special reference to diabetes mellitus, hypertension, hypercholesterolemia and others. Concept of antioxidants - use of antioxidants as dietary supplements in prevention and treatment of cancer, obesity and stress. Role of nutraceuticals and functional foods in pediatrics, geriatrics, sports, pregnancy and lactation.

10 Hours

Unit 4: Nutraceuticals of plant and animal origin

Plant secondary metabolites, classification and sub-classification - Alkaloids, phenols, Terpenoids. Extraction and purification, applications with specific examples with reference to skin, hair, eye, bone, muscle, heart, brain, liver, kidney, general health and stimulants. Concept of cosmoceuticals and aquaceuticals.

Animal metabolites - Sources and extraction of nutraceuticals of animal origin. Examples: chitin, chitosan, glucosamine, chondroitin sulphate and other polysaccharides of animal origin, uses and applications in preventive medicine and treatment.

10 Hours

Unit 5: Microbial and algal nutraceuticals

Concept of prebiotics and probiotics - principle, mechanism, production and technology involved, applications - examples of bacteria used as probiotics, use of prebiotics in maintaining the useful microflora - extraction from plant sources. Synbiotics for maintaining good health. Algae as source of omega - 3 fatty acids, antioxidants and minerals - extraction and enrichment.

6 Hours

Unit 6: Biotechnology in Phytonutraceuticals

Role of medicinal and aromatic plants in nutraceutical industry – propagation - conventional and tissue culture, cultivation, post harvest technology and strategies for crop improvement, development of high yielding lines and yield enhancement, plant genomics and metabolomics. Introduction to nanobiotechnology with special reference to nutraceuticals.

6 Hours**Unit 7: Product development and clinical trials**

Activity screening, formulations, toxicology, bioavailability, bioequivalence; use of animal models and pre-clinical and clinical trials involved.

6 Hours**Reference Books**

1. Handbook of nutraceuticals and functional foods by Robert E C. Wildman, CRC/Taylor&Francis
2. Handbook of nutraceuticals Vol I by Yahwant Vishnupant Pathak, CRC press,2009
3. Handbook of nutraceuticals Vol II by Yahwant Vishnupant Pathak, CRC press,2011
4. Handbook of Prebiotics, Glenn R. Gibson, Marcel Roberfroid, CRC press, 2008.
5. Swaminathan M., Essentials of Food and Nutrition, 2nd Ed, 1985, Ganesh and Co.
6. Understanding Nutrition, 8th Edition, by Whitney, E.N. & Rolfes, S.R.. (1999): WesV Wadsworth, An International Thomson Publishing Co.
7. Nutrition in Health and Disease 17th Edition; Anderson, Dibble, Turkki, Mitchell, Rynbergen J.B. Lippincott Company, 1982
8. Nutritional Quality Index of Foods; R.G. Hansen, B.W. Wyse, A.W. Sorenson AVI Publishing Co., Inc., 1979.
9. Dietary Supplements of Plant Origin, M. Maffei (Ed.), Taylor & Francis, 2003.
10. Bioprocesses and Biotechnology for Functional Foods and Nutraceuticals, Jean – Richard Neeser & J. Bruce German, Marcel Dekker, Inc., 2004.
11. Herbal Products –Timotht S. Tracy, Richard L. Kingston.
12. Herbal beauty products with formulation & processes-H. Panda
13. Medicinal Plants (Traditional Knowledge)-P C Trivedi
14. Nutritional Biochemistry, II edition by Tom Brody
15. Nutraceuticals in health and disease prevention, Klaus Krämer, Peter-Paul Hoppe, Lester Packer
16. Zubay, Geoffrey L., Biochemistry, 4th Ed, Dudagey, IAWCB Wm. C. Brown Publishers, 1988, London.
17. Nutraceutical beverages Chemistry, Nutrition and health Effects, Shahidi and Weerasinghe (Ed.), American Chemical Society, 2004.
18. Functional Foods: Principles and Technology, M. Guo, CRC press, 2009.
19. Marine Products for Healthcare, Vazhiyil Venugopal, CRC press, 2008
20. Phytochemicals, Mark S. Meskin, Wayne R. Bidlack, R. Keith Randolph, CRC press, 2008.

PAPER II – FOOD PROCESSING

Code: BTFS – NFP 02

52 HOURS

Unit 1: Introduction to Food Processing Industry

Food Processing Industry, scope, Indian and global scenario.

4 Hours

Unit 2: Food Chemistry

Carbohydrates, lipids, proteins and enzymes - nomenclature, classification, structure, physical and chemical properties. Sources and uses in food processing industry.

12 Hours

Unit 3: General principles and technology of food processing

(a) Physical and chemical principles in different types of food processing techniques, food additives- types of food additives with examples of preservatives, emulsifiers, gums, antioxidants, dough conditioners, flour improvers, enzymes, starches, Basics of colours and flavours - chemistry and technology of natural and synthetic colors and flavors, chelating agents and nutritional enhancers.

(b) Preservation, storage, packaging - food spoilage and defects, food infections - different types of microorganisms involved in food spoilage, factors affecting spoilage. Basics of dehydration, different types of drying, freezing, radiation and chemical preservation.

(c) Types of packaging, materials, methods and operations.

16 Hours

Unit 4: Technologies in food processing

Fruit and vegetable processing - Introduction to fruit and vegetable products, different types of products, dehydration techniques, canning, processed fruits and vegetables - pulps, jams, jellies, marmalades and other products like fruit juice and fruit bars.

Cereals and pulses processing - Different types of processing methods used in case of cereals and pulses-conventional and modern methods, uses of products and by-products of processed cereals and pulses. Case studies of paddy, pulses and maize processing.

Dairy technology - milk processing by filtration, clarification, standardisation, homogenisation and pasteurisation, cream separating techniques and chilling techniques. Types of milk and milk products-cream, butter, spray dried powder, casein, lactose, whey, ice cream, fermented dairy products, technology and applications with examples of Yoghurt, Acidophilous milk and value added products.

Sugar and Confectioneries - Types of sugars and different products of sugar industry, sugar processing - chocolate and confectionary manufacturing.

Beverages and spices technology - Chemistry and production technology of coffee, tea and cocoa cultivation, harvesting, management and manufacture, value added products; Spice industry - cultivation, processing, chemical constituents of spices, and manufacture of value added products, specific examples of pepper, cardamom, ginger, turmeric, vanilla, garlic etc.,

Bakery - Different types of bakery products, manufacturing process of bread, biscuits and others.

Poultry, meat and fish processing - sources, process and products.

20 Hours

Reference Books

1. Unit operations in food processing, R L Earle and M D Earle, NZIFST Publications
2. Food processing handbook, James G Brennan, Wiley VCH
3. Emerging technologies for food processing by Da-Wen Sun
4. Ultra high pressure treatment of foods, Marc E. G. Hendrickx, Dietrich W. Knorr
5. Novel Food processing technologies, Gustavo V. Barbosa-Cánovas, María S. Tapia, M. Pilar Cano, CRC press, 2005
6. Non Thermal preservation of foods, Gustavo V. Barbosa-Cánovas, Marcel Dekker, 1998
7. Handbook on food preservation by Shafiur Rahman
8. Physical principles of food preservation, Marcus Karel, Daryl B. Lund, Marcel Dekker, 2003
9. Aseptic processing and packaging of food- a food industry perspective, Jairus R. D. David, Ralph H. Graves, V. Robert Carlson, CRC press, 1995
10. Food packaging and shelf life-A practical guide, Gordon L. Robertson, CRC Press/Taylor & Francis Group, 2009
11. Food Biochemistry and Food processing, YH Hui (Ed), Wai-Kit Nip (Ass Ed), Leo ML Nollet (Ass Ed), Gopinadhan Paliyath (Ass Ed), Benjamin K Simpson (Ass Ed), Wiley Blackwell, 2006
12. Modern Technology of Food processing and Agro based industries, NIIR Board, II edition.
13. Food processing: Biotechnological Applications by Marvaha and Arora, 2000, Asiatech Publishers New Delhi.
14. Food packaging principles and practice, Gordon L. Robertson, Marcel and Dekker Inc. New York. 1993.
15. Ultra high pressure treatment of foods, Marc E. G. Hendrickx, Dietrich W. Knorr
16. Novel Food processing technologies, Gustavo V. Barbosa-Cánovas, María S. Tapia, M. Pilar Cano, CRC press, 2005
17. Non Thermal preservation of foods, Gustavo V. Barbosa-Cánovas, Marcel Dekker, 1998
18. Handbook on food preservation by Shafiur Rahman
19. Physical principles of food preservation, Marcus Karel, Daryl B. Lund, Marcel Dekker, 2003
20. Aseptic processing and packaging of food- a food industry perspective, Jairus R. D. David, Ralph H. Graves, V. Robert Carlson, CRC press, 1995
21. Food packaging and shelf life-A practical guide, Gordon L. Robertson, CRC Press/Taylor & Francis Group, 2009

**PAPER III: ANALYTICAL TECHNIQUES IN FOOD
PROCESSING AND NUTRACEUTICAL INDUSTRY**
Code: BTFS – NFP 03

52 HOURS

Unit 1: Introduction to analytical techniques and scope.

4 Hours

Unit 2: Chromatography

Basic concepts, principle and methodology, paper chromatography, thin layer chromatography, ion exchange chromatography, affinity chromatography and gel exclusion chromatography. High pressure liquid chromatography, gas liquid chromatography - principle, instrumentation and applications. Column chromatography as a separation technique.

12 Hours

Unit 3: Spectroscopy

Basic principles of spectroscopy-, UV-Visible spectroscopy, colorimetry, NMR, ESR, Mass spectrometry, Flame photometry and atomic absorption spectroscopy, Fluorescence spectrometry, IR spectrometry- Instrumentation and applications.

12 Hours

Unit 4: Food measurements

Viscosity and consistency, rheological properties and texture. Measurement of specific gravity, refractive index, gel strength, densitometry, refractometry, polarimetry and measurement of colour, relative humidity and water activity measurement. pH, conductivity, turbidity and stability measurements.

12 Hours

Unit 5: Electrophoresis

Basic principles in electrophoresis, electrophoretic mobility - Capillary and zone electrophoresis- Instrumentation and applications of Gel electrophoresis - PAGE, SDS-PAGE, two dimensional electrophoresis, pulsed field gel electrophoresis, isoelectric focussing and isotachopheresis.

12 Hours

Reference Books

1. Methods of Analysis for Functional Foods and Nutraceuticals Edited by W. Jeffrey, Hursts, Routledge Publishers.
2. Handbook of Analytical Techniques Vol. I, Gunzler and Williams, Wiley-VCH, 2002.
3. Handbook of Analytical Techniques Vol. II, Gunzler and Williams, Wiley-VCH, 2002.
4. Chromatography: Liquid Chromatography, Mass Spectrometry, W M A Niesson, 2nd and 3rd Ed.
5. Solvent Extraction (Principles & Practices)-Jan Rydberg, Claude Musikas
6. HPLC: A Practical handbook of Preparative HPLC-Donald A Welling
7. Mass Spectrometry (Principle & Application)-E. Hoffmann & V. Strooban
8. Methods of Analysis for Functional Foods and Nutraceuticals, Second Edition, W. Jeffrey Hurst, **CRC press 2008.**

PAPER IV: SAFETY REGULATIONS, CONTROL AND ENTREPRENEURSHIP

Code: BTFS – NFP 04

52 HOURS

Unit 1: Quality control and Quality assurance

Good laboratory practices and good manufacturing practices, development of SOPs and safety practices in the production areas. Microbial load assessment - classification of microorganisms, physical and chemical factors affecting growth of microorganisms, water co-efficient and other properties. Heavy metal load, safety, toxicity, stability, pH and other physical and chemical characteristics of food and nutraceuticals.

12 Hours

Unit 2: Safety regulations

Structure, organisations and operations of national and international regulatory bodies. Role of regulatory authorities in India - functioning, legal acts and their enforcements with suitable examples. Concept of HACCP - Hazard assessment, ISO 22000 regulations - implementation in food, diary, poultry, meat and meat products industry.

14 Hours

Unit 3: Labelling regulations

Need, scope and limitations of labelling - components of labelling, regulations of labelling of irradiated products, organic foods, products of biotechnological applications, GMOs, national and international regulations on labelling; claims related to health and nutritional profile.

10 Hours

Unit 4: Ethics and environmental concern

Biosafety guidelines for research, environmental aspects of GMOs, handling and disposal of laboratory organisms, waste disposal and environmental concern. Legal issues involved, Indian drug and cosmetics Act. Ethical issues related to animal testing.

12 Hours

Unit 5:

Entrepreneurship, research, IPR related issues and job opportunities

4 Hours

Reference Books

1. Microbiology, by M. J. Pelczar, 4th edition, McGraw-Hill. Inc. N.Y. 1977.
2. Quality Management in Nutraceuticals , Chi Tang Ho & Quan Yi Zheng (Ed.), American Chem. Soc., 2002
3. Nutrition labeling handbook, Ralph Shapiro (Ed.), Marcel Dekker, N.Y., 1995
4. Intellectual Property rights: Unleashing the Knowledge Economy Ganguli, Tata Macgraw Publishing company (2001).
5. Regulations and Quality: Pharmaceutical Manufacturing Handbook, Shayne Cox God (Ed.), Wiley Interscience 2008.

6. Packaging technologies of functional foods in Functional food ingredients and Nutraceuticals processing technologies John Shi (Ed.) CRC Taylor & Francis group, 2007.

PAPER V: SOFT SKILLS

Code: BTFS – NFP 05

1. **Campus to Corporate:** Transition from College to Corporate world; Perceptions v/s Real Corporate life; Working in Teams; Basics of corporate communication.
2. **Corporate & Office Etiquette:** Elements of a good handshake; Visiting cards exchange & How to manage business cards; Small Talk & Networking; Basics dining etiquette.
3. **English Grammar:** A quick round up: Nouns, Pronouns, Adjectives, Verbs, Adverbs, Tenses, Prepositions, Clauses, Subject and Predicate, Punctuations, Subject- verb agreement, Confusing prepositions, Missing Articles, Editing paragraphs.
4. **Negotiation Skills:** Introduction to Bargaining and Negotiation; The Negotiation Process: Four Stages; An Analytical framework of Negotiation; Bargaining Approaches; Strategy for Value Added Negotiation.
5. **Selection & Interviewing Skills:** Current market for talent & methods for attracting & sourcing; Best practices for different hiring situations - Campus, Market, Head hunter agencies; Selection process design & assessment centers; Effective interview.
6. **Personality Development:** Self assessment: SWOT; Understanding Personality - Identifying different personalities; Levels of Human Learning; Change v/s Transformation; Sensitivity - Sharpen your senses; Creativity and Lateral thinking; Developing Positive Mental Attitude; Emotional Quotient; Handling Criticism; Positive Health; Food habits and Meditation; Goal setting - Creative Visualization - Law of Attraction; Living a created life - Personal Leadership
7. **Business Etiquette – Video Conferencing (VC):** Introduction to Video Conferencing; Concept & uses of VC; VC Etiquette.
8. **Business Communication:** Seven Cs of communication: Complete, Courteous, Considerate, Clear, Concise, Concrete, Correct; Verbal/ Nonverbal Communication.
9. **Writing Process:** Identifying objective; Categorizing Information; Organizational Patterns; Designing document; Memo writing; Revision checklist; Releasing document.
10. **Business Proposal & Report Writing:** Types of Proposals; Top-Down & Bottom-Up Approach; Study of Technical Bid & Cost Bid; Transmittal Letters; Formal Reports (Short and Long); Types of graphics & illustrations; Business Report Templates; Study of Sample Proposals;
11. **Project Report Writing:** Project Charter; Project Plan; Gant Chart; Activities List; Resources List; Risks List, Project Status Report; Project Closure Report; Types of graphics & illustrations; Study of Project Report Templates.

12. **Email Writing:** Problems resulting out of emails; Contents of email, Importance of a good subject line; Dos and Don'ts; Using your email software to its maximum; Setting up signatures; Setting up accounts; Creating HTML stationary; Creating email templates for common emails; Using short mails for internal communication; Importance of acknowledging emails; Creating folder structure for easily accessing emails; Care to be taken while deleting emails, Archiving emails; Comparison of emails and letters; Writing typical emails, sending point-wise reply to emails.
13. **Cross-Cultural Training:** Cross-Cultural Sensitivity; American, European, Australian, Middle-east and South-East Asian countries culture training; Cultural Foundations; Cross Cultural Communication; Communication Styles; Comparative Values (American – Indian); Regional Dialects; Cross-Cultural Customer Attitude & Expectations.
14. **Interpersonal Skills:** Introduction & Importance of Interpersonal Skills; Cost of Poor interpersonal skills; Standing up for self assertiveness; Strategies to achieve self-assertiveness; Managing conflicts, disputes; Dealing with Diversity Interpersonal Relationship and influence.
15. **Patents & Intellectual Property:** The Patents Act, 1970 as amended in April 2005; Types and tenure of Patent; Patentable Inventions and Non Patentable Inventions; Procedure for filing Patent Application; Rights of Patentee and Patent Infringement.
16. **Trademark:** Trademark / Service Mark; What is a Trademark; How do you coin a Trademark; Types of Trade Marks; Features of the Trademark Act 1999; Application of a Trademark; Opposition of a Trademark; Advertisement of the marks; Registrars issuance of the Trade Mark certificate – it's validity, how changes are to be made etc.; Classification of goods; Assignment and Licensing of a Trademark; Spurious goods with examples.
17. **Copyright:** What is a Copyright; How do you get a Copyright; Where do you register your Copyright; Is registration compulsory; Application of a Copyright; Registrars issuance of the Copyright certificate; Example of Remix music and violation; Incidental issues - does it amount to copyright; Downloading music & photos from net for your use; Using background music for a commercial; Exceptions to the infringement of copyright; Trademark or Copyright, which one should you choose and why; Practical case laws on Trade Marks and Copyrights.
18. **Trade Secrets:** Application & importance a Trade Secret; Confidentiality Agreements / Secrecy Agreements; Practical applicability of Trade Secrets.
19. **Geographical Indications (GI):** Definition & importance of a Geographical Indications, How do you take advantage of GI.
20. **Handling Customers:** Customer Service Standards; Customer Relations; Understanding Customer Needs; Searching for the facts; Probing without offending; Identifying personality types and anticipating their reactions; Looking at the problem from the customer's angle; Developing effective strategies to keep problems from escalating; How to keep your own reactions under control; What to do when a customer tunes you out; When to turn a complaint

over to your boss or another department; Handling Difficult Customers - tough, irate and emotional customers; Actions to take when the customer is angry; Strategies that position you as a helper – not an adversary.

21. **Stress Management:** Anatomy of Stress; General Adaptation Syndrome; Stress Management Strategies - Different type stress Management; Personality type & Individual Strategies; Lifestyle Management and stress; Organizational Stress; Stressors; Occupational Stress Management; Personal action Plan; Progressive Muscle Relaxation Technique.
22. **Time Management:** Priorities & time matrix; Time wasters; Work effectiveness and productivity; Bio-rhythm; Strategic breaks; 80/20 rule; Meetings as time wasters; Overcoming Interruptions; Procrastination; Identifying procrastination; Overcoming procrastination; Prioritization & Scheduling; Delegation; Setting up SMART action plan; Balanced lifestyle.
23. **Leadership & Effective Team Building:** Leading a Team; Alignment for Maximizing Performance; Work of Leadership; Leadership Decision Styles; Situational Leadership, Leader or a Manager; Setting standards and follow up; Developing your own leadership development strategy; Pre-empting and Managing conflict as a leader; Appraisal/development skills; Decision making; Creating a team identity; Building an emotional bond.
24. **Accelerated Learning:** Read 3-10 times faster with better understanding; Improve memory and sharpen concentration; Better manage time and increase once productivity; Enhance intuition and develop true potential; Accelerate the speed of learning anything; Enhance self-confidence in all fields of endeavor; Learn to access Unconscious mind.
25. **Goal Setting and Career Planning:** Circle of Control; Circle of Influence; Proactive behavior; Differentiate between proactive & reactive behavior; Decision Making Model; Pitfalls in decision Making; Goal Setting & Self-Analysis; Creative Visualization; Career Planning; Transcendence.
26. **Work-life Balance:** Planning for a balanced life; Managing time for effective work-life balance Stress and work-life balance; Tackling the long-hour culture; Integrate personal, family, and work lives; Importance of strategic breaks; Planning vacations and weekends

**PRACTICAL I:
NUTRACEUTICALS AND FOOD PROCESSING
Code: BTFS – NFP 06**

1. Extraction of plant secondary metabolites by different methods.
2. Chemical profiling of plant samples and extracts.
3. Isolation and purification of colours and flavours from plant sources
4. Preparation of chitin, chitosan and glucosamine from prawn shell.
5. Optimization of extraction methods for herbal extracts with active principles.
6. Extraction of alkaloids
7. Extraction of polyphenols and related compounds
8. Extraction of flavonoids and isoflavones.
9. Extraction of terpenes and terpenoids
10. Extraction of saponins.
11. Lab scale cultivation of algae of nutraceutical importance
12. Lab scale production of probiotics
13. Extraction of prebiotics from suitable plant sources.
14. Formulation of health drinks
15. Preparation of syrups, squashes, jams, jellies, fruit bars, ketchups and sauces.
16. Processing of fruits and vegetables- wine preparation.
17. Lab scale preparation of fermented milk products.

**PRACTICAL II:
QUALITY CONTROL AND ANALYTICAL TECHNIQUES
Code: BTFS – NFP 07**

1. Biochemistry of food products- Quantitative determination of reducing sugars by DNS method
2. 19. Quantification of proteins by Folins cio-calteau method.
3. Enzyme studies- Activity and Specific activity measurements of amylase, protease, catalase, peroxidise and urease.
4. Immobilization of enzymes by gel entrapment method.
5. Determination of activity of phosphatase in milk.
6. Test for cellulase activity.
7. Determination of moisture, total sugars, fiber, ash and fat content.
8. Determination of caffeine and tannin content in coffee and tea.
9. Study of different drying methods employed in food processing industry.
10. Preparation of culture media for cultivation of bacteria, molds and yeasts.
11. Assessment of sanitation quality at food preparation units-swab and rinse techniques
12. Isolation of microorganisms- Different methods and maintenance of cultures of microorganisms.
13. Bacteriological analysis of foods, yeast and mold count in food samples.
14. Microbial analysis of water and milk-Total count, MPN Coliform and MBRT.
15. Biochemical tests for characterisation of bacteria.
16. Rapid methods for identification of microorganisms using diagnostic kits.
17. Determination of physical constants in food samples- bulk density, specific gravity, refractive index, gel strength, melting and freezing points, viscosity and consistency measurement.

18. Separation techniques- Chromatographic separation-paper, TLC, column, GC and HPLC.
19. 36 Electrophoretic separation.
20. Spectroscopic techniques- Quantitative determination of active principles and minerals in nutraceuticals and processed foods by UV-Vis and Atomic absorption spectroscopy.
21. Determination of BMR and BMI.
22. Study of different documentation procedures involved in food processing and nutraceutical industry.
23. Stability studies of processed foods and nutraceutical products.