



**B. TECH. FOOD TECHNOLOGY  
BYE-LAWS & SYLLABUS  
IMPLMENTED FROM 2018**

**DEPARTMENT OF FOOD TECHNOLOGY**



**DEPARTMENT OF FOOD TECHNOLOGY  
SCHOOL OF INTERDISCIPLINARY SCIENCES AND TECHNOLOGY  
JAMIA HAMDARD, NEW DELHI-110062**



---

## DEPARTMENT OF FOOD TECHNOLOGY

### 1. About the Department

The School of Interdisciplinary Sciences and Technology (SIST) promotes education and research in interdisciplinary sciences. The school provides opportunities to researchers and academicians having specific expertise to cross the boundaries of their respective subject areas and think across them. It encourages researchers to pool their approaches and modify them so that they are better suited to the problems at hand. The school is currently offering B. Tech. & M. Tech. in Food Technology and PhD in Food & Fermentation Technology and Interdisciplinary Sciences. The Department of Food Technology received a substantial grant of Rs. 75 lakhs in 2010 from Ministry of Food Processing Industries to strengthen the laboratories and infrastructure of the Department. As the demand of professionals and trained personnel in the food industry as well as in research and development in government and industrial set-up is immense. The department has funding for research projects from UGC, AICTE, SERB etc.

#### *Objectives of the Institution*

As the demand of professionals and trained personnel in the food industry as well as in research and development in government and industrial set-up is immense, the Department of Food Technology has the following objectives

- To produce professionally competent, proficient and highly skilled personnel in the field of food technology, with a knowledge of various aspects of food science and technology including the quality of raw material, packaging standards and methodology, health and hygiene parameters, processing techniques, storage and food value.
- To enhance institutional capability to develop linkages with Industries and Community based regular and continuing education programs in the relevant areas.
- To impart technical and techno-managerial skill to the unemployed youth and the agrarian society.
- To promote R&D in the field and assist in the implementation of the food processing, safety and quality management of the food regulating bodies like FSSAI, BIS, ISO, CODEX.

---

## 2. Faculty and Area of Interest



**Prof. Afrozul Haq**

Dean, School of Interdisciplinary Sciences and Technology &  
Head, Department of Food Technology  
Jamia Hamdard



**Dr. Sayeed Ahmad**

Coordinator  
Department of Food Technology



**Dr. Z R A A Azad**

Assistant Professor  
Department of Food Technology



**Dr. Vasudha Sharma**

Assistant Professor  
Department of Food Technology



**Dr. Kulsum Jan**

Assistant Professor  
Department of Food Technology



**Dr. Sweta Joshi**

Assistant Professor  
Department of Food Technology



**Dr. Khalid Bashir**

Assistant Professor  
Department of Food Technology



**Er. Jinku Bora**

Assistant Professor  
Department of Food Technology



**Er. Mifftha Yaseen**

Lecturer  
Department of Food Technology



**Er. Aastha Bhardwaj**

Lecturer  
Department of Food Technology

Faculty	Area of Interest
<b>Prof. Afrozul Haq</b> Dean, School of Interdisciplinary Sciences & Technology (SIST) and Head, Department of Food Technology	Food fortification, functional foods, drugs, Vitamin D, HPLC, Metabolomics, Nutrition, Food chemistry, Human health.
<b>Dr. Sayeed Ahmad,</b> Coordinator	Pharmacognosy, Quality Control of Herbal drugs and Botanicals: Chromatography, Metabolomics, HPLC, HPTLC, GCMS, LCMS
<b>Dr. Z R A A Azad</b> Assistant Professor	Meat and Meat Products Processing and Preservation, Meat based Functional Foods, Food Preservation.
<b>Dr. Vasudha Sharma</b> Assistant Professor	Probiotics, Fermented Functional Foods, Nutraceuticals, By-product utilization, food safety, food fermentation.
<b>Dr. Khalid Bashir</b> Assistant Professor	Gamma Irradiation, Starch and Protein Modification, Food Rheology, Drying technology, Food fortification, probiotics, powder engineering.
<b>Dr. Sweta Joshi</b> Assistant Professor	Food Chemistry, Functional foods, Nutraceutical, phytochemicals, extraction techniques, food additives, bioactive components, nanotechnology.
<b>Dr. Kulsum Jan</b> Assistant Professor	Cereal processing, Edible films, agricultural waste utilization, by-product utilization, starch and protein modification.
<b>Er. Jinku Bora</b> Assistant Professor	Food Engineering, Food Biotechnology, Food Chemistry, Starch modification, Nanotechnology
<b>Er. Mifftha Yaseen</b> Lecturer	Food Packaging, Food Product Development, Food Preservation, Meat technology
<b>Er. Aastha Bhardwaj</b> Lecturer	Food Packaging, Nutraceuticals, Functional Foods, dairy technology

### 3. Facilities

The Department is well equipped with processing and analytical equipments and is in the process of procuring many more equipments to make the state of the art facilities. Great emphasis is laid on practical for processing of foods and for analyzing their quality. List of some major equipments available with department and University are as follows: HPLC, Texture Analyser, Rheometer, Hunter Lab Color Spectrophotometer, UV-Vis Spectrophotometer, Motic Inverted Microscope, Deep Freezer, Moisture analyser, Freeze dryer, Rheometer, BOD Incubator, Rotary Vacuum Evaporator, Biohazard Safety Cabinet, Lab. Scale Spray Drier, Tray Drier, Fluidized Bed Drier, Oven, Meat Processing Unit, Bakery lab, Food Juice Processing Equipments, Packaging Equipments, Hammer Mill, Ball mill, Laboratory Pasteurizer, Shrink Packaging Machine, Vacuum Packaging Machine, Viscometer, Infra-red moisture meter, Fruit Crasher, etc.

---

#### 4. Research Activities

No. of papers published in the year 2014-19: 60+

No. of current Ph.D. scholars: 17

#### 5. Selected Publications

1. Jan, Y., Malik, M., Yaseen, M., Ahmad, S., Imran, M., Rasool, S., & **Haq, A.** (2019). Vitamin D fortification of foods in India: present and past scenario. *The Journal of steroid biochemistry and molecular biology*, 105417.
2. **Haq A.**, Svobodová J, Sofi NY, Jindrová A, Kába B, Rajah J, Al Anouti F, Abdel-Wareth L, Wimalawansa SJ, Razzaque MS. (2017) Vitamin D status among the juvenile population: A retrospective study. *J Steroid Biochem Mol Biol.* 2017 Jan 17. pii: S0960-0760(17)30005-5. doi: 10.1016/j.jsbmb.2017.01.005.
3. Uwitonze AM, Murererehe J, Ineza MC, Harelimana E, Nsabimana U, Uwambaye P, Gatarayiha A, **Haq A**, Razzaque MS. (2017) Effects of vitamin D status on oral health. *J Steroid Biochem Mol Biol.* 2017 Feb 1. pii: S0960-0760(17)30030-4. doi: 10.1016/j.jsbmb.2017.01.020.
4. Safar HA, Chehadeh SE, Abdel-Wareth L, **Haq A**, Jelinek HF, ElGhazali G, Anouti FA.(2017) Vitamin D receptor gene polymorphisms among Emirati patients with type 2 diabetes mellitus. *J Steroid Biochem Mol Biol.* 2017 Mar 16. pii: S0960-0760(17)30077-8. doi: 10.1016/j.jsbmb.2017.03.012.
5. Pludowski P, Holick MF, Grant WB, Konstantynowicz J, Mascarenhas MR, **Haq A**, Povoroznyuk V, Balaska N, Barbosa AP, Karonova T, Rudenka E, Misiorowski W, Zakharova I, Rudenka A, Łukaszewicz J, Marcinowska-Suchowierska E, Łaszcz N, Abramowicz P, Bhattoa HP, Wimalawansa SJ (2017) Vitamin D supplementation guidelines. *J Steroid Biochem Mol Biol.* pii: S0960-0760(17)30031-6. doi: 10.1016/j.jsbmb.2017.01.021.
6. **Haq A.**, Sofi N.Y. (2017) Vitamin D and breast cancer: Indian perspective. *Clin Nutr Exper* doi:10.1016/j.yclnex.2016.12.001.
7. Carlberg C., **Haq A.** (2016) The concept of the personal vitamin D response index. *J Steroid Biochem Mol Biol* <http://dx.doi.org/10.1016/j.jsbmb.2016.12.011>.
8. **Haq A.**, Wimalawansa S., Pludowski P, Anouti F.(2016) Clinical practice Guidelines for vitamin D in the United Arab Emirates. *J Steroid Biochem Mol Biol.* <http://dx.doi.org/10.1016/j.jsbmb.2016.09.021>
9. **Haq A.**, Svobodova J., Imran S., Stanford C., Razzaque MS.(2016) Vitamin D deficiency: A single centre analysis of patients from 136 countries. *J Steroid Biochem. Mol Biol* <http://dx.doi.org/10.1016/j.jsbmb.2016.02.007>
10. **Haq A.** Sofi NY and Atef S.(2016) Vitamin D deficiency status, measurement and its treatment in the United Arab Emirates. *Europ J Pharma Med Res.* 3(12):131-137.
11. Osman E., Al Anouti F., El Ghazali G., **Haq A.**, Mirgani R. and Al Safar H. (2015) Frequency of rs731236 (Taql), rs2228570 (Fok1) of Vitamin-Receptor (VDR) gene in Emirati healthy population. *Meta Gene* 6:49-52.
12. **Haq A.**, Stanford C. (2015) Vitamin D Deficiency, metabolism and routine measurement of its metabolites [25(OH) D2 and 25(OH)D3]. *J Chromatogr Sep Tech* 6: 275. doi:10.4172/2157-7064.1000276.
13. Brown R, **Haq, A**, Stanford C and Razzaque M.(2015) Vitamin D, phosphate and vasculotoxicity. *Canad J Physiol Pharmacol*; doi: 10.1139/cjpp-2015-0083.
14. **Haq A** (2013) Vitamin D: A molecule of universal interest and its measurement. *J Chromatograph Separat Techniq*, 4: e117. doi:10.4172/2157-7064.1000e1177064
15. Muzzafar, A., **Sharma, V.** (2018). Microencapsulation of probiotics for incorporation in cream biscuits. *Journal of Food Measurement & Characterization*, 09/2018, 12 (3), 1-9.



- 
16. Gangwar, A.S., Bhardwaj A, **Sharma, V.** (2017). Fermentation of Tender Coconut Water by Probiotic Bacteria *Bacillus coagulans*. International Journal of Food Studies, 04/2018; 7(1), ISSN: 2182-1054.
  17. Use of fine wine lees for value addition in the ice cream, Journal of Food Science and Technology, page 10-13, May-2013, ISSN-0022-1155 /Peer reviewed. IF-2.024 (Ajay Kumar Sarma, Rajeev Kumar, **Z.R.A.A. Azad**, P.G.Adsule).
  18. Edible Mushroom as Health promoting Agent Advance Science Focus, Vol-1, pp-1-8, 2013, ISSN-2330-0760, Peer reviewed, IF-1.253 (M.F.Ahmad, F.A.Ahmad, **Z.R.A.A. Azad**, M.I.Alam, J.A.Ansari, B.P.Panda).
  19. **Sharma V**, Mishra H. N., Unstructured kinetic modeling of growth and lactic acid production by *Lactobacillus plantarum* NCDC 414 during fermentation of vegetable juices, LWT-Food Science & Technology, 05/2014; 59(2):1123-1128.
  20. **Sharma V**, Mishra H.N., Fermentation of vegetable juice mixture by probiotic lactic acid bacteria, Nutrafoods. 01/2013; 12(1).
  21. **Aastha Bhardwaj**, Tanweer Alam, Nishtha Talwar (2019); Recent advances in active packaging for shelf life enhancement and postharvest management of agri-produce: A review; Journal of Postharvest Technology, 7(1): 33-62
  22. **Sharma V**, Mishra H. N., Non Dairy Probiotic Beverages: A Review, International Journal of Food Research 06/2012; 20:7-15.
  23. **Sweta Joshi**, Ahmed Mobeen, Kulsum Jan, Khalid Bashir, Z.R.A Azad (2019). "Emerging Technologies in Dairy Processing: Present status and Future Potential". *Health and Safety Aspects of Food Processing Technologies* by A. Malik, Z. Erginkaya, H. Erten as editors and published by Springer Nature (Switzerland). (In press).
  24. **Kulsum Jan**, Khalid Bashir, Shumaila Jan, **Sweta Joshi**, Z.R.A Azad (2019). "Emerging Technologies in Cereal Processing: Present status and Future Potential". *Health and Safety Aspects of Food Processing Technologies* by A. Malik, Z. Erginkaya, H. Erten as editors and published by Springer Nature (Switzerland). (In press).
  25. **Jan K**, Riar CS, Saxena DC (2014). Mathematical Modelling of Thin Layer Drying Kinetics of Biodegradable Pellets. Journal of Food Process Technol 5: 370. doi:10.4172/2157-7110.1000370
  26. **Kulsum Jan**, C. S. Riar & D. C. Saxena (2015). Engineering and functional properties of biodegradable pellets developed from various agro-industrial wastes using extrusion technology. J Food Sci Technol 52 (12), 7625-7639.
  27. S. I. Rafiq, **K. Jan**, S. Singh, D. C. Saxena (2015). Physicochemical, pasting, rheological, thermal and morphological properties of horse chestnut starch. J Food Sci Technol. 52 (9), 5651-5660
  28. **K Jan**, CS Riar, DC Saxena (2016). Optimization of Pellet Production from Agro-Industrial By-Products: Effect of Plasticizers on Properties of Pellets and Composite Pots. J Polym Environ, 25, 1, 56-73
  29. **K Jan**, CS Riar, DC Saxena (2016). Value addition to food industry by-products and wastes (deoiled rice bran and banana peel) by optimizing pellets' formulation using response surface methodology: Characterisation and classification by PCA approach. Journal of Food Processing and Preservation doi:10.1111/jfpp.13132.
  30. **K Jan**, CS Riar, DC Saxena (2016). Value addition to agro industrial by-products: Effect of temperature and plasticizer on various properties of pellets developed using extrusion technology. *Journal of Food Processing and Preservation*. doi.org/10.1111/jfpp13257.
  31. Khalid Bashir, **Kulsum Jan**, Manjeet Aggarwal. (2017). Thermo-rheological and functional properties of gamma irradiated whole wheat flour. International Journal of Food Science and Technology. 52,4, 927-935.
  32. **K Jan**, CS Riar, DC Saxena (2017). Characterization of agroindustrial byproducts and wastes for sustainable industrial application. Journal of Food measurement and characterization. 11, 3, 1254-1265.

- 
33. M.S. beg, Sameer Ahmad, **Kulsum Jan**, Khalid Bashir. (2017). Status supply chain and processing of cocoa- A review. *Trends in Food Science and Technology* .66, 106-108.
  34. Ruchi Verma, Shumaila Jan, Savita Rani, **Kulsum Jan**, Tanya L. Swer, Kumar S. Prakash, M. Z. Dar, Khalid Bashir. (2018). Physicochemical and functional properties of gamma irradiated buckwheat and potato starch. *Radiation Physics and Chemistry*. 144:37-42.
  35. M Zuhaib Dar, Km Deepika, **Kulsum Jan**, Tanya L Swer, Pradeep Kumar, Ruchi Verma, Kush Verma, Kumar S Prakash, Shumaila Jan, Khalid Bashir. (2017). Modification of structure and physicochemical properties of buckwheat and oat starch by  $\gamma$ -irradiation. *International Journal of Biological Macromolecules*.
  36. Pradeep Kumar, Kumar S. Prakash, **Kulsum Jan**, Tanya L. Swer, Shumaila Jan, Ruchi Verma, Km Deepika, M. Zuhaib Dar, Kush Verma, Khalid Bashir. Effects of gamma irradiation on starch granule structure and physicochemical properties of brown rice starch. *Journal of Cereal Science*, 77 (2017) 194-200.
  37. **Khalid Bashir**, Manjeet Aggarwal. (2016). Effects of gamma irradiation on the Physicochemical, Thermal and Functional Properties of Chickpea flour. *LWT-Food Science and Technology*. 69: 614-622.
  38. **Khalid Bashir**, Manjeet Aggarwal. (2017). Physicochemical, Thermal and Functional Properties of Gamma Irradiated Chickpea Starch. *International Journal of Biological Macromolecules*. 97:426-433.
  39. **Khalid Bashir**, Tanya L. Swer, Kumar Satya Prakash, Manjeet Aggarwal. (2017). Physico-chemical and functional properties of gamma irradiated whole wheat flour and starch. *LWT-Food Science and Technology*.
  40. Leela Chauhan, Kumar Satya Prakash, P.P. Srivastav, **Khalid Bashir**. (2015). Physicochemical and thermal properties of candy crystals prepared from Palmyra palm jaggery. *Journal of Food Process Engineering*. 40(1):1-6.
  41. Sameer Ahmad, P. K. Nema, **Khalid Bashir**. (2017). Effect of different drying techniques on physicochemical, thermal, and functional properties of seera. *Drying Technology*. 36 (11): 1284-1291.
  42. Tanya L Swer, C. Mukhim, **Khalid Bashir**, Komal Chauhan. (2018). Optimization of enzyme aided extraction of anthocyanins from *Prunus nepalensis* L. *LWT-Food Science and Technology*. 91: 382-390
  43. Tanya L. Swer, Komal Chauhan, Prodyut K Paul, C. Mukhim, **Khalid Bashir**, Rachna Sehrawat. (2018). Production and optimization of anthocyanin-rich food colorant extracted from *Prunus nepalensis* L. (Sohiong). *Pigment and Resin Technology*. 47: 453-463
  44. Tanya L. Swer, Komal Chauhan, C. Mukhim, **Khalid Bashir**, Anit Kumar. Application of anthocyanins extracted from Sohiong (*Prunus nepalensis* L.) in food processing. *LWT-Food Science and Technology*. 114.
  45. **Khalid Bashir**, Manjeet Aggarwal. (2019). Physicochemical, structural and functional properties of native and irradiated starch: A Review. *Journal of Food Science and Technology*. 56(2): 513-523.
  46. J Saxena, S Joshi, M Ali Khan, 'Kinetic study of Supercritical Fluid Extraction of Essential oil from Cumin (*C. cuminum*) Seeds'. *Journal of Agricultural Engineering and Food Technology*, 2015, 2 (1), pp. 32-38; ISSN: 2350- 0263.
  47. Singh A.K., **Sharma V.**, & Yadav, K.C., "Effect of Moisture Content on Physical Properties of Flaxseed" in Research & Reviews: *Journal of Food Science & Technology*, ISSN: 2278 – 2249, Vol. 3, Issue 2, pp. 19-27, August 2014
  48. Chakraborty, S., Sarma, M., **Bora, J.**, Faisal, S., & Hazarika, M. K. (2016). Comparative study between ANN and master curve technique for the thin layer drying kinetic study of paddy and modeling of its critical drying temperature by using ANN-PSO approach. *Agricultural Engineering International: CIGR Journal*, 18(4), 177-189.

- 
49. Chakraborty, S., Hazarika, M.K., Khobragade, C.B., Paul, S.K. & **Bora, J.** (2017). Study on in-bed drying system for the drying of paddy in Assam. *International Food Research Journal* 24(3), 24 (3), 1345-1348.
  50. Varisha Anjum, Shami Alam, **Sweta Joshi**, Rabea Parveen, Sayeed Ahmad (2019). In silico docking analysis and in vivo pharmacokinetics study of flavonoids for reversal of dengue fever related thrombocytopenia. *Journal of Food Composition and Analysis*. (Communicated)
  51. **Bhardwaj, A.**, Shakil, N.A., Jha, V. and Gupta, R.K. (2014). Screening of nutritional, phytochemical, antioxidant and antibacterial activity of underutilized seeds of *Scirpus articulatus*: the basis of Khubahi Ramdana industry. *Journal of Pharmacognosy and Phytochemistry*, 3(4): 11-20. (IF: 0.255)
  52. **Bhardwaj, A.**, Satpathy, G. and Gupta, R.K. (2014). Preliminary screening of nutraceutical potential of *Annona squamosa*, an underutilized exotic fruit of India and its use as a valuable source in functional foods. *Journal of Pharmacognosy and Phytochemistry*, 3(2): 172-180
  53. **Mifftha Yaseen**, Dr. Z.R.A.A.Azad, Need of Innovative Agriculture Practices for Sustainable Economic Development in India. *International Journal of Advanced Studies*, Pune Research Discovery, ISSN 2455-9202 (Vol.2, Issue 1), 2017.
  54. **Mifftha Yaseen**, Dr. Z.R.A.A.Azad, Role of Food Processing Industries in Socio- Economic Development in India, *International Journal of Social Sciences and Arts Royal-* ISSN-2278-8158 (pp: 117-116), 2017.
  55. **Aastha Bhardwaj**, Najam A. Shakil, Vidyath Jha, Rajinder Kumar Gupta (2014); Screening of Nutritional, Phytochemical, Antioxidant and Antibacterial activity of underutilized seeds of *Scirpus articulatus*: The basis of Khubahi ramdana industry: *Journal of Pharmacognosy and Phytochemistry*; 3(4): 11-20.
  56. Dinker Singh, Tanweer Alam, **Aastha Bhardwaj**, Jai Singh (2016); Optimisation of Formulation for the Manufacturing of Soy Fortified Shrikhand; *Indian Journal of Dairy Science*, 69(6): 649-659.
  57. **Vasudha Sharma** and **Aastha Bhardwaj** (2019); Scanning Electron microscopy (SEM) in food quality evaluation. *In: Evaluation technologies for food quality* (Eds: Zhong, J and Wang, X), Chapter – 29, Elsevier, Woodhead Publishing, ISBN: 9780128142172.
  58. **Aastha Bhardwaj**, Bisma Kaloo and Tanweer Alam (2018) Quality characteristics of Packaging Materials And Containers Used For Storage Of Fresh Produce. *In: Packaging and Storage of Fruits and Vegetables for Quality Preservation* by AAP-CRC Press, Taylor & Francis Group, USA. (In Press).



---

## B. TECH. PROGRAMME IN FOOD TECHNOLOGY

### BYE-LAWS

---

#### 1. OBJECTIVE

To prepare highly skilled professionals with a strong conceptual and theoretical background in the field of Food Technology, especially in the emerging areas of packaged food.

#### 2. The PROGRAMME

Highlights of the course are described in the following table:

a.	Name of the Programme	BACHELOR OF TECHNOLOGY (FOOD TECHNOLOGY)
b.	Nature	Regular and Full Time
c.	Duration	Four Years (8 Semesters)
d.	Total number of credits	187
e.	Medium of Instruction and English Examinations	English
f.	Eligibility criteria	A candidate seeking admission to this program must have passed Senior Secondary (12 <sup>th</sup> / Intermediate) examination with Mathematics/ Biology from CBSE or any other Board recognized by Jamia Hamdard as equivalent thereto, securing atleast 50% marks or equivalent CGPA in aggregate.
g.	Selection procedure	Selection will be based on merit of JEE/NEET score <i>In case the seats remain unfilled, Jamia Hamdard may admit candidates on the basis of merit of qualifying examination or the merit of internal test and/ or interview conducted by Jamia Hamdard which will be announced separately, if situation arises.</i>
h.	Total Seats	30; inclusive of seats reserved for NRI/ sponsored candidates; additional seats are available for Foreign Nationals.
i.	Period of Completion	Not more than 07 years (14 Semesters)
j.	Commencement of the Programme	July of the every academic session.

Total Credits-187

---

### 3. Course Structure:

1. A minimum of three credits shall be assigned for each theory paper and maximum of 4 credits, with one credit for Tutorial and 2 for the lab work (practical). The lab work may also include a report or industrial visit.
2. One of the papers of at least 3 credits in semester VI and VII will be discipline centric elective course offered in the main subject of study, and a student shall have a choice of two papers each to choose from.
3. One of the papers of at least 3 credits in semester VI and VII will be Generic elective course which could be chosen from any discipline or subject.
4. One theory credit will be counted as 1 h of teaching per week, and two practical hours will be counted as 1 credit per week.
5. The students will be sent for Compulsory Industry visits in Fourth, Fifth Semester.
6. After Sixth Semester, the students shall undergo summer internship of 4-6 weeks. The students will submit their reports to the department forwarded by Supervisor and Head of the Department and shall give a presentation in 7<sup>th</sup> Sem.
7. The students have to do a minor project during their Seventh Sem. The students shall select any topic of their interest and they shall submit a report/status/review to the department and guide and give a presentation the topic at the end of Sem.
8. There shall be a project/thesis work in the eighth semester instead of the theory papers. The credit to this course (thesis) should not exceed the maximum limits set for the number of credits in a semester. The thesis work shall include the experimental work on a specified topic and submission of the thesis towards the end of the Semester VIII. The project work/thesis shall be evaluated as per the guidelines proposed by the Board of Studies and specified into the syllabus. For the project work/thesis, the Head of the Department/Program Coordinator shall convene a meeting of all teachers of the Department and assign appropriate number of students to each teacher to act as supervisor for the project work. The student in consultation with the supervisor shall select a topic for the project work under the intimation to the Head of the Department/Program Coordinator in writing. The project/thesis work may be carried out in an institute/industry/university other than JH. In such cases, the person with whom the students is working shall be considered as the supervisor and the Head of the Department/Program Coordinator will assign a co-supervisor from the

---

Department in consultation with teachers keeping in view of the nature of the work and the expertise available with the teacher. The evaluation of the dissertation, project presentation and viva voce will be conducted by external examiner. The project shall comprise of the three components namely **Part A, Part B and Part C**. Part A will be assigned 150 marks and will comprise of submission of a project report after completion of the project. Part B will be assigned 150 marks and will comprise of a presentation on the topic of his/her project work carried out in department/industry/institute/research Centre. Part C will be assigned 100 marks and will include viva voce examination

9. The project report of the eighth semester shall comprise the following three components:
- Each student will undertake a project work in the fourth semester under the supervision of either faculty member from Jamia Hamdard or an expert from industry/ institute research centre and under the overall supervision of Dean and Head of the faculty. After the completion of project each student has to submit a project report by the deadline fixed for the same purpose.
  - Each student will deliver two presentations on the topic of his/ her project work carried out in department/ industry/ institute/research centre, which will be evaluated by an external examiner on the date and time fixed for the purpose.
  - A viva voce examination will be conducted by an external examiner on the date and time fixed for the purpose.
  - The topic for the IV Semester project dissertation will be finalized in the III Semester in consultation with the faculty members of the department as well as experts from the industry / institute/ research centre. The students will be informed about the topics accordingly.
10. A student shall have to score minimum pass marks (40%) separately in internal assessment and semester examination for each paper.

Mode of curriculum delivery includes classroom teaching, assignments, test, lab work, presentations, participation in relevant events and regularity.

#### **4. THE GRADING SYSTEM**

As per University Rule

#### **5. CALCULATIONS OF SGPA AND CGPA OF A STUDENT IN A SEMESTER**

As per University Rule



---

## 6. ADMISSION

A candidate, aspiring for admission to **B. Tech (FT) Programme**, shall have to apply in the prescribed application form that is complete in all respect, on or before the last date of submission.

NOTE:

- a. Different procedure may be adapted for admission of Foreign/ NRI/ Industry sponsored candidates, who apply for admission in the prescribed form and fulfill the eligibility requirements.
- b. The admission committee, duly constituted for purpose, would prepare a merit list on the basis of the selection criteria.
- c. Admission committee shall display/ publish the list of candidates that are declared eligible for admission, after the due approval of the competent authority.
- d. Eligible candidates shall have to complete the prescribed formalities, for completion of admission, within the stipulated period of time; otherwise they will forfeit the right to admission.

## 7. ATTENDANCE

- a. All students are supposed to attend every lecture and practical classes. However, the attendance requirement for appearing in the examination shall be a minimum of 75% of the classes held.
- b. Each one- period teaching shall account for one attendance unit.
- c. The concerned teacher will take a roll call in every scheduled class, maintains and consolidate the attendance record, which would be submitted to the Head of the Department at the conclusion of the semester.
- d. Attendance on account of participation (with prior submission from the head of the department) in the co-curricular/extra-curricular activities can be granted by the Dean on receipt of certificates or recommendations of the respective activity issued by the Head of the Department.
- e. Attendance records displayed on notice board from time to time, in respect of short attendance, shall be deemed to be a proper notification and no individual notice shall be sent to the students/local guardian.
- f. In case a student is found to be continuously absent from the classes without prior information for a period of 30 days, the concerned faculty shall report it to the Head of the department.
- g. Head of the department may recommend for striking off the name of the student from rolls, after ensuring **“one month continuous absence”** from all the concerned teachers.
- h. A student, whose name has been struck off on account of long absence, may apply to the Dean for readmission within 15 days of the notice of striking off the name. The readmission shall be effected on payments of prescribed readmission fees.
- i. A student with less than 75 % attendance, in aggregate shall not be allowed to appear in the semester examination. The Head of the department shall recommend all such cases to the Dean of the faculty.
- j. The Dean, on recommendation of the Head of the department, may consider the relaxation of attendance upto 10 % on account of sickness and/or any other valid reason. No

---

application for relaxation of attendance (duly certified by a Registered medical practitioner/Public hospital or a concerned authority) will be entertained after 15 days from the recovery of illness etc.

- k. A student detained on account of short attendance will start afresh in the same class in the next academic year on payment of current fees except enrollment fee, identity card fee and security deposits etc.

## 8. INTERNAL ASSESSMENT

- a. Internal assessment, to be made by concerned teachers, will be based on minor test, quizzes, presentation, programming test, demonstrations and assignments.
- b. Maximum of three minor tests, with a total of 20 marks, for each theory paper shall be mandatory. Other modes of assessment shall account for remaining 10 marks. Whereas, for lab course internal assessment will be of 50 marks each.
- c. A minor test shall be scheduled after the completion of first and second term.
- d. Dates of minor test will be announced at the beginning of the semester, by the examination coordinator.
- e. The concerned teachers shall submit the compiled internal assessment marks to the Head of the department, on the conclusion of teaching of the current semester.
- f. The Head shall display a copy of the compiled sheet, of internal assessment marks of all the papers, before forwarding it to the Controller of Examination, i.e. at the conclusion of the semester.
- g. A promoted candidate, who has to reappear in the examination of the paper, will retain internal assessment marks.
- h. In the case of re-admission, the candidates shall have to go through the internal assessment afresh and shall retain nothing of the previous year.

## 9. SEMESTER EXAMINATIONS

Prescriptions for conducting semester examinations of theory and lab papers, those shall be conducted after the inclusion of each of the semesters, are presented in the following table:

a..	Mode	(theory papers)	Written only
		(Lab papers)	Written, Demo, Programming and viva-voce
b.	Duration	(Theory papers)	03 hours
c.	Total Marks	(Theory papers)	70 (Seventy only)
		(Lab papers)	50 (Fifty only)

## 10. MAJOR PROJECT

- a. Each student of the final semester (VIII sem) will have to carry out a project under the guidance of one or two faculty members.
- b. There shall be a mid-term evaluation of the progress and the internal supervisors.

- 
- c. All the candidates shall submit Three (03) hard copies of the project report that are duly approved and signed by internal as well as external (if applicable) supervisors.
  - d. An external examiner, appointed for the purpose, shall evaluate the project report.
  - e. Head of the department shall forward the compiled total marks (awarded in internal assessment, project report and viva-voce examination), in the project-semester of each of the candidate, to the concerned Dean/Controller of Examination.

## 11. EXAMINATION

- a. The performance of a student in a semester shall be evaluated through continuous class assessment and end-semester examination. The continuous assessment shall be based on class tests, assignments/tutorials, quizzes/viva-voce and attendance. The end-semester examination shall be comprised of written papers, practical and viva-voce, inspection of certified course work in classes and laboratories, project work, design reports or by means of any combination of these methods.
- b. The marks obtained in a subject shall consist of marks allotted in end-semester theory paper, practical examination and Sessional work.
- c. The minimum pass marks in each subject including sessional marks (Theory, practical or project etc.) shall be 40%.

## 12. PROMOTION SCHEME

In order to pass a paper, a student has to secure at least grade D in that paper.

- a. A student will be promoted from first year to second year/second year to third year/third year to fourth year provided that he/she is **not having more than 07 (seven) backlog papers** including labs; excluding non-credit papers) in total. A student who fails to satisfy the criteria mentioned for the promotion shall be **detained** in the same year.
- b. A **detained** student is not allowed to reappear in the minor tests. His/Her old internal assessment marks will remain same. However, he/she will be required to re-appear in the semester examination for those papers in which he/she had failed, when these papers are offered again (Examination for odd semester paper will be held in Odd semester, and for even semester papers will be held in even semester).
- c. **Supplementary examination:** For the final year students, students can appear in supplementary examinations in their all backlog papers after the declaration of their final semester results only.

## 13. CLASSIFICATION OF SUCCESSFUL CANDIDATES

The result of successful candidates, who fulfill the criteria for the award of **B. Tech Food Technology**, shall be classified at the end of last semester, on the basis of his/her final CGPA (to be calculated as per university rules).



**CURRICULUM OF B. TECH. PROGRAMME IN FOOD TECHNOLOGY**  
**DEPARTMENT OF FOOD TECHNOLOGY**  
**JAMIA HAMDARD**

**COURSE OF STUDY**

**L-T-P** stands for number of contact hours as Lecture-Tutorial-Practical in a week.

**B. TECH. FIRST SEMESTER (July- Dec)**

S. No.	Paper Code	Subject Category	Paper Title	Marks	L	T	P	Credits
			Orientation Programme					
1.	BFTC-101	Core	Communication Skills-I	100	2	1	0	3
2.	BFTC-102	Core	Mathematics - I	100	3	1	0	4
3.	BFTC-103	Core	Applied Physics	100	3	1	0	4
4.	BFTC-104	Core	Applied Chemistry	100	3	1	0	4
5.	BFTC-105	Core	Basic of Computer Programing	100	3	1	0	4
6.	BFTC-106	Core	Engineering Mechanics	100	3	1	0	4
7.	BFTC-107	Core	Applied Physics Lab	100	0	0	4	2
8.	BFTC-108	Core	Applied Chemistry Lab	100	0	0	4	2
9.	BFTC-109	Core	C Programing Lab	100	0	0	4	2
10.	Total			900	17	6	12	29

---

**B. TECH. SECOND SEMESTER (Jan- May)**

S. No.	Paper Code	Subject Category	Paper Title	Marks	L	T	P	Credits
1.	BFTC-201	Core	Communication Skills-II	100	2	1		3
2.	BFTC-202	Core	Mathematics - II	100	3	1		4
3.	BFTC-203	Core	Electrical Science	100	3	1		4
4.	BFTC-204	Core	Biochemistry and Basic Organic Chemistry	100	3	1		4
5.	BFTC-205	Core	Introduction to Food Technology	100	3			3
6.	BFTC-206	Core	Introductory Biology	100	3			3
7.	BFTC-207	Core	Electrical Science Lab	100			4	2
8.	BFTC-208	Core	Biochemistry Lab	100			4	2
9.	BFTC-209	Core	Introduction to Food Technology Lab	100			4	2
10.	*ES-01	Compulsory	Environmental studies and Disaster Management	100	2			
11.	Total			1000	19	4	12	27

**B. TECH. THIRD SEMESTER (July- Dec)**

S. No.	Paper Code	Subject Category	Paper Title	Marks	L	T	P	Credits
1.	BFTC-301	Core	Food Chemistry	100	3	1		4
2.	BFTC-302	Core	Food Microbiology	100	3	1		4
3.	BFTC-303	Core	Nutrition and Dietetics	100	3			3
4.	BFTC-304	Core	Thermodynamics	100	3	1		4
5.	BFTC-305	Core	Cereal, Pulses & Oilseed Technology	100	3	1		4
6.	BFTC-306	Core	Food Chemistry Lab	100			4	2
7.	BFTC-307	Core	Food Microbiology Lab	100			4	2
8.	BFTC-308	Core	Cereal, Pulses & Oilseed Technology Lab	100			4	2
	Total			800	15	4	12	25

### B. TECH. FOURTH SEMESTER (Jan-May)

S. No.	Paper Code	Subject Category	Paper Title	Marks	L	T	P	Credits
1	BFTC-401	Core	Unit Operations in Food Processing	100	3	1		4
2	BFTC-402	Core	Functional Foods and Nutraceuticals	100	3	1		4
3.	BFTC-403	Core	Post harvest Technology of Fruit and Vegetables	100	3	1		4
4.	BFTC-404	Core	Food Engineering I	100	3	1		4
5.	BFTC-405	Core	Unit Operations Lab	100			4	2
6.	BFTC-406	Core	Fruits and Vegetables Lab	100			4	2
8.	BFTC-V1	Compulsory	Industrial Visit-1	50				
	Total			650	12	4	8	20

### B. TECH. FIFTH SEMESTER (July-Dec)

S. No.	Paper Code	Subject Category	Paper Title	Marks	L	T	P	Credits
1	BFTC-501	Core	Dairy Technology	100	3	1		4
2	BFTC-502	Core	Food Engineering II	100	3	1		4
3.	BFTC-503	Core	Food Fermentation & Biotechnology	100	3	1		4
4.	BFTC-504	Core	Dairy Technology Lab	100			4	2
5.	BFTC-505	Core	Food Engineering II Lab	100			4	2
6.	BFTD-506	Discipline Specific Elective	Bakery & Confectionery Technology	100	3	1		4
7.	BFTD-507	Discipline Specific Elective	Beverage Technology					
8.	BFTG-508	Generic Elective	Techniques in Food Analysis	100	3	1		4
9.	BFTG-509	Generic Elective	Food Storage & Plant Layout					
11	BFTC-V2	Compulsory	Industrial Visit-2	50				
12	BFTC-V3	Compulsory	Research Institute Tour-1	50				
	Total			800	15	5	8	24



### B. TECH. SIXTH SEMESTER (Jan-May)

S. No.	Paper Code	Subject Category	Paper Title	Marks	L	T	P	Credits
1	BFTC-601	Core	Meat, Fish & Poultry Technology	100	3	1		4
2	BFTC-602	Core	Engineering Properties of Foods	100	3	1		4
3.	BFTC-603	Core	Food Engineering III	100	3	1		4
4.	BFTC-604	Core	Meat Technology Lab	100			4	2
5.	BFTC-605	Core	Engineering Properties of Foods Lab	100			4	2
6.	BFTC-606	Core	Food Engineering III Lab	100			4	2
7.	BFTD-606	Discipline Specific Elective	New Product Development	100	3	1		4
8.	BFTD-607	Discipline Specific Elective	Engineered, Textured and Fabricated Foods					
9.	BFTG-608	Generic Elective	Non Thermal Food Processing	100	3	1		4
10	BFTG-609	Generic Elective	Food Business Management					
11	BFTC-V4		Summer Training	100				
	Total			900	15	5	18	26

### B. TECH. SEVENTH SEMESTER (Jul-Dec)

S. No.	Paper Code	Subject Category	Paper Title	Marks	L	T	P	Credits
1	BFTC-701	Core	Packaging Technology	100	3	1		4
2.	BFTC-702	Core	Research Methodology	100	3	1		4
3.	BFTC-703	Core	Food Safety & Quality Management	100	3	1		4
4.	BFTC-704	Core	Packaging Technology Lab	100			4	2
5.	BFTC-705	Core	Food Safety Lab	100			4	2
6.	BFTD-706	Discipline Specific Elective	Food Process & Equipment Design	100	3	1		4
7.	BFTD-707	Discipline Specific Elective	IPR in Food Technology					
8.	BFTG-708	Generic Elective	Technology of Effluent Treatment and Waste Management	100	3	1		4
9	BFTG-709	Generic Elective	Food Additives					
10	BFTC-P1		Minor Project/Status Paper/Review	100				
	Total			800	15	3	8	24

---

---

### B. TECH. EIGHTH SEMESTER (Jan-May)

S. No.	Paper Code	Paper Title	Marks	L	T	P	Credits
1	BFTC-801	Project report/Industrial Training, Departmental Seminar Viva Voce	150 150 100		2	20	12
	Total		400		2	20	12

Total Credits:  $29+27+25+20+24+26+24+12 = 187$

Total Marks:  $900+1000+800+650+800+900+800+400 = 6250$

### DETAILED SYLLABUS OF BTECH (FOOD TECHNOLOGY)

#### FIRST YEAR

#### CORE PAPER

#### SEMESTER I

**Paper Title: Communication Skills I**

**Paper Code: BFTC-101**

Total Credits: 3, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-30, Final Exam-70)

---

#### UNIT - I

Remedial Grammar: Errors of Accidence and syntax with reference to Parts of Speech; Agreement of Subject and Verb; Tense and Concord; Conditional Clauses; Use of connectives in Complex and Compound sentences; Question tags and short responses.

#### UNIT - II

Vocabulary and Usage: Word Formations (by adding suffixes and prefixes); Technical Word Formation; Synonyms, Antonyms, Homophones, and Homonyms; One Word Substitution; Misappropriations; Indianisms; Redundant Words; Phrasal Verb Idioms.

#### UNIT - III

Technical Writing:

(A) Scientific Attitude and Impersonal Style; Plain Statements, Definitions; Description and Explanations (of objects, instruments, Processes, Scientific Principles, etc.); Summarizing and abstracting; Expressing ideas within a restricted word limit; Paragraph Writing (Paragraph division, introduction and the conclusion, Variety in sentences and paragraphs); Interpretation and use of charts, graphs and tables in technical writing; Punctuation.

---

(B) Reading at various speeds (slow, fast, very fast); reading different kinds of texts for different purpose (e.g. for relaxation, for information, for discussion at a later stage, etc.); reading between the lines; Comprehension of Unseen Passages

#### **UNIT - IV**

Text: The following prose pieces from Best Science Writing : Reading and Insights edited by Robert Gannon prescribed text (Hyderabad: University Press (India) Limited, 1991).

1. Chapter 2: "After 63 years, Why Are They Still Testing Einstein?" by C.P. Gilmore
2. Chapter 5: "Star Wars : The Leaky Shield" By Carl Sagan
3. Chapter 10: "Chaos : The Ultimate Asymmetry" by Arthur Fisher
4. Chapter 11: "Bill Moss, Tentmaker" by Robert Gannon
5. Chapter 12: "Totality - A Report" by Michael Rogers

#### **BOOKS RECOMMENDED:**

1. Maison, Margaret M. Examine Your English, Hyderabad: Orient Longman, 1980
2. Sharma, R.S. Technical Writing. Delhi: Radha Publication, 1999
3. Sudarsanam, R. Understanding Technical English. Delhi: Sterling Publishers Pvt. Ltd., 1992
4. Gannon, Robert, Edt. Best Science Writing: Readings and Insights. Hyderabad: University Press (India) Limited, 1991

#### **CORE PAPER**

#### **SEMESTER I**

**Paper Title: Mathematics - I**  
**Paper Code: BFTC-102**

Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-30, Final Exam-70)

---

#### **UNIT-I**

**RELATIONS AND FUNCTION:** Properties of Relations, Equivalence Relation, Function: Domain and Range, Composite and Inverse Functions, Introduction of Trigonometric and Identities, Logarithmic and Exponential Functions.

#### **UNIT-II**

**Determinant:** Definition, Minors, Cofactors, Properties of Determinants **MATRICES:** Definition, Types of Matrices, Addition, Subtraction, Scalar Multiplication and Multiplication of Matrices, Adjoint, Inverse, Cramers Rule, Rank of Matrix, Dependence of Vectors, System of linear equations.

#### **UNIT-III**

**LIMITS & CONTINUITY:** Limit at a Point, Properties of Limit, Computation of Limits of Various Types of Functions, Continuity at a Point, Continuity Over an Interval.

#### **UNIT-IV**

**DIFFERENTIATION:** Derivative, Derivatives of Sum, Differences, Product & Quotients, Chain Rule, Derivatives of Composite Functions, Logarithmic Differentiation, Maxima and Minima.



---

INTEGRATION: Definition of Integration, Basics of Integration, Integration of Polynomial Functions, Trigonometric Functions, Logarithmic Functions.

**BOOKS RECOMMENDED:**

1. NCERT Books of XI & XII Mathematics.
2. Shanti Narayan, "Differential Calculus", S.Chand & Company, 1998.
3. B.S. Grewal, "Elementary Engineering Mathematics", 34th Ed.. 1998.

**CORE PAPER**

**SEMESTER I**

**Paper Title: Applied Physics**

**Paper Code: BFTC-103**

Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assessment-30, Final Exam-70)

---

**UNIT - I**

**Interference of Light:** Interference due to division of wavefront and division of amplitude, Young's double slit expt., Interference, Principle of Superposition, Theory of Biprism, Interference from parallel thin films, wedge shaped films, Newton rings, Michelson interferometer. **Diffraction:** Fresnel Diffraction, Diffraction at a straight edge, Fraunhofer diffraction due to N slits, Diffraction grating, absent spectra, dispersive power of Grating, resolving power of prism and grating.

**UNIT - II**

**Polarization:** Introduction, production of plane polarized light by different methods, Brewster and Malus Laws. Double refraction, Quarter & half wave plate, Nicol prism, specific rotation, Laurent's half shade polarimeter.

**UNIT - III**

**Laser:** Introduction, temporal and spatial coherence, principle of Laser, stimulated and spontaneous emission, Einstein's Coefficients, He-Ne Laser, Ruby Laser, Application of Lasers. **Fibre Optics:** Introduction, numerical aperture, step index and graded index fibres, attenuation & dispersion mechanism in optical fibers (Qualitative only), application of optical fibres, optical communication (block diagram only)

**UNIT - IV**

**Mechanics:** Central and non-central forces, Inverse square force, SHM, Damped, undamped and forced Oscillations. **Special theory of Relativity:** Frame of reference, Michelson-Morley experiment, basic postulates of special relativity, Lorentz transformations (space – time coordinates & velocity only), mass energy relation.

**BOOKS RECOMMENDED:**

1. A. Ghatak, "Optics" TMH
2. N. Subrahmanyam and Brij Lal, "Optics"
3. Jenkins and White, "Fundamentals of Optics"

- 
4. Kittle, "Mechanics", Berkeley Physics Course, Vol.- I.
  5. A. Beiser, "Concepts of Modern Physics"

## CORE PAPER

## SEMESTER I

### Paper Title: Applied Chemistry

### Paper Code: BFTC104

Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-30, Final Exam-70)

---

#### UNIT - I

Water: Specifications for water, analysis of water – alkalinity, hardness and its determination (EDTA method only). Water for domestic use, Water softening processes – Lime – Soda process, Ion exchange method, boiler feed water, boiler problems-scale, sludge, priming and foaming, caustic embitterment and corrosion, their causes and prevention, removal of silica, removal of dissolved gases, carbonate and phosphate conditioning, colloidal conditioning, calgon treatment, Numerical problems on alkalinity, hardness, Lime-Soda process and Ion exchange method, EDTA method.

#### UNIT - II

**Fuels:** Classification, combustion and chemical principles involved in it, calorific value: gross and net calorific values and their determination by bomb calorimeter and Boy's gas calorimeter. **Solid Fuels:** Proximate and ultimate analysis of coal and their importance, High and low temperature carbonisation, Coke: Its manufacture by Otto Hoffman oven. **Liquid Fuels:** Conversion of coal into liquid fuels (Bergius process and Fisher-Tropsch Process) and mechanism, **Petroleum:** its chemical composition and fractional distillation, cracking of heavy oil residues – thermal and catalytic cracking, knocking and chemical structure, octane number and cetane number and their significance, power alcohol, Analysis of flue gases by Orsat's apparatus, Numerical on calorific value, combustion, proximate and ultimate analysis of coal, flue gas analysis.

#### UNIT - III

**Environmental Pollution and Control:** Air Pollution: Types of pollutants, source effects, sink and control of primary pollutants – CO, Nox, HC, Sox and particulates, effects of pollutants on man and environment – photochemical smog and acid rain. **Water Pollution:** Classification of pollutants, their sources, waste water treatment – domestic and industrial. **Soil Pollution:** Composition of soil, classification and effects of soil pollutants and their control. **Solid Waste Pollution:** Classification, waste treatment & Disposal methods (Composting, sanitary landfilling, thermal processes, recycling and reuse). **Hazardous Wastes:** Classification – radioactive, biomedical and chemical, treatment and disposal – physical, chemical and biological processes.

#### UNIT - IV

**Solutions:** Ideal and non-ideal solutions, Raoult's Law, Distillation of binary solutions, Henry's Law, Nernst distribution law, Arrhenius theory and special behaviour of strong electrolytes. **Corrosion:** Types of corrosion (dry, wet, atmospheric and soil corrosion), theories of corrosion, protective measures against corrosion.

---

**BOOKS RECOMMENDED:**

1. Chemistry in Engineering and Technology (Vol. I and II) (Latest ed.), By J.C. Kuracose and J. Rajaram.
2. Environmental Chemistry and Pollution control (Latest ed.), By S.S. Dara.
3. J.D. Lee, "Inorganic Chemistry", latest ed.
4. Puri, Sharma and Pathania, "Principles of Physical Chemistry", Latest ed.
5. V.R. Gowariker, N.V. Viswanathan and Jayadev Sreedha, "Polymer Science", latest ed.
6. Engineering Chemistry by Sunita Rattan Katson Books

**CORE PAPER****SEMESTER I****Paper Title: Basics of Computer Programming  
Paper Code: BFTC105**

Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-30, Final Exam-70)

---

**UNIT - I**

**Introduction to Programming:** Concept of algorithms, Flow Charts, Data Flow diagrams etc., Introduction to the Editing tools such as vi or MS-VC editors, Concepts of the finite storage, bits bytes, kilo, mega and gigabytes. Concepts of character representation, Number Systems & Binary Arithmetic.

**UNIT - II**

**Programming using C:** The emphasis should be more on programming techniques rather than the language itself. The C Programming language is being chosen mainly because of the availability of the compilers, books and other reference materials.

**Example of some simple C program.** Concept of variables, program statements and function calls from the library (Print f for example)

C data types, int, char, float etc., C expressions, arithmetic operation, relational and logic operations, C assignment statements, extension of assignment of the operations. C primitive input output using getchar and putchar, exposure to the scan f and print f functions, C Statements, conditional executing using if, else. Optionally switch and break statements may be mentioned.

**UNIT - III**

**Iterations and Subprograms:** Concept of loops, example of loops in C using for, while and do-while. Optionally continue may be mentioned.

One dimensional arrays and example of iterative programs using arrays, 2-d arrays Use in matrix computations. Concept of Sub-programming, functions Example of functions. Argument passing mainly for the simple variables.



---

## UNIT - IV

**Pointers and Strings:** Pointers, relationship between arrays and pointers Argument passing using pointers Array of pointers. Passing arrays as arguments. Strings and C string library. Structure and Unions. Defining C structures, passing strings as arguments Programming examples.

### BOOKS RECOMMENDED:

1. Yashwant Kanetkar, "Let us C", BPB Publications, 2nd Edition, 2001.
2. Herbert Schildt, "C: The complete reference", Osbourne Mcgraw Hill, 4th Edition, 2002.
3. Raja Raman, "Computer Programming in C", Prentice Hall of India, 1995.
4. Kernighan & Ritchie, "C Programming Language", The (Ansi C Version), PHI, 2nd Edition.

## CORE PAPER

## SEMESTER I

**Paper Title: Engineering mechanics**

**Paper Code: BFTC106**

Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-30, Final Exam-70)

---

### UNIT - I

**Force system:** Free body diagram, Equilibrium equations and applications. **Friction:** Static and Kinetic friction, laws of dry friction, co-efficient of friction, angle of friction, angle of repose, cone of friction, friction lock, friction of flat pivot and collared thrust bearings, Belt drive- derivation of equation.

$T_1/T_2 = e^{\mu\theta}$  and its application

### UNIT - II

**Structure:** Plane truss, perfect and imperfect truss, assumption in the truss analysis, analysis of perfect plane trusses by the method of joints, method of section. **Distributed Force:** Determination of center of gravity, center of mass and centroid by direct integration and by the method of composite bodies, mass moment of inertia and area moment of inertia by direct integration and composite bodies method, radius of gyration, parallel axis theorem, Pappus theorems, polar moment of inertia.

### UNIT - III

**Kinematics of Particles:** Rectilinear motion, plane curvilinear motion-rectangular coordinates, normal and tangential component. **Kinetics of Particles:** Equation of motion, rectilinear motion and curvilinear motion, work energy equation, conservation of energy, impulse and momentum conservation of momentum, impact of bodies, co-efficient of restitution, loss of energy during impact.

---

## UNIT - IV

**Kinematics of Rigid Bodies:** Concept of rigid body, type of rigid body motion, absolute motion, introduction to relative velocity, relative acceleration (Corioli's component excluded) and instantaneous center of velocity, Velocity and acceleration polygons for four bar mechanism and single slider mechanism.

**Kinetics of Rigid Bodies:** Equation of motion, translatory motion and fixed axis rotation, application of work energy principles to rigid bodies conservation of energy. Shear force and bending Moment Diagram.

### BOOKS RECOMMENDED:

1. A.K.Tayal, "Engg Mechanics", Umesh Publications
2. Sadhu Singh, "Engg Mechanics", Khanna Publishers
3. Irving H. Shames, "Engg Mechanics", PHI publications
4. U.C.Jindal, "Engg Mechanics", Galgotia Publications
5. "S Timoshenko, DH Young & JV Rao" Engineering Mechanics TMH.
6. Subramanyam, "Engg Mechanics"
7. K L Kumar, "Engineering Mechanics", TMH

CORE PAPER

SEMESTER I

**Paper Title: Applied Physics Lab**

**Paper Code: BFTC107**

Total Credits: 2, Total Contact Hours 50, Maximum Marks:100 (Internal Assesment-50,Final Exam50)

---

### LIST OF PRACTICALS:

1. To plot a graph between the distance of the knife-edge from the center of the gravity and the time period of bar pendulum. From the graph, find
2. The acceleration due to gravity
3. The radius of gyration and the moment of inertia of the bar about an axis.
4. To determine the moment of inertia of a flywheel about its own axis of rotation.
5. To determine the value of acceleration due to gravity using koter's pendulum.
6. To determine the frequency of A.C. mains using sonometer and an electromagnet.
7. To determine the frequency of electrically maintained tuning fork by Melde's method.
8. To determine the dispersive power of prism using spectrometer and mercury source.
9. To determine the wavelength of sodium light by Newton's Ring.
10. To determine the wavelength of sodium light using diffraction
11. To determine the refractive index of a prism using spectrometer.

- 
12. To determine the specific rotation of cane sugar solution with the help of polarimeter.
  13. To find the wavelength of He-Ne Laser using transmission diffraction grating.
  14. To determine the numeral aperture (NA) of a Optical Fibre.
  15. Compute simulation (simple application of Monte Carlo) e.g. Brownian motion, charging & discharging of capacitor.
  16. Measurement of the diameter of a thin wire using the phenomenon of diffraction.
  17. To measure the divergence of a laser beam
  18. To measure the spring constant K of a spring by  
Static Method and Dynamic method

Note: Any 8-10 experiments out of the list may be chosen. Proper error – analysis must be carried out with all the experiments.

**CORE PAPER**

**SEMESTER I**

**Paper Title: Applied Chemistry Lab**

**Paper Code: BFTC108**

Total Credits: 2, Total Contact Hours 50, Maximum Marks: 100 (Internal Assesment-50, Final Exam 50)

---

**LIST OF EXPERIMENTS:**

1. To determine the percentage composition of a given mixture of NaCl (Sodium Chloride) and NaOH (Sodium hydroxide) 8 gms. Of which is dissolved per litre of the solution.
2. AIM: To determine the amount of Na<sub>2</sub>CO<sub>3</sub> (Sodium Carbonate) and NaHCO<sub>3</sub> (Sodium bicarbonate) in the given mixture of Na<sub>2</sub>CO<sub>3</sub> and NaHCO<sub>3</sub>.
3. Determine the amount of Oxalic Acid and Sulphuric Acid in 1 litre of solution given .1 N (standard) NaOH (Sodium Hydroxide) and KMnO<sub>4</sub> (Potassium Permanganate) solution
4. To determine the number of water molecules of crystallization in Mohr's salt provided standard dichromate solution (0.1 N) using diphenylamine as internal indicator.
5. To determine the strength in g/L of a given K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> (Potassium dichromate) solution, provided approximately N/10 sodium thiosulphate and N/10 K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>.
6. Determine the strength of Cu in the copper ore solution provided hypo solution (0.1N).
7. Determine the strength in grams per litre of a given AgNO<sub>3</sub> solution being provided N/30 NaCl solution by Mohr's Method



- 
8. Determine volumetrically the strength of a given ammonium thiocyanate solution by Bolhard's method, provided N/30 silver nitrate solution.
  9. (a) To determine the strength of calcium ions in given CaCO<sub>3</sub> solution by Complexometric Titrations.  
(b) To determine the strength of Magnesium ions in given MgSO<sub>4</sub> Solution by Complexometric Titrations

**CORE PAPER**

**SEMESTER I**

**Paper Title: C Programming Lab**  
**Paper Code: BFTC109**

Total Credits: 2, Total Contact Hours 50, Maximum Marks: 100(Internal Assesment-50, Final Exam-50)

---

1. Write a program to produce ASCII equivalent of given number
2. Write a program to find divisor or factorial of a given number.
3. Write a program to evaluate the following algebraic expressions after reading necessary values from the user
  - $(ax+b)/(ax-b)$
  - $\log x - \cos 30 + |x^2 - y^2| + \sqrt{2xy}$
  - $(x^5 + 10x^4 + 8x^3 + 4x + 2)$
4. Write a program to find sum of a geometric series
5. Write a program to cipher a string
6. Write a program to check whether a given string follows English capitalization rules
7. Write a program to find sum of the following series
$$1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \dots + \frac{1}{20}$$
8. Write a program to search whether a given substring exist in an input string or not and then delete this string from input string.
9. Write a recursive program for tower of Hanoi problem
10. The fibonacci sequence of numbers is 1,1,2,3,5,8..... Based on the recurrence relation  $F(n) = F(n-1) + F(n-2)$  for  $n > 2$

---

Write a recursive program to print the first m Fibonacci number

11. Write a menu driven program for matrices to do the following operation depending on whether the operation requires one or two matrices

- a) Addition of two matrices
- b) Subtraction of two matrices
- c) Finding upper and lower triangular matrices
- d) Trace of a matrix
- e) Transpose of a matrix
- f) Check of matrix symmetry
- g) Product of two matrices.

12. Write a program that takes two operands and one operator from the user perform the operation and then print the answer

13. Write a program to print the following outputs

1	1
2 2	2 2
3 3 3	3 3 3
4 4 4 4	4 4 4 4
5 5 5 5 5	5 5 5 5 5

14. Write functions to add, subtract, multiply and divide two complex numbers  $(x+iy)$  and  $(a+ib)$  Also write the main program.

15. Write a menu driven program for searching and sorting with following options:-

- a) Searching (1) Linear searching (2) Binary searching
- b) Sorting (1) Insertion sort (2) Selection sorting

16. Write a program to copy one file to other, use command line arguments.

17. Write a program to mask some bit of a number (using bit operations)

18. An array of record contains information of managers and workers of a company. Print all the data of managers and workers in separate files.

19. Introduction to MATLAB software and its applications

**Paper Title: Communication Skills II****Paper Code: BFTC201**

Total Credits: 3, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-30, Final Exam-70)

---

**UNIT – I**

**Basic Concepts in Communication:** Communication as sharing; context of communication; the speaker/writer and the listener/reader; medium of communication; barriers to communication; accuracy, brevity, clarity and appropriateness in communication.

**UNIT - II**

**Writing Skills:** Types of writings (Expository, Descriptive, Analytic, Argumentative, Narrative etc) and their main features. Resumes and CV"s and Cover letters. Memos and Notices. Basics of Formal Reports.

**UNIT - III**

**Verbal, Non-Verbal and Listening Skills:** Elementary Phonetics (Speech Mechanism, The Description of Speech Sounds, The Phoneme, the syllable; Prosodic Features, Word Accent, Features of Connected Speech); Paralanguage and Body language; and Classroom Presentations, Hearing and Listening; Essentials of Good Listening: Achieving ability to comprehend material delivered at relatively fast speed.

**UNIT - IV**

**Group Discussion:** Use of persuasive strategies including some rhetorical devices for emphasizing (for instance; being polite and firm; handling questions and taking in criticism of self; turn-taking strategies and effective intervention; use of body language).

**BOOKS RECOMMENDED:**

1. R. K. Bansal, and J. B. Harrison, "Spoken English For India: A Manual of Speech and Phonetics", Hyderabad: Orient Longman, 1983.
2. Lewis, Hedwig. "Body Language: A Guide For Professionals. New Delhi: Response Books", A division of Sage Publication, 2000
3. Sides, H. Charles, "How to Write & Present Technical Information", Cambridge: CUP, 1999.
4. Forsyth, Sandy & Lesley Hutchison, "Practical Composition", Edinburgh Oliver & Boyd, 1981.

**Paper Title: Mathematics II****Paper Code: BFTC202**

Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-30, Final Exam-70)

---

**UNIT –I**

INTEGRATION-Indefinite Integrals. Substitution Methods, Integration by Parts, Integration of the type  $\int \frac{1}{x^2+a^2} dx$  etc. Definite Integral, Evaluation of Definite Integral by Substitution, Some basic Properties of Definite Integrals.

**UNIT-II**

FUNCTIONS OF SEVERAL VARIABLES: Partial Differentiation.

VECTOR: Introduction of Vector, Types of Vectors, Addition of Vectors, Multiplication of a Vector by a Scalar, Double Scalar and Vector Product Differentiation of Vectors. Scalar and Vector Fields, Grad, Div and Curl.

**UNIT-III**

ORDINARY DIFFERENTIAL EQUATIONS : Variable - Separable Method, Homogeneous Differential Equations, Exact Differential Equations, Linear Differential Equations, Bernoulli's Differential Equations, Differential Equations of First Order and First Degree by Integrating Factor.

**UNIT -IV**

COMPLEX ALGEBRA: Complex Number System, Algebra of Complex Numbers, Polar Form of Complex Number, Argand Plane, Conjugate of Complex Number, Properties of Modulus, Modulus of Complex Number, Square Root of Complex Numbers.

INTRODUCTION TO STATISTICS: Meaning of Statistics, Meaning of Population and Sample, Mean, Mode, Median, Variance, Standard Deviation, Dispersion, Skewness, Kurtosis.

**BOOKS RECOMMENDED:**

1. NCERT Books of XI & XII Mathematics.
2. Shanti Narayan, "Integral Calculus", S. Chand & Company. 1999
3. B.S. Grewal, "Elementary Engineering Mathematics", 34th Ed., 1998.



**Paper Title: Electrical Science****Paper Code: BFTC203**

Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-30, Final Exam-70)

---

**UNIT – I CIRCUIT ANALYSIS:**

Ohm's Law, KCL, KVL Mesh and Nodal Analysis, Circuit parameters, energy storage aspects, Superposition, Thevenin's, Norton's, Reciprocity, Maximum Power Transfer Theorem, Millman's Theorem, Star-Delta Transformation. Application of theorem to the Analysis of dc circuits.

**UNIT – II A. C.CIRCUITS:**

R-L, R-C, R-L-C circuits (series and parallel), Time Constant, Phasor representation, Response of R-L, R-C and R-L-C circuit to sinusoidal input Resonance-series and parallel R-L-C Circuits, Q-factor, Bandwidth.

**UNIT – III MEASURING INSTRUMENTS:**

Principles, Construction and application of moving coil, moving iron, dynamometer type, induction type instruments, extension of range of ammeter, voltmeter (shunt and multiplier), Two-wattmeter method, for the measurement of power, Cathode-ray Oscilloscope and Applications.

**UNIT – IV TRANSFORMERS:**

Construction and Working principles and phasor diagrams of Single-phase Transformer, EMF equation, Equivalent circuit, Regulation and efficiency, and Auto transformer.

**ROTATING MACHINES:**

Construction and working principles of dc motor and generator and its characteristics Applications of DC machines

Construction and working principles of 3-Induction motor, Torque-speed characteristics, and Industrial applications.

**BOOKS RECOMMENDED:**

1. Vincent DEL TORO "Electrical Engineering Fundamentals" Prentice Hall India", Ed 2002.
1. D.P. Kothari & L.J. Nagrath, "Basic Electrical Engineering", TMH.
2. B L Thareja, "Basic Electrical and Electronics"
3. P.C. Sen "Principles of Electric Machines and Power Electronics", Wiley Eastern 2003.
4. Basic Electrical Engineering. "Mittle/Mittal" TMH.
5. A.K.Sawhney, Electrical & Electronics Measurement & Instrumentation, Hanpat Rai & Sons, India.

**Paper Title: Biochemistry & Basic Organic Chemistry****Paper Code: BFTC204**Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-30, Final Exam-70)

---

**UNIT I**

Carbohydrates; Definition & classification; General chemistry of carbohydrates; Metabolic pathways for breakdown of carbohydrates: glycolytic pathway, pentose phosphate pathway, citric acid cycle, electron transport chain, ATP balance, gluconeogenesis; General chemistry of lipids; Essential fatty acids; Digestion & absorption of lipids.

**UNIT II**

Proteins and protein structures; Essential amino acids. Metabolism of proteins (digestion and absorption); Nitrogen balance & nitrogen pool; Evaluation of quality of proteins, Enzymes; Definition, function, classification, nomenclature & structure; Co-enzymes and its function; Mechanism of enzyme action, enzyme kinetics; Enzyme inhibition.

**UNIT III**

Vitamins & minerals: Introduction to human nutrition; Nutritive values of foods; Basal metabolic rate; Techniques for assessment of human nutrition, Dietary requirements and deficiency diseases of different nutrients.

**UNIT IV**

Organic Reaction Mechanism: Mechanisms of selected organic, bio-organic, polymerization and catalytic reactions.

Stereochemistry of Carbon Compounds: Selected Organic Compounds: Natural products and Biomolecules (Amino acids/nucleic acids/proteins).

**BOOKS RECOMMENDED:**

1. Lehninger, Nelson & Cox, Principle of Biochemistry, CBS Publication
2. Modern Experimental Biochemistry, Boyer, Pearson Education
3. Lubert stryer, Biochemistry, Freeman & Co, N.Y.
4. Voet & Voet, Fundamentals of Biochemistry, Jonh Willey & Sons
5. Hames, B. D. (Ed), Biochemistry, Viva Books
6. Essentials of Food and Nutrition, Swaminathan, Vol 1 & 2
7. Fundamentals of Food and Nutrition by Sumati. R. Muldambi

**Paper Title: Introduction to Food Technology****Paper Code: BFTC205****Total Credits: 3, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-30, Final Exam-70)**

---

**UNIT I**

Introduction - Historical development of food science and technology, Evolution of Food Processing from prehistoric times till date, Introduction to various branches of Food Science and Technology

**UNIT II**

Introduction to various food processing and preservation technologies

Freezing- Introduction to refrigeration and freezing, definition, principle of freezing, freezing curve, changes occurring during freezing, types of freezing i.e. slow freezing, quick freezing, introduction to thawing, changes during thawing and its effect on food.

**UNIT III**

Drying and Dehydration- Definition, drying as a means of preservation, differences between sun drying and dehydration (i.e. mechanical drying), factors affecting rate of drying, normal drying curve, names of types of driers used in the food industry.

**UNIT IV**

Food processing and preservation technologies - Food Irradiation- Introduction, kinds of ionizing radiations used in food irradiation, uses of radiation processing in food industry, concept of cold sterilization.

Thermal Processing- Concept of pasteurization, sterilization, commercial sterilization, blanching, and canning.

**BOOKS RECOMMENDED:**

1. Food Science and Technology, Geoffrey Campbell – Platt, Wiley-Blackwell, 1st Edition, 2009
2. Food Science, Norman N Potter, Joseph H Hotchkiss, Springer, 5th Edition, 1995
3. Introduction to Food Science and Technology, George F. Stewart, Maynard A. Amerine, Bernard S. Schweigert and John Hawthorn, Academic Press, 2nd Edition, 1982
4. Food Technology: An Introduction, Anita Tull, Oxford University Press, 1st Edition, 2002.
5. Koronye A. I. and Ngoddy P.O. (1985). Intergrated Food Science for the Tropics. Macmillan Education LTD., London and Oxford UK
6. NPCS Board (2012). Modern Technology on Food Preservation (2nd Edition). Asia Pacific Business Press Inc. 528

**Paper Title: Introductory Biology****Paper Code: BFTC-206**Total Credits: 3, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-30, Final Exam-70)

---

**Unit I Introduction to Macromolecules**

Introduction to Biology; Macromolecules; Carbon chemistry; Proteins: Structure, folding, catalysis; Nucleic acids: storage and transfer of genetic information; Lipids: membranes, energy storage; Carbohydrates: energy storage, building blocks.

**Unit II**

**Molecular genetics:** Genes; Basics of DNA replication, transcription, translation, Mutations; Genetechnology.

**Cell biology and energetic:** Cell structure; Membranes; Function of cell organelles; Energetics; ATP and glycolysis; Respiration; Photosynthesis.

**Unit III****Reproduction, Heredity, Evolution**

Reproduction and Heredity; Cell division: mitosis, meiosis, gamete formation, pollination; Mendelian genetics; Evolution; Gene variation (Hardy-Weinberg principle); Darwin's theory of evolution.

**Unit IV****Principles of Classification**

Physiology aspects: Regulatory systems (nervous, endocrine, immune systems); Ecology; Populations and communities; Biosphere; Conservation

**BOOKS RECOMMENDED:**

1. W. K. Purves et al. Life, The Science of Biology, 7th Edition, W. H. Freeman and Co., 2003. [http:// www.whfreeman.com/thelifewirebridge2/](http://www.whfreeman.com/thelifewirebridge2/)
2. Peter H. Raven et al., Biology, 6th Edition, McGraw Hill, 2007. <http://www.ravenbiology.com>
3. Basic Concepts in Biology by Starr 5th ed.
4. Essential Biology, 3rd edition, by Campbell, Reece, and Simon



**Paper Title: Electrical Science Lab****Paper Code: BFTC-207**

Total Credits: 2, Total Contact Hours-50, Maximum Marks: 100 (Internal Assesment-50, Final Exam-50)

---

**LIST OF EXPERIMENTS**

1. Verification of Thevenin's theorem.
2. Verification of Norton's theorem
3. Verification of max. power theorem.
4. Verification of Superposition theorem
5. Measurement of Power and Power factor in single phase Load using Wattmeter, ammeter and voltmeter.
6. Calibration of Energy Meter/Wattmeter/Voltmeter/Ammeter
7. Load test on Single Phase Transformer, Regulation and Efficiency of Transformer
8. Resonance.
9. To find out the value of  $\mu$  by using Anderson bridge.

**Paper Title: Biochemistry Lab****Paper Code: BFTC-209**

Total Credits: 2, Total Contact Hours-50, Maximum Marks: 100 (Internal Assesment-50, Final Exam-50)

---

**PRACTICALS**

1. Qualitative test for Reducing Sugars:
  - a. Molisch's test
  - b. Iodine test
  - c. Fehling test
  - d. Barfoed's Test
2. Qualitative test for Protein:
  - a. Biuret's test
  - b. Ninhydrin test
3. Measurement of pH of different food samples.
4. Casein content in milk
5. Gluten content in wheat flour

**Paper Title: Food Technology Lab****Paper Code: BFTC-209**

Total Credits: 2, Total Contact Hours-50, Maximum Marks: 100 (Internal Assessment-50, Final Exam-50)

---

**PRACTICALS**

1. To determine the efficacy of blanching treatment.
2. To perform pasteurization and sterilization of foods.
3. To carry out tray drying of different fruits.
4. To carry out osmotic dehydration of onion slices.
5. To perform canning of pineapple slices.
6. To perform vacuum drying of spices.
7. Setting up of sensory evaluation lab and introducing the concept of organoleptic testing.
8. Estimation of pH of different foods
9. Adulteration tests for different foods:
  - Milk and milk products
  - Tea and coffee
  - Spices
10. To give the concept of shelf life of different foods.(processed and unprocessed)
11. Standards of identity, standards of minimum quality and standards of fill of container.
12. Identification of different types of packaging materials used in the food industry.

**COMPULSORY****SEMESTER II****Paper Title: Environmental Studies****Paper Code: ES-01**

Total Credits: 2, Total Lectures-50, Maximum Marks: 100 (Internal Assessment-30, Final-70)

---

**Unit- I**

THE MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES, Definition, scope and importance. Need for public awareness

**Unit –II**

NATURAL RESOURCES: RENEWABLE AND NON RENEWABLE RESOURCES,

1. Natural resources and associated problems  
Forest resources: Use and over-exploitation, deforestation, case studies, Timber extraction, mining, dams and their effects on forests, and tribal people. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dam's benefits and problems. Mineral Resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. Food Resources: World food problems, changes caused by agriculture and over grazing, effects of modern agriculture, fertilizers- pesticides problems, water logging, salinity, case studies. Energy

---

Resources: Growing energy needs, renewable and nonrenewable energy sources, use of alternate energy sources, case studies Land Resources: Land as a resource, land degradation, man induced landslides, soil erosion, and desertification.

2. Role of individual in conservation of natural resources.
3. Equitable use of resources for sustainable life styles.

### **Unit 3: ECO SYSTEMS**

Concept of an eco system, Structure and function of an eco system., Producers, consumers, decomposers. Energy flow in the eco systems. Ecological succession. Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following eco-systems Forest ecosystem, Grass land ecosystem Desert ecosystem. Aquatic eco systems (ponds, streams, lakes, rivers, oceans, estuaries)

### **UNIT -IV BIODIVERSITY AND ITS CONSERVATION**

Introduction- Definition: Genetics, species and ecosystem diversity. Biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, national and local level. India as a mega diversity nation. Hot-spots of biodiversity. Threats to biodiversity: habitats loss, poaching of wild life, man wildlife conflicts. Endangered and endemic spaces of India. Conservation of biodiversity: in-situ and ex-situ conservation of biodiversity

### **UNIT -V ENVIRONMENTAL POLLUTION**

Definition Causes, effects and control measures of:

Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Natural hazards, Solid waste Management: Causes, effects and control measures of urban and industrial wastes Role of an individual in prevention of pollution, Pollution case studies, Disaster management: Floods, earth quake, cyclone and land slides

### **BOOKS RECOMMENDED:**

1. Textbook of Environmental studies, Erach Bharucha, UGC
2. Fundamental concepts in Environmental Studies, D D Mishra, S Chand & Co

---

## **SECOND YEAR**

### **CORE PAPER**

### **SEMESTER III**

#### **Paper Title: Food Chemistry**

#### **Paper Code: BFTC-301**

Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-30, Final-70)

---

#### **UNIT-I**

Water : Structure of water and ice, properties, bound water, water activity. Post-harvest and Postmortem biochemical changes in foods and its implications on quality of foods.

Carbohydrates: monosaccharides, disaccharides, polysaccharides, Reactions and properties of simple and complex carbohydrates, starch gelatinization and retrogradation; Enzymatic and Non enzymatic browning, formation of acrylamide in food

#### **UNIT-II**

Lipids: Types and properties: function of lipids in foods; Lipolysis, Auto-oxidation, Rancidity, Reversion, lipid Refining: degumming, neutralization, bleaching, deodorization; hydrogenation; food lipids and health.

Proteins: classification of amino acids; primary, secondary, tertiary structure of proteins; properties of proteins, Important protein sources, Nutritive value of food protein; Denaturation and its implications.

#### **UNIT-III**

Vitamins: Fat soluble and water soluble, food sources, dietary requirements, deficiency disorders; Minerals: Macronutrients and micronutrients, food sources, dietary requirements and physiological function of minerals.

#### **BOOKS RECOMMENDED:**

1. O.R. Fennema Food Chemistry
2. Food chemistry, Lillian Hoagland Meyer, CBS publication, New Delhi, 2nd Edition, 2006.
3. Food Science Chemistry & Experimental Foods, Dr. M. Swaminathan, Bappco Ltd 2nd Edition, 2001.
4. Food Chemistry by L. H. Muyer
5. Food chemistry, S. Yadav, Anmol Publications 1st Edition, 1997
6. Essentials of Food & Nutrition by Swaminathan, Vol. 1 & 2



**Paper Title: Food Microbiology****Paper Code: BFTC-302**

Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-30, Final-70)

---

**UNIT I**

Importance of microorganisms in foods; Classification, morphology, growth, nutrition and reproduction: bacteria, moulds, yeasts, viruses; Methods of isolation, pure culture techniques and maintenance of cultures; enumeration methods for micro-organisms.

**UNIT II**

Incidence of microorganisms in foods, sources of contamination. Factors affecting microbial growth; Principles underlying spoilage and preservation of foods. Contamination, spoilage and preservation of fruit and vegetables, meat, fish and sea foods, egg and poultry and dairy.

**UNIT III**

Probiotics and prebiotics. Beneficial microorganisms and their utilization in food fermentation of bread, malt beverages, fermented vegetables, fermented dairy products.

**UNIT IV**

Control of microorganisms by physical, chemical, antibiotic and other chemotherapeutic agents. Food borne diseases: types, common foodborne diseases and their causal agents (food borne infection and intoxication), factors responsible for FBDs; Mycotoxins

**BOOKS RECOMMENDED:**

1. Microbiology, J. Willey, L. M. Sherwood, C. Woolverton, McGraw Hill International, 8<sup>th</sup> Edition, 2010.
2. Food Microbiology, W. C. Frazier & D.C. Westhoffs, TMH, 4<sup>th</sup> Edition, 1993.
3. Essentials of food Microbiology, J. Garbutt, Arnold Publication, 2<sup>nd</sup> Edition, 1997.
4. Microbiology, M. J. Pelczar Jr., E.C.S. Chan and N.R. Krieg, TMH Book Company, 5<sup>th</sup> Edition, 1993.
5. Modern Food Microbiology, James M. Jay, CBS Publishers Delhi, 4<sup>th</sup> Edition, 1993.
6. Essentials of Microbiology; K. S. Bilgrami; CBS Publishers, Delhi

**Paper Title: Nutrition and Dietetics****Paper Code: BFTC-303**

Total Credits: 3, Total Lectures-50, Maximum Marks: 100 (Internal Assessment-30, Final Exam-70)

---

**UNIT-I**

Introduction to the study of nutrition, characteristics, functions, digestion and assimilation of food, metabolism, food sources of different nutrients.

**UNIT-II**

Recommended allowances-RDA for Indians, basis for requirement, computation of allowance based on energy expenditure, components of energy expenditure. General concepts about growth and development through different stages of life, BMR, BMI, Calorific value and Thermic effect of food.

**UNIT-III**

Energy metabolism, special nutrition needs during pregnancy, nutrition during lactation, infancy: premature infant and their feeding, weaning foods, for children, adolescents and aged; nutrition and public health. Dietary modification, planning a menu.

**UNIT-IV**

Introduction to therapeutic nutrition, diet in disease conditions: jaundice, coronary heart disease, obesity, anaemia, renal problems, GI tract problems; inborn errors of metabolism, diabetes: nutraceuticals, Fortification, Enrichment.

**BOOKS RECOMMENDED:**

1. Robert's Nutrition Work with Children, Martin S.R., 1963, The University of Chicago Press, Chicago.
2. Assessment of Nutrition Status of the Community, Jelliffe D.B. 1966, WHO, Geneva.
3. Nutrition in the Sub Tropics and Tropics, Jelliffe D.B.
4. Essentials of Food and Nutrition, Swaminathan, Vol 1 & 2
5. Fundamentals of Food and Nutrition by Sumati. R. Muldambi
6. Nutrition and dietetics by Rose 9. Nutrition and dietetics by Joshi

**Paper Title: Thermodynamics****Paper Code: BFTC-304**

Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-30, Final Exam-70)

---

**UNIT I**

Definitions and concepts: SI Units, Thermodynamic systems, states, properties, processes, heat, work and energy, Thermodynamic Equilibrium: Zeroth Law, Temperature Scale.

**UNIT II**

First Law of Thermodynamics; Properties of pure substances and steam, Mollier Chart. Second Law of Thermodynamics; Carnot Cycle, Entropy; Corollaries of Second Law; Applications of First and Second Law to closed and open systems, non-flow and flow processes; steady state, steady flow and transient flow processes.

**UNIT III**

Heat Engine and Heat Pumps. Refrigeration. Irreversibility and availability, energy analysis; thermodynamic relations; Properties of mixtures and ideal gases; Thermodynamic Cycles: Otto, Diesel, Dual and Joule Cycle.

**UNIT IV**

Third Law of Thermodynamics. Introduction to IC Engines. Introduction to Power Cycle –Carnot, Rankine and Modified Rankine Cycle.

**BOOKS RECOMMENDED:**

1. Engineering thermodynamics. P. K. Nag, Tata McGraw-Hill, New Delhi, 3rd Edition, 2005.
2. Fundamentals of Thermodynamics. R. E. Sonntag, and C. Borgnakke, John Wiley & Sons, 7th Edition, 2008.
3. Thermodynamics, an Engineering Approach. Y. A. Cengel and M. A. Boles, McGraw Hill, 7th Edition, 2010.
4. Fundamentals of Engineering Thermodynamics. J. P. Howell and P. O. Buckius, McGraw Hill, 2nd Edition, 1992.
5. Richardson, J.F., Peacock, D.G.Coulson & Richardson's Chemical Engineering- Volume 3ed., First Indian ed. Asian Books Pvt. Ltd. 1998
6. Levenspiel.O., Chemical Reaction Engineering, Wiley Eastern Ltd

**Paper Title: Technology of Cereals, Pulses and Oilseeds****Paper Code: BFTC-305**Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-30, Final Exam-70)

---

**UNIT-I**

Wheat: Milling; types of wheat flour, Wheat protein and its function; Wheat-based baked products: Bread, biscuit, chapattis and cakes; Extruded products: pasta, noodles; Rheology of flour- Falling number, Pasting properties.

**UNIT- II**

Rice: structure, milling, parboiling, By-products of rice milling, Technology of breakfast cereals: Puffed Rice, flaked rice

Corn: Wet and dry milling; Corn products: Corn flakes, corn syrup and corn starch. Quality aspects of different flours. Corn products: Corn flakes, corn starch, canned corn products, puffed product;

**UNIT -III**

Sorghum, pearl millet, finger millet, and kodo millet: structure, composition; milling and malting; barley: milling and malting; Oats: Milling and processing. Traditional and nutritional products based on,

**UNIT- IV**

Legumes: Structure, composition and processing, Milling of pulses. Legume-based products; anti-nutritional factors; utilization of pulses.

Oilseed: Structure; processing: traditional and modern methods of oil extraction, refining, bleaching, deodorizing, hydrogenation; Applications of different oils and fats in food processing and products.

**Suggested Reading:**

1. Chakrabarty MM. Chemistry and Technology of Oils and Fats. Prentice Hall.
2. Dendy DAV & Dobraszczyk BJ. Cereal and Cereal Products. Aspen.
3. Hamilton RJ & Bhati A. Fats and Oils - Chemistry and Technology. App. Sci. Publ.
4. Kent NL. Technology of Cereals. 4th Ed. Pergamon Press.
5. Kulp K & Ponte GJ. Handbook of Cereal Science and Technology. 2nd Ed. Marcel Dekker.
6. Lorenz KL. Handbook of Cereal Science and Technology. Marcel Dekker.
7. Mathews RH. Legumes Chemistry, Technology and Human Nutrition. Marcel Dekker.
8. Matz SA. Cereal Science. AVI Publ.



**Paper Title: Food Chemistry Lab****Paper Code: BFTC-306**Total Credits: 2, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-50, Final Exam-50)

---

**Practical's:**

1. Preparation of standard solutions for the chemical analysis i.e. HCl, H<sub>2</sub>SO<sub>4</sub>, KMnO<sub>4</sub> and Sodium Thiosulphate.
2. Determination of moisture content.
3. Determination of reducing and non-reducing sugar
4. Determination of fiber content of different food material.
5. Determination of protein by Kjeldal method.
6. Determination of Ash content.
7. Detection of presence of starch by Iodine test.
8. Determination of water activity of different food materials.
9. To distinguish between mono-saccharides and di-saccharides by barfoed test.
10. Determination of minerals: calcium, phosphorous and iron
11. Estimation of vitamins: ascorbic acid, carotene and thiamine.

**Paper Title: Food Microbiology Lab****Paper Code: BFTC-307**Total Credits: 2, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-50, Final Exam-50)

---

**PRACTICALS**

1. Culture media preparation, sterilization and activities of microorganism
2. Determination of microbial growth curves based on absorbance.
3. Isolation, plating and characterization of microbes, population, colony count.
4. Gram staining.
5. Antibiotic sensitivity and determination of minimum inhibitory concentration.
6. Isolation and characterization from normal and decayed food items
7. Effect of environmental factor on growth and development of microbes.
8. Study on food fermentation processes.
9. Isolation and identification of coli forms and *vibrio* species.

---

**CORE SUBJECT****SEMESTER IV****Paper Title: Cereal, Pulses and Oilseed Lab****Paper Code: BFTC-308**Total Credits: 2, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-50, Final Exam-50)

---

**List of Experiments:**

1. Physical-tests on wheat and rice;
2. Determination of gluten content in wheat flour;
3. Milling of wheat and rice by laboratory mill;
4. Assessment of degree of polishing;
5. Quality tests of rice; Amylose content determination in rice;
6. Malting of Barley,
7. Extraction of oil using expeller and solvent extraction methods.
8. Detection of ergot in food grains.
9. Detection of extraneous matter in grains and flours.
10. Detection of dhatura in grains.
11. Detection of khesari dal in dal.
12. Study of milling characteristics of Food by Ball mill.
13. Study of milling characteristics of Food by Hammer mill
14. Visit to FCI Godown, Silo

**SECOND YEAR****CORE SUBJECT****SEMESTER IV****Paper Title: Unit Operations in Food Processing****Paper Code: BFTC-401**Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-30, Final Exam-70)

---

**UNIT-I**

Material handling and storage - Theory, classification of various material handling equipment – conveyors: belt, bucket, screw and pneumatic conveyors. Characteristics of bulk material and flow through orifices; Traditional, improved and modern grain storage structures.

**UNIT-II**

Cleaning- aim of cleaning, aspiration, magnetic cleaning and abrasive cleaning. Screening, types of screens: Grizzly, Rotary, Vibratory, Revolving, Wiremesh, Perforated metal screens; Dry and wet cleaning methods.

---

### UNIT III

Milling –Size Reduction: principles and laws of size reduction: Kick’s law, Bonds law and Rittinger’s law, equipment selection, Particle size analysis, size reduction procedures: crushing, impact shearing and cutting; size reduction machinery: crushers, grinders and cutting machines.

### UNIT V

Engineering properties of agricultural material, physical, mechanical, thermal, rheological properties,

### Recommended Books:

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

### CORE SUBJECT

### FOURTH SEMESTER

**Paper Title: Functional Foods and Nutraceuticals**

**Paper Code: BFTC-402**

Total Credits: 3, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-30, Final Exam-70)

---

### UNIT I

Scope, importance and renewed emphasis on speciality foods, health foods, functional foods. Nutraceuticals, infant and baby foods, adolescent/ teen age foods, foods for pregnant ladies and nursing mothers, geriatric foods.

### UNIT II

Food recommended and restricted in metabolic disorders and disturbances, gastrointestinal disorders; fever and infection; liver, gall, bladder and pancreatic disturbances; blood, circulatory and cardiac diseases; urinary and musculoskeletal diseases; allergies. Nutritional deficiencies and its correction through fortification and supplementation of foods.

### UNIT III

Beneficial effect of spices, honey, spirulina etc. Health benefits/ mode of action of PUFA/ gamma linolenic acids, antioxidants, dietary fiber, oligosaccharides, sugar alcohols, peptides and proteins, glycosides, alcohols, iso-prenoides and vitamins, choline, LAB, phenolics, flavonols, minerals and other minor food constitutes as reported in literature.

### UNIT IV

Transgenic plant foods with health claims. Prebiotics and Probiotics, regulatory issues for nutraceuticals, Clinical testing of nutraceuticals

---

**BOOKS RECOMMENDED:**

1. Human nutrition: A textbook of nutrition in health and disease. B. T. Burton, Mc Graw Hill, 3rd Edition, 2002.
2. Nutrition and Dietetics. S. A. Joshi, Tata Mc Graw Hill Co. Ltd., 2nd Edition, 2003.
3. Dietetics. B. Shrilakshmi, New Age International (P) Ltd., New Delhi, 5th Edition, 2005.
4. Nutrition and Dietetic Foods, A. E. Bender, Chem. Pub. Co. New York, 2nd Edition, 2004.
5. Basic Nutrition in Health and Disease. P. S. Howe, W. B. Saunders Company, London, 2nd Edition, 2003.
6. Fundamentals of Food and Nutrition by Sumati. R. Muldamb

**CORE SUBJECT****SEMESTER IV**

**Paper Title: Postharvest Technology of Fruits and Vegetables**

**Paper Code: BFTC-403**

Total Credits: 3, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-30, Final Exam-70)

---

**Unit –I**

Composition and nutritive value of fruits and vegetables; Importance and scope of post-harvest management of fruits and vegetables. Maturity indices and standards for selected fruits and vegetables; Methods of maturity determinations; Harvesting and handling of important fruits and vegetables; Post harvest losses; Post-harvest physiological and biochemical changes in fruits and vegetables.

**Unit- II**

Preservation: Processing for pulp, puree and concentrates, from different fruits using aseptic packaging, RTS fruit beverages, individual quick freezing. Technology for processing of pickles, chutneys, sauces. Canning, Blanching, Thermal death time, D value, Z value, F value calculations Spoilage of canned foods, Emerging technologies for fruits and vegetables processing technologies.

**Unit-III**

Controlled and modified atmosphere Storage, Hypobaric storage; Field heat of fruits and vegetables and primary processing; Pre-cooling and cold storage.

**Unit-IV**

Drying, Dehydration and concentration of fruits and vegetables, sun drying, solar drying, osmotic, tunnel drying, fluidized bed drying, freeze drying and spray drying. Food concentration: methods of concentration.

**References:**

1. Lal G, Siddappa GS & Tandon GL. Preservation of Fruits and Vegetables. ICAR.
2. Salunkhe DK & Kadam SS., Handbook of Vegetables Science & Technology: Production, Composition, Storage and Processing. Marcel Dekker.
3. Srivastava RP & Kumar S. Fruit and Vegetable Preservation - Principles and Practices. International Book Distributors



- 
4. Verma LR & Joshi VK. 2000. Post Harvest Technology of Fruits and Vegetables. Indus Publ.

**CORE SUBJECT**

**SEMESTER IV**

**Paper Title: Food Engineering I**

**Paper Code: BFTC-404**

Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-30, Final Exam-70)

---

**UNIT-I**

Introduction to food engineering & processes: principles of thermodynamics, enthalpy, entropy, fundamentals of heat transfer. Kinetics of reactions occurring in processed foods, reaction velocity constant, order of reaction; quality changes during storage of foods.

**UNIT-II**

Methods for thermal process evaluation - Commercial sterility, pasteurization and sterilization, thermal death time,  $d$ ,  $z$  and  $f$  values. Calculation of process time for fluids on stream line flow and turbulent flow heated in heat exchangers; general introduction to aseptic canning process.

**UNIT-III**

Food chilling and freezing, Properties of frozen foods; freezing point depression; general introduction to enthalpy change during freezing, IQF; design of food freezing equipment such as air blast freezers, plate freezers and immersion freezers.

**UNIT IV**

Material and energy balances, types and Properties of fluids. Flow rate, friction losses and pressure drop relationships for Newtonian fluids through pipe. Material handling - Theory, classification of various material handling equipment. Diffusion, Mass transfer in packed and fluidized beds, Diffusion through membranes and applications.

**Recommended Books:**

1. Heldman DR & Singh RP. Food Process Engineering. AVI Publ
2. R.C. Sachdeva. Fundamentals of Engineering Heat and mass transfer.
3. Fellows P. Food Processing Technology. VCH Ellis Horwood.
4. Brennan JG, Butter JR, Corell ND & Lilly AVE. Food Engineering Operations. Elsevier.
5. Charm SE, McCabe WL, Smith JC & Harriott P. Unit Operations of Chem Engineering. McGraw Hills.
6. Sahay KM & Singh KK. Unit Operation of Agricultural Processing. Vikas Publ. House.
7. Geankopolis J Christie. (1999). Transport Process and Unit Operations. Allyn & Bacon

---

**CORE SUBJECT**

**SEMESTER IV**

**Paper Title: Unit Operations Lab**

**Paper Code: BFTC-405**

**Total Credits: 2, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-50, Final Exam-50)**

---

**List of Experiments:**

1. Determination of physical properties such as bulk density, porosity, sphericity, angle of repose.
2. Particle size distribution using sieve shaker.
3. Size reduction using Ball Mill and calculation of critical speed of mill.
4. Size reduction using Jaw crusher and calculation of equivalent diameter of solid particle.
5. Study of mechanical expression of edible oil.
6. Mixing experimentation and determination of uniformity coefficient.
7. Determination of power consumption in mixing/agitation.
8. Filters and filter resistance.
9. Determine the terminal velocity of Cyclone separator.
10. Studies on membranes separation processes.

**CORE SUBJECT**

**SEMESTER IV**

**Paper Title: Fruits and Vegetable Technology Lab**

**Paper Code: BFTC-406**

**Total Credits: 2, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-50, Final Exam-50)**

---

**List of Experiments:**

1. Comparison of tray dryer and vacuum tray drying of food and vegetable
2. Freeze drying characteristic of food material
3. Determination of TSS of different fruits
4. Processing of tomato products;
5. Study on Zero Energy Cooling Chamber for Shelf-life study of Fruits and Vegetable
6. Preparation of pickle/mixed pickle
7. Design of Cold storage
8. Preparation of banana and potato wafers;
9. Preparation of dehydrated vegetables

---

**Paper Title: Industrial Visit**

**Paper Code: BFTC- V1**

Maximum Marks: 50 (Attendance: 20, Report-30)

---

The students will visit the different food processing industries, to acquaint them with different handling, processing and preservation techniques. Different hazards and risks associated with the processing will also be explained. The students have to make a report, which shall include; the layout of the industry, different machineries and their uses, limitations in the processing line and suggestions.

**THIRD YEAR**  
**CORE SUBJECT**

**SEMESTER V**

**Paper Title: Dairy Technology**

**Paper Code: BFTC-501**

Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-30, Final Exam-70)

---

**UNIT I**

Introduction: Milk: Factors affecting composition and quality; Types of milk; Dairy Chemistry & Microbiology: Processing aspects in brief: Reception, Homogenization, Pasteurization, Sterilization, Cleaning and sanitization of dairy equipments.

**UNIT-II**

Milk products; Condensed milk: definition, methods of manufacture; Evaluation of condensed and evaporated milk; Dried milk: definition, methods of manufacture of skim and whole milk powder; Properties in defects in dried milk powder. Cream: definition, classification, composition; Cream processing; Evaluation and defects in cream

**UNIT-III**

Milk products: Cheese: Definition, composition, classification, methods of manufacture, cheddar, cottage and processed cheese; defects in cheese. Ice cream: definition; Composition, Classification; Methods of manufacture; over run, Defects in ice cream; Butter: definition, composition, classification, methods of manufacture, theories of churning, and defects in butter.

**UNIT-IV**

Indigenous milk products: present status; Methods of manufacture of yoghurt, khoa, burfi, kalakand, gulabjamun, rosogolla, chhana, paneer, shrikhand.

**References:**

1. Aneja RP, Mathur BN, Chandan RC & Banerjee AK. Technology of Indian Milk Products. Dairy India Publ.
2. De S. Outlines of Dairy Technology. Oxford Univ. Press.

- 
- Henderson JL. Fluid Milk Industry. AVI Publ.
  - Walstra P., Geuits T.J., Noomen A., Jellema A. and Van Boekel M.A.J.S., Dairy technology- Principles of milk properties and processes; Marcel Dekker Inc.
  - Web BH, Johnson AH & Lford JA. 1987. Fundamental of Dairy Chemistry. 3rd Ed. AVI Publ.
  - Walstra P., Geuits T.J., Noomen A., Jellema A. and Van Boekel M.A.J.S., Dairy technology- Principles of milk properties and processes; Marcel Dekker Inc.

**CORE SUBJECT**

**SEMESTER V**

**Paper Title: Food Engineering II**

**Paper Code: BFTC-502**

Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-30, Final Exam-70)

---

**UNIT I**

Principles of mass transfer, mass balance calculations, Calculations involved in dilution, concentration dehydration, evaporation and other unit operations. Modes of heat transfer, steady state heat conduction equation, Heat conduction in slabs, cylinders & spheres heat generation inside solids, unsteady state heat conduction, properties of heat flow in fluids individual and over all heat transfer coefficient.

**UNIT-II**

Design of single & multi effect evaporators, mechanics of movements of air through stationary bed, then layer and thick layer bed drying. Natural convection and its applications. Refrigeration cycles, performance of refrigeration compressors, refrigeration system balance and multiple evaporation systems.

**UNIT III**

Theory, process and equipment for humidification and dehumidification, Theory, process and equipment for osmosis, reverse osmosis, adsorption and absorption.

**UNIT IV**

Drying of Foods: various mechanisms of moisture removal in solid and liquid foods during drying; properties of air-water vapour mixture; Pyschrometry. Types of Dryers and their performance.

**Recommended Books:**

- Heldman DR & Singh RP. Food Process Engineering. AVI Publ
- R.C. Sachdeva. Fundamentals of Engineering Heat and mass transfer.
- Fellows P. Food Processing Technology. VCH Ellis Horwood.
- Brennan JG, Butter JR, Corell ND & Lilly AVE. Food Engineering Operations. Elsevier.
- Charm SE, McCabe WL, Smith JC & Harriott P. Unit Operations of Chem Engineering. McGraw Hills.
- Sahay KM & Singh KK. Unit Operation of Agricultural Processing. Vikas Publ. House.
- Geankoplis J Christie. (1999). Transport Process and Unit Operations. Allyn & Bacon



**Paper Title: Food Fermentation and Biotechnology****Paper Code: BFTC-503**Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-30, Final Exam-70)

---

**UNIT-I**

Nucleic acids: structure and types of DNA and RNA, Watson and Crick model; central dogma of life-replication, transcription, translation and their inhibition

**Unit -II**

Bioreactors, Fermenter design and various types of fermentation systems (submerged, surface and solid state). production of alcoholic beverages; waste utilization

**UNIT-III**

Fermented food products:: sauerkraut, pickles, fermented soy products, yoghurt, cheese, bread; application of fermentation for value-addition; Production of amino acids, citric acid, lactic acid, Baker's yeast, vinegar. Principles and production of Poly Unsaturated Fatty Acids, Dextran, Xanthan and gum – properties and applications.

**UNIT-IV**

Recombinant-DNA technology, Expression and production of foreign genes, enzymes; biomass utilization-SCP; genetically modified organism; Cell and tissue culture, Secondary metabolites synthesis.

**Suggested reading**

1. Bains W.. Biotechnology from A to Z. Oxford Univ. Press.
2. Joshi VK & Pandey A. Biotechnology: Food Fermentation. Vols. I, II. Education Publ.
3. Knorr D. Food Biotechnology. Marcel Dekker.
4. Lee BH. Fundamentals of Food Biotechnology. VCH.
5. Prescott SC & Dunn CG. Industrial Microbiology. McGraw Hill.
6. Ward OP. Fermentation Biotechnology. Prentice Hall.
7. Perman D. Annual Reports of Fermentation Processes. Vols. I-III.
8. Prescott SC & Dunn CG. Industrial Microbiology. Mc Graw Hill.
9. Robert EC. Handbook of Nutraceuticals and Functional Foods. 2<sup>nd</sup> Ed. Wildman.
10. Shi J. (Ed.). Functional Food Ingredients and Nutraceuticals: Processing Technologies. CRC Press.

---

**CORE SUBJECT**

**SEMESTER V**

**Paper Title: Dairy Technology Lab**

**Paper Code: BFTC-504**

Total Credits: 2, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-50, Final Exam-50)

---

**List of Experiments:**

1. Determination of titrable acidity, pH and clot on boiling test in milk.
2. Detection of added starch and cane sugar in milk
3. Detection of water in milk.
4. Detection of presence of neutralizers in milk.
5. Preparation of chana and paneer from milk.
6. Preparation of flavored milk.
7. Estimation of salt in butter sample.
8. Design and layout of Dairy plant.
9. Preparation of whey-based beverages
10. To prepare a HACCP plan for a dairy processing unit.
11. Detection of preservatives: formalin, H<sub>2</sub>O<sub>2</sub> in milk.
12. Detection of presence of urea in milk.
13. Preparation of cheese from milk.
14. Preparation of yoghurt.
15. Preparation of Ice cream.
16. Calculation of over run in ice cream.
17. Design and layout of Dairy plant.
18. Detection of presence of detergent in milk.
19. To prepare a HACCP plan for a dairy processing unit.
20. Visit to Dairy Plant

**CORE SUBJECT**

**SEMESTER V**

**Paper Title: Food Engineering Lab**

**Paper Code: BFTC-505**

Total Credits: 2, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-50, Final Exam-50)

---

**List of Experiments:**

1. Material balance in food processes.
2. Particle size analysis for determination of mean particle diameter.
3. Performance evaluation of different mills.
4. Efficiency of separation for a grain mixture using indented cylinder separator

- 
5. Efficiency of separation for a grain mixture using spiral separator.
  6. Mixing index of food material by ribbon blender and cone blender.
  7. Efficiency of cyclone separator.
  8. Compression of tray dryer and vacuum tray drying of food and vegetable
  9. Freeze drying characteristic of food material.
  10. Effect of processing parameter on Spray drying of milk.

## DISCIPLINE SPECIFIC ELECTIVE I

## SEMESTER V

### **Paper Title: Bakery and Confectionery Technology** **Paper Code: BFTD-506**

Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assessment-30, Final Exam-70)

---

#### **UNIT I**

Bakery industry status in India and World. Raw materials and quality parameters; Product types; Functions of Gluten, rheological testing of dough-Farinograph, Mixograph, Rapid Visco Analyzer, Falling number.

#### **UNIT-II**

Technology for the manufacture of bakery products-bread, biscuits, crackers, buns, pizza base Equipments used, product quality characteristics, faults and corrective measures; Staling and losses in baking.

#### **UNIT III**

Technology for the manufacture of cakes, types of cakes-pound cake, fruit cake, sponge cake; Equipments used for the manufacture of cakes, product quality characteristics, faults and corrective measures. Different types of icings.

#### **UNIT IV**

General technical aspects of Industrial sugar confectionery, Quality characteristics of confectionery ingredients; technology for manufacture of chocolate, boiled sweets, caramel, toffee and fudge. Processing of liquorice paste, cream paste, marshmallow and fondents

#### **References:**

1. Matz, (1989). Bakery Engineering and Technology, Vol I and II, CBS Publishers, New Delhi.
2. Dubey SC. Basic Baking. The Society of Indian Bakers, New Delhi.
3. Manley D. 2000. Technology of Biscuits, Crackers & Cookies. 2nd Ed. CRC Press.
4. Pomeranz Y. Modern Cereal Science and Technology. MVCH Publication
1. Levie A. Meat Hand Book. 4th Ed. AVI Publ.
2. Mead M. Poultry Meat Processing and Quality. Woodhead Publ.
3. Mead GC. Processing of Poultry. Elsevier.
4. Pearson AM & Gillett TA. Processed Meat. 3rd Ed. Chapman & Hall.
5. Stadelman WJ & Cotterill OJ. Egg Science and Technology. 4th Ed. CBS.

**Paper Title: Beverage Technology****Paper Code: BFTD-507****Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-30, Final Exam-70)**

---

**UNIT-I**

Introduction and ingredients: Scope and status of beverages in North East region and in India. Definition of beverage, study of ingredient like sweeteners, emulsifier, colouring agent, flavoring agent, stabilizer.

**UNIT II**

Technology for non-alcoholic beverages: Raw materials quality and handling. Equipment and machinery for carbonated beverages, water treatment, syrup preparation, containers and closures, handling of empty containers and cleaning, carbonation, filling, inspection and quality control.

**UNIT III**

Technology for non-carbonated beverages: Raw materials quality and handling. Technology, specification, equipment and machinery for instant tea and coffee, fruit juice based beverages, milk and whey based beverages.

**UNIT IV**

Technology for alcoholic beverages: Raw materials quality and handling. Technology, equipment and machinery for Wine, Beer, Whiskey, Brandy, and Rum. Cereal Fermentation. Packaging and storage of different beverages. Sanitation in beverage industry. Waste utilization of beverage industries.

**BOOKS RECOMMENDED:**

1. Prescott, S. C and Dunn, C. G. Industrial microbiology, (Agrobios, 2007).
2. Boulton, C. and Quain, D. Brewing, Yeast and Fermentation, (Blackwell Science Ltd, 2001)
3. Fix, G. J. Principles of Brewing Science, (Brewers Publications, 1999)
4. Stanbury, P. F., Hall, S. and Whitaker, A. Principles of Fermentation Technology, (Aditya Books Pvt. Ltd., 1997)
5. Global Advances in Tea Science. N.K.Jain, Aravali Books International, 1st Edition, 1999.
6. Coffee: Botany, Biochemistry and Production of Beans and Beverage. M.N. Clifford and K.C.Willson, AVI publishing Co., 1st Edition, 1985



**Paper Title: Techniques in Food Analysis****Paper Code: BFTG-508**Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-30, Final Exam-70)**UNIT-I**

Sampling techniques, Importance of sampling in food analysis, Food Safety and toxicity, calibration and standardisation of instruments, Accuracy and Precision.

**Unit- II**

Chromatographic Techniques, Thin layer, Paper chromatography, column chromatography, normal phase and reverse phase chromatography, HPLC, GC, detectors (flame ionization, conductivity, photoionization, MS, electron capture, MALDI), FTIR, Spectroscopy.

**Unit-III**

Microscopic techniques in food analysis: Light microscopy, Compound microscopy, Scanning electron microscopy, Transmission electron microscopy.

**Unit-IV**

Biosensors, Artificial tongue, electronic nose, PCR, ELISA, NMR, Differential scanning calorimetry.

**Unit- V**

Basic principles of centrifugation, relation between  $g$  and RCF, gel electrophoresis techniques,

**References:**

1. Skoog, D. A., Holler, F. J., & Crouch, S. R. (2017). Principles of instrumental analysis. Cengage learning.
2. Nielsen S. (Eds.). 1994. Introduction to Chemical Analysis of Foods. Jones & Bartlett
3. Ranganna S. 2001. Handbook of Analysis and Quality Control for Fruit and Vegetable Products. 2nd Ed. Tata-McGraw-Hill
4. AOAC International. 2003. Official methods of analysis of AOAC International. 17th Ed.

**Paper Title: Food storage and Plant Layout****Paper Code: BFTG-509**Total Credits: 4 Total Lectures-50, Maximum Marks: 100 (Internal Assesment-30, Final Exam-70)

---

**UNIT I**

Grain storage: Levels of storage, properties of grain affecting storability, factors of spoilage, changes occurring during storage; bulk storage structures: traditional storage structures bukhari, kothar, morai, mud kothi; improved storage structures pusa bin, RCC bin, -, air distribution system and aeration fans; Bag storage: general Design consideration for warehouse

**UNIT II**

Modified atmospheric storage and controlled atmosphere storage; Biological spoilage of grains: common insects of stored grains, insecticides: principle, toxicity; fumigants-principle, properties and application; Rodenticides: anticoagulants. Cold storage and cold chain management: Introduction, scope of Cold Chain for enhancing marketing potentials of perishables in domestic and international markets, importance, cold chain transportation, different types of freezing methods, temperature- time management along the cold chain Food, temperature abuse in cold chain.

**UNIT III**

Plant layout: plant design concepts - situations giving rise to plant design problems - differences in design of food processing and non-food processing plants, general design considerations. Waste disposal and sanitation

**Recommended Readings:**

1. Norman G. Marriott and Robert B. Gravani. (2006). Principles of Food Sanitation, 5th edition
2. Rao, D. G. (2010). Fundamentals of Food Engineering, PHI learning Private Ltd.
3. Fellows P. (2000). Food Processing Technology, 2nd Edition. Woodhead Publishing Limited and CRC Press LLC
4. James A (2013). The supply chain handbook, distribution group.
5. FAO, US (1984) Design and operations of cold store in developing

**Paper Title: Industrial Visit****Paper Code: BFTC- V2**

Maximum Marks: 50 (Attendance: 20, Report-30)

---

The students will visit the different food processing industries, to acquaint them with different handling, processing and preservation techniques. Different hazards and risks associated with the processing will also be explained. The students have to make a report, which shall include; the layout of the industry, different machineries and their uses, limitations in the processing line and suggestions.

---

**Paper Title: Research Institute Tour 1**

**Paper Code: BFTC- V2**

Maximum Marks: 50 (Attendance: 20, Report-30)

---

The students will visit any Food Research Institute, to acquaint them with different handling, processing and preservation techniques. Different hazards and risks associated with the processing will also be explained. The students have to make a report, which shall include; the layout of the industry, different machineries and their uses, limitations in the processing line and suggestions.

**CORE SUBJECT**

**SEMESTER VI**

**Paper Title: Technology of Meat, Fish and Poultry**

**Paper Code: BFTC-601**

Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-30, Final Exam-70)

---

**UNIT I**

Introduction to meat and poultry industries, Meat: composition from different sources; Muscle structure and composition; Modern abattoirs, Scientific methods of Stunning and Slaughtering: Halal, jhatka and kosher meat processing, Steps in slaughtering and dressing.

**Unit- II**

Postmortem muscle chemistry: Exsanguination, Loss of Homeostasis, Postmortem pH Decline, Rigor Mortis, Resolution of Rigor, Color, water holding capacity (WHC) and juiciness, texture and tenderness, odour and taste, meat tenderization;. Chilling and freezing of carcass and meat; Cold storage, Canning, cooking, drying, pickling, curing and smoking; Prepared meat products salami, kebabs, sausages, sliced, minced, corned, Meat microbiology and safety

**Unit-III**

Poultry industry in India; Microbiology of poultry meat; Spoilage factors; Layout, sanitation and processing operations of poultry processing. Byproducts: eggs, egg products; Whole egg powder and egg yolk products: manufacture, packaging and storage.

**Unit-IV**

Fish: structure and composition, post mortem changes, rigor mortis, autolytic changes, bacteriological changes, rancidity, physical changes.

Meat plant hygiene: GAP and HACCP; Packaging of meat products, Packaging of poultry products, refrigerated storage of poultry meat.

**References:**

1. Forrest JC. Principles of Meat Science. Freeman.
2. Govindan TK. Fish Processing Technology. Oxford & IBH.
3. Hui YH. Meat Science and Applications. Marcel Dekker.
4. Kerry J. et al. Meat Processing. Woodhead Publ. CRC Press.

**Paper Title: Engineering Properties of Food Materials****Paper Code: BFTC-602****Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-30, Final Exam-70)**

---

**UNIT-I**

Physico-chemical characteristics: shape, sphericity, size, volume, density, porosity, surface area, terminal velocity, drag coefficient, coefficients of friction and angle of repose.

**UNIT-II**

Specific heat, thermal conductivity, thermal diffusivity, electrical resistance and conductance, dielectric constant, energy absorption, Numerical calculations.

**UNIT-III**

Physical states of Matter, Rheology of food materials, Newtonian and Non-Newtonian fluids, rheological models and equations, Linear Visco-elasticity, Creep stress relaxation, Plastic behaviour. Texture profile analysis.

**UNIT-IV**

Application of engineering properties in process development as well as design and operation of equipment and structures associated with handling, processing and storage of raw as well as processed food products.

**Recommended Books:**

1. M.A. Rao & S.S. H. Rizvi. Engineering Properties of Foods. CRC Press.
2. J. M. Aguilera & D. W. Stanley. Micro-structural principles of food processing and Engineering.
3. N. N. Mohsenin. Physical properties of plant and animal materials.
4. Zeki Berk. Food Process Engineering and Technology. Academic Press.



**Paper Title: Food Engineering III****Paper Code: BFTC-603**Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-30, Final Exam-70)

---

**UNIT-I**

Drying-Theory of drying, Spray drying, Freeze drying, Vacuum drying, Sun drying, Foam mat drying, Evaporators, Continuous, Multiple effect, Falling and Rising film evaporators, fluidized bed drying. Psychrometry, Moisture sorption curves, Drying rate periods, Water activity, moisture content; wet basis and dry basis; calculations.

**Unit- II**

Drying rate curves, bound moisture, free moisture, equilibrium moisture content, critical moisture content, , engineering aspects of different types of driers including bin drier, tray drier, drum drier, tunnel drier, spray drier, fluidized bed drier, freeze drier. Principle of humidification & dehumidification, humidity chart, wet and dry bulb temperature.

**UNIT-II**

Rheological classification of Fluid Foods: Newtonian and Non-Newtonian fluids; Mechanisms and relevant models for non-Newtonian flow; Effect of temperature; Compositional factors affecting flow behaviour. Pasting properties and Linear Viscoelastic Range, Creep recovery.

**UNIT III**

Rheological and textural properties of selected food products. Texture profile analysis, Effect of processing and additives (stabilizers and emulsifiers) on food product rheology; Relationship between instrumental and sensory data. Comparative assessment of different types of Viscometers. Modifying microstructure, glass transition (starch, proteins and fats), effects of processing on rheology and texture.

**References:**

1. Singh RP. 1991. Fundamentals of Food Process Engineering. AVI Publ.
2. Singh RP and Heldman DR. 1993. Introduction to Food Engineering. Academic Press.
3. Fellows P. 1988. Food Processing Technology: Principle and Practice. VCH Publ.
4. Geankoplis J Christie. 1999. Transport Process and Unit Operations. Allyn & Bacon.
5. Henderson S & Perry SM. 1976. Agricultural Process Engineering. 5th Ed. AVI Publ.
6. McCabe WL & Smith JC. 1999. Unit Operations of Chemical Engineering. McGraw Hill.
7. Sahay KM & Singh KK. 1994. Unit Operation of Agricultural Processing. Vikas Publ. House.
8. Bourne, M. Food Viscosity and Texture, 2<sup>nd</sup> Edition, Academic Press, New York, 2002.
9. José Miguel Aguilera. Microstructural Principles of Food Processing Engineering.
10. Macosko, Ch.W. Rheology: Principles, Measurements, and Applications (Advances in Interfacial Engineering), Wiley-VCH, 1994.
11. Morrison, Faith. Understanding Rheology, Oxford University Press, 2001.
12. Donald B. Bechtel. New Frontiers in Food Microstructure.
13. Moskowitz. Food Texture.

---

**CORE SUBJECT**

**SEMESTER VI**

**Paper Title: Meat Technology Lab**

**Paper Code: BFTC-604**

Total Credits: 2, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-50, Final Exam-50)

---

**List of Experiments:**

1. Determination of moisture content in meat samples.
2. Determination of fat content in meat samples
3. Determination of protein content.
4. Determination of crude fibre content.
5. Study of Animal Carcass and Meat grading and cutting practices.
6. Study of Smoking on different physico-chemical and sensory characteristics on Meat and meat products.
7. To carry out candling and grading of shell eggs.
8. Visit to a meat processing plant.
9. Preparation of different meat products.

**CORE SUBJECT**

**SEMESTER VI**

**Paper Title: Engineering Properties Lab**

**Paper Code: BFTC-605**

Total Credits: 2, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-50, Final Exam-50)

---

**List of Experiments:**

1. Determination of viscosity of different foods.
2. To study the engineering properties of different food materials.
3. To calculate the angle of repose of different grains.
4. To calculate the heat penetration in foods.
5. To evaluate texture of raw and processed foods using texture analyser.
6. To analyse the flour quality by Falling Number.
7. Design of Cold storage.
8. Design of Grain storage and Silo.
9. Performance evaluation of different mills.
10. Material balance in food processes.
11. Comparison of tray dryer and vacuum tray drying of food and vegetable.
12. Freeze drying characteristic of food material
13. Particle size analysis of different flours.

**Paper Title: Food Engineering III Lab****Paper Code: BFTC-606**Total Credits: 2, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-50, Final Exam-50)

---

**List of Experiments:**

1. Comparison of tray dryer and vacuum tray drying of food and vegetable.
2. Freeze drying characteristic of food material
3. To study the drying characteristics of different food materials.
4. To plot drying curve for onion, potato, tomato slices.
5. Moisture Sorption Isotherm of different foods.
6. Calculation of moisture content on dry weight basis and wet weight basis.
7. Model fitting to drying curves.
8. To check the rheology of different materials.
9. To check the pasting properties of flours.

**DISCIPLINE SPECIFIC ELECTIVE I****SEMESTER VI****Paper Title: Food Product Development****Paper Code: BFTD-607**Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-30, Final Exam-70)

---

**Unit I**

New Proprietary Food Products: Sources for R&D initiative, Definition, Classification, Characterization, Factors shaping new product development- Social concerns, health concerns, impact of technology. Product integrity and conformance to standard.

**UNIT-2**

Market and market place influence on new product development, Market Survey, Consumer survey to identify new products in terms of Line Extension, Repositioning Existing Products, New form/Reformulation. New packaging of existing products, Innovative products, Creative Products. Tapping traditional foods and unconventional sources of foods.

**UNIT-3**

Identification of concept and product for development, Market research for the concept and selected product, Identification of products, selection of one product and its standardization improving success. Costing the product and determining the sales price, Advertising and test marketing the product, Report preparation.

---

#### UNIT-4

Shelf life testing of new product (testing for appropriate quality parameters-chemical, microbiological and nutrient content, acceptability studies), Overview of sensory principles and practices: General consideration in sensory testing, Selection and screening of panel: Types of panel (Trained panel, discriminative and communicative panel).

#### Recommended Books

1. Amerine, M.A.; Pangborn, R.M.; Roessler, E.B., Principles of Sensory Evaluation, Academic Press, NY
2. Kapsalis, J.G., Objective, Methods in Food Quality Assessment, CRC Press, Florida.
3. Martens, M.; Dalen, G.A.; Russwurm, H. (eds), Flavour Science and Technology, John Wiley and Sons, Chichester.
4. Moskowitz, H.R.(eds), Food Texture: Instrumental and Sensory Measurement, Marcel Dekker Inc. , New York.
5. Earle R, Earle R & Anderson A. 2001. Food Product Development. Woodhead Publ.
6. Fuller 2004. New Food Product Development - from Concept to Market Place. CRC.
7. Moskowitz, Howard R. 2009. An Integrated Approach to New Food Product Development. CRC Press.
8. Earle R, Earle R & Anderson A. 2001. Food Product Development. Woodhead Publ.
2. Lyon, D.H.; Francombe, M.A.; Hasdell, T.A.; Lawson, K. (eds) ,Guidelines for Sensory Analysis in Food Product Development and Quality Control, Chapman and Hall, London.

#### DISCIPLINE SPECIFIC ELECTIVE II

#### SEMESTER VI

**Paper Title: Engineered Textured and Fabricated Foods**

**Paper Code: BFTD-608**

Total Credits: 3, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-30, Final Exam-70)

---

#### Unit I

Introduction, need of the engineered foods, Extruders. Single Screw and Multiple Screw Extruders, Design and geometry of different parts. Extrusion process. Extrusion cooking. Compression during extrusion, effects of food components, Physical and Chemical Changes during Extrusion Process. Glass transition.

#### Unit II

Textured vegetable protein products. Soy protein fibres, isolate and concentrate, Puffing Gun, Puffed Products. Meat Analogues. Imitation Paneer.

#### Unit III

Fabricated Ready to serve Beverages, stimulating and nourishing beverages, Bakery Products, Margarine, Peanut Butter, Imitation Milks Designer Lipids, Technology and manufacture of Macaroni, Pasta, Noodles, Vermicilli.



---

## Unit IV

Weaning Foods/ Baby Foods. Therapeutic Foods. Geriatric Foods.

### References:

1. M.A. Rao & S.S. H. Rizvi. Engineering Properties of Foods. CRC Press.
2. J. M. Aguilera & D. W. Stanley. Micro-structural principles of food processing and Engineering.
3. N. N. Mohsenin. Physical properties of plant and animal materials.
4. Zeki Berk. Food Process Engineering and Technology. Academic Press.

## GENERIC SPECIFIC ELECTIVE I

## SEMESTER VI

**Paper Title: Non-Thermal Food Processing**

**Paper Code: BFTG-609**

Total Credits: 3, Total Lectures 50, Maximum Marks 100 (Internal Assesment-25, Final Exam-75)

### UNIT I

Traditional preservation technologies; Emerging techniques - principles of minimal processing and non-thermal processing, use of natural food preservatives and hurdle technology concept; Irradiation processing - equipment, effect on microorganisms and foods.

### UNIT II

Non-thermal processing using high hydrostatic pressure, pulsed light, ultrasound, pulsed electric field, reverse osmosis and ultrafiltration, microfiltration, osmotic distillation, membrane distillation; Oscillating magnetic field processing - equipment, effect on micro-organisms, enzymes and food components. Applications in Food Processing.

### UNIT III

Freeze drying, freeze concentration, UV radiation, electron beam, ozone, antimicrobial proteins, non-thermal plasma tech., radio frequency, electrolysed water, steam condensation and pasteurization, bacteriocins and lactoferrin, etc.

### References:

1. P J Fellows (2009). Food Processing Technology: Principles and Practice. Third edition. Wood Head Publishing in Food Science, Technology and Nutrition.
2. Ortega-Rivas, Enrique (2012). Non-thermal Food Engineering Operations. Springer
3. P J Cullen, Brijesh K. Tiwari, VasilisValdramidis (2011). Novel Thermal and Non-Thermal Technologies for Fluid Foods. Academic Press.
4. Gustavo V. Barbosa Canovas (1998). Nonthermal Preservation of Foods. Marcel Dekker.

**Paper Title: Food Business Management****Paper Code: BFTG-610**

Total Credits: 3, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-30, Final Exam-70)

---

**UNIT-I**

Concept and functions of marketing, Advertising; how advertising works? Deciding advertising objectives, advertising budget and advertising message, Media Planning, Personal Selling, Publicity; Sales Promotion, Food and Dairy Products Marketing.

**UNIT-II**

Production Cost and Pricing Strategies, Introduction to the theories of production and cost; Law of variable proportions; Returns to scale; Producer's Equilibrium; Producer's surplus; revenue curves of a firm .Different pricing strategies: Average pricing and Marginal pricing.

**UNIT III**

Market measurement- present and future demand; Market forecasting; market segmentation, micro and macro environments; Consumer behaviour, Marketing Planning Process, Product policy and planning: Product-mix; product line; product life cycle, New product development process. Product brand, packaging, services decisions, Brain Storming.

**UNIT IV**

Entrepreneurship: Definition of Entrepreneur, Internal and External Factors, Functions of an Entrepreneur, Entrepreneurial motivation and Barriers, Classification of Entrepreneurship, Theory of Entrepreneurship, Concept of Entrepreneurship, Development of entrepreneurship; Culture, stages in entrepreneurial process.

**References:**

1. Damodaran Suma, Managerial Economics; OUP, New Delhi.
2. C. H. Peterson, Managerial Economics; Pearson Education Inc. Indian Reprint
3. L J Truett and D B Truett, Managerial Economics: Analysis, Problems, Cases; John Wiley and Sons.
4. Bridge S et al (2003). Understanding Enterprise: Entrepreneurship and Small Business, Palgrave.
5. Holt (1990) Entrepreneurship, New Venture Creation, Prentice-Hall
6. 3 Dollinger M J (1999) Entrepreneurship, Prentice-Hall

---

**COMPULSORY  
SUMMER TRAINING  
BFTC-V4**

Maximum Marks: 100

---

Industrial training: Training will be of 4-6 weeks duration carried out during the summer break after the 6<sup>th</sup> semester. The students will submit their reports, and make a presentation in the 7<sup>th</sup> Semester.

**FOURTH YEAR**

**CORE SUBJECT  
SEMESTER**

**SEVENTH**

**Paper Title: Food Packaging Technology  
Paper Code: BFTC-701**

Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-30, Final Exam-70)

---

**UNIT-I**

Definitions, Functions of packaging and packaging materials; Types of packaging materials: Rigid, Semi-rigid and flexible: Paper and types of papers; Glass: composition, properties, types of closures, Metals: Tinplate containers, tinning process, components of tinplate, tin free steel (TFS), types of cans, aluminum containers, lacquers; Plastics: types of plastic films, laminated plastic materials (Retort pouches).

**UNIT-II**

Properties of materials such as tensile strength, bursting strength, tearing resistance, puncture resistance, impact strength, tear strength, Barrier properties of packaging materials: Theory of permeability, factors affecting permeability, permeability coefficient, gas transmission rate (GTR) and its measurement, water vapour transmission rate (WVTR) and its measurement, prediction of shelf life of foods,.

**UNIT-III**

Active packaging and techniques: oxygen, ethylene, carbon dioxide and other scavengers, intelligent packaging and techniques: Time temperature indicators (TTIs): Definition and classification, Introduction to antimicrobial food packaging and Non-migratory bioactive polymers used in food packaging.

**UNIT-IV**

Modified atmosphere packaging (MAP), Controlled atmosphere packaging (CAP), combination of MAP and other preservative techniques. Vacuum packaging of food products, Aseptic packaging: Sterilization of packaging material, biodegradable, edible films and recyclable packaging material, Labelling.

**Recommended Books:**

1. Ahvenainen, R. Novel Food Packaging Techniques. Woodhead Publishing Series.

- 
2. Robertson, (2005), Principles of Food Packaging. CRC Press, USA
  3. Scharow, S., and Griffin, R.C. (1980). Principles of Food Packaging, 2nd Edition, AVI Publications Co. Westport, Connecticut, USA.
  4. Yam, KL, Lee, DS and Piergiovanni, L. Food Packaging Science and Technology. CRC Press.

## CORE SUBJECT

## SEMESTER VII

**Paper Title: Research Methodology**

**Paper Code: BFTC-702**

Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-30, Final Exam-70)

---

### UNIT I

Research – Meaning, Objectives and types, criteria of good research, Significance of research, Research and scientific methods. Research ethics, research integrity, standards and problems in research ethics, research safety in laboratories, welfare of animals used in research. Selection of research problem, Justification, theory, hypothesis, basic assumptions, limitations and delimitations of the problem.

### UNIT-II

Sampling techniques, Population and sample, collection and classification of data, Frequency distribution, Diagrammatic Representation of data, Measures of central tendencies–Mean, Median and Mode, Measures of dispersion – Range, Quartile deviation, standard deviation, Skewness and Kurtosis.

### UNIT-III

Introduction to Regression, Significance Level, ANOVA, Co-Relations, Chi square test, T-Test, F-Test, RSM. Introduction to different statistical software's.

### UNIT-IV

Introduction to Funding Agencies: DST, DBT, MoFPI, CSIR, ICMR, SERB, UGC.

### UNIT-V

Report writing, Research proposal, Bibliography, Impact factor.

### Recommended Books:

1. Kothari, C.K., Research Methodology- Methods and Techniques, (New Age International, New Delhi).
2. Trochim, William M.K., Research Methods, (Biztantra, Dreamtech Press, New Delhi).
3. Gupta, C.B., An Introduction to Statistical Methods, 23rd Edition, Vikash Publications.
4. Gupta, SC & Kapoor, VK. Fundamentals of mathematical Statistics: A modern approach, (2000), Sultan Chand & Sons.



- 
5. Aggarwal, BL. 2003. Basic Statistics. New Age Publishers, New Delhi.

**CORE SUBJECT**

**SEMESTER VII**

**Paper Title: Food Safety and Quality Management**

**Paper Code: BF7C-703**

**Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-30, Final Exam-70)**

---

**UNIT 1**

Need for Food Safety, Definition of Food Safety, Types of hazards, biological, chemical, physical hazards, Factors affecting Food Safety, Emergence of Street foods and Convenience foods and the related safety concerns, Food borne diseases- types, impact and control

**UNIT 2**

Definition, Environmental contaminants (indirect additives, residues and contaminants), Residues of insecticides/pesticides/weedicides, veterinary drug residues, metal contaminants, radio-nuclides, contamination from packaging material, Food Adulteration, types of adulterants in common foods, impact on human health, tests to check common adulterants and admixtures

**UNIT 3**

GMP, GHP, Good Veterinary Practices, Good Animal Feeding Practices, Good Transport Practices, Good Storage Practices, Good Retail Practices, Design & Facilities for food processing facilities, HACCP, ISO 22000 series, TQM, Auditing and accreditation, Traceability and Recall, Crisis Management

**UNIT 4**

FSSAI – (transition from PFA, FPO, MMPO, MFPO), composition and role, FSS Act, Rules and Regulations, Export Promotion Bodies and Export Inspection Council and their role, Accreditation and Certifications (BIS, QCI, AGMARK, etc.), Codex Alimentarius, International organizations in area of food standardization, International Organization for Standardization (ISO)

**BOOKS RECOMMENDED:**

1. Lawley, R., Curtis L. and Davis, J. The Food Safety Hazard Guidebook, RSC publishing, 2004
2. De Vries. Food Safety and Toxicity, CRC, New York, 1997
3. Forsythe, S.J. The Microbiology of Safe Food, Willey-Blackwell, U.K., 2010
4. Mortimore S. and Wallace C. HACCP-A Practical Approach, Chapman and Hill, London, 1995
5. Blackburn CDW and Mc Clure P.J. Food Borne Pathogens- Hazards, Risk Analysis and Control. CRC Press, 2005
6. Hester, R E and Harrison R M -Food Safety and Food Quality :Issues in Environmental Science and Techonology, Cambridge, 2001
7. Paster T - The HACCP Food Safety Training Manual, John Wiley and Sons Inc., 2007
8. Roday, S - Food Hygiene and Sanitation, Tata McGraw Hill, 1999

---

**CORE SUBJECT**

**SEMESTER VII**

**Paper Title: Food Packaging Lab**

**Paper Code: BFTC-704**

Total Credits: 2, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-50, Final Exam-50)

---

**List of Experiments:**

1. Identification of different types of packaging and packaging materials
2. Determination of tensile strength of given material
3. Destructive and non-destructive test on glass container, drop test
4. Determination of wax weights, tensile strength of papers, bursting strength
5. WVTR of packaging materials
6. Measurement of thickness of packaging materials
7. Testing of chemical resistance of packaging materials
8. Determination of shelf life of packaged foods; determination of ERH of foods.
9. Introduction of students with the latest trends in packaging from websites and magazines.
10. Shelf life and sensory study of Vacuum packed food products.
11. Shelf life and sensory study of Shrinked packed food products.

**CORE SUBJECT**

**SEMESTER VII**

**Paper Title: Food Safety Lab**

**Paper Code: BFTC-705**

Total Credits: 2, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-50, Final Exam-50)

---

**List of Experiments:**

1. Development of GHP and GMP plan for a food factory.
2. Development of HACCP plan.
3. Identification of hazards associated to various processed food products.
4. Development of FSMS.
5. Visit to a food industry/outlet and identifying the gaps for HACCP plan.
6. To check the various adulterants in spices and processed foods.

**Paper Title: Food Process and Equipment Design****Paper Code: BFTD-706****Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-30, Final Exam-70)**

---

**UNIT 1**

Introduction to equipment or machine design, Basic requirements for machine elements and machines, classification of engineering materials, selection of materials for engineering purposes, mechanical properties of metals, Manufacturing considerations in machine design; introduction to load, stress, strain, Young Modulus of Elasticity or Stress modulus or Modulus of rigidity, Stress strain diagram, Factor of safety, Theories of failure under static load, Corrosion mechanism and its control.

**UNIT II**

Concept of heat transfer, efficiency of parallel and counter current flow heat exchanger, design of heat exchanger, Different types of pipes, fabrication method of different types of pipes, testing of piping material, colour codes, different types of piping joints, different types of flow regulators. Dryers, design of dryers

**UNIT II**

Loss mechanism in storage tanks, optimum proportions of a storage tank, spherical storage tanks, design of rectangular storage tanks, different types of roofs of tanks, nozzles and mountings in storage tanks, estimation of nozzle diameter for drain and vent in a storage tank

**References:**

1. M. V. Joshi. Process equipment design
2. R.T. Toledo. Fundamentals of food process Engg
3. Brennan, J.G. and J.R. Cowell. Food Engineering. Operations
4. Heldman, D.R. and R.P.Singh. Food Process Engineering.

**Paper Title: IPR and Patenting in Food Technology**

**Paper Code: BFTD-707**

Total Credits: 4, Total Lectures 50, Maximum Marks 100 (Internal Assesment-25, Final Exam-75)

**UNIT I**

Introduction of intellectual property right and the need for IPR, IPR in India and abroad.

**UNIT II**

Macroeconomic impact of the patent system, Patent and kind of inventions protected by a patent, Patent document, How to protect your inventions? Granting of patent, Rights of a patent, How extensive is patent protection? Why protect inventions by patents? Searching a patent, Drafting of a patent, Filing of a patent.

**UNIT III**

What is covered by: Trademarks, Copyrights, Industrial Designs and Geographical Indication. Rights of the Patentee, Obligations of a Patentee, Working of a patent, Compulsory Licensing, Revocation of Patents, IPR in Food Technology.

**References:**

1. P.N. Cheremisinoff, R.P. Ouellette and R.M.Bartholomew,Biotechnology Applications and Research, Technomic Publishing Co., Inc. USA, 1985.
2. D.Balasubramaniam, C.F.A.Bryce,K. Dharmalingam, J. Green and K. Jayaraman, Concepts in Biotechnology, University Press (Orient Longman Ltd.), 2002
3. Bourgagaize, Jewell and Buiser,Biotechnology: Demystifying the Concepts, Wesley Longman, USA, 2000.
4. Ajit Parulekar and Sarita D' Souza, Indian Patents Law – Legal & Business Implications; Macmillan India ltd , 2006
5. B.L.Wadehra; Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications; Universal law Publishing Pvt. Ltd., India 2000
6. P. Narayanan; Law of Copyright and Industrial Designs;Eastern law House, Delhi , 2010

**Paper Title: Technology of Effluent Treatment and Waste Management****Paper Code: BFTG-708****Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-30, Final Exam-70)**

---

**UNIT-I**

Types of waste and waste generation in different food processing industries; Concept, scope and importance of waste management and effluent treatment Temperature, pH, Oxygen Demands (BOD, COD), fat, oil and grease content, metal content, forms of phosphorus and sulphur in waste waters, microbiology of waste, other ingredients like insecticide, pesticides and fungicides residues

**UNIT II**

Environmental protection act and specifications for effluent of different food industries, Population forecast; Water demand for various purposes; Estimation of wastewater quantity; Variation in quantity of water and wastewater

**UNIT III**

Waste Utilization, Effluent treatment, Pre-treatment of waste : sedimentation, coagulation, flocculation and floatation, Secondary treatments: Biological oxidation-trickling filters, oxidation ditches, activated sludge process, rotating biological contractors, lagoons, Tertiary treatments : Advanced waste water treatment processs and, coal and activated carbon filters, phosphorus, sulphur, nitrogen and heavy metals removal.

**Recommended Readings:**

1. Food Processing Work Management by Green and Krammer; CBS Publication
2. Principles of Food Sanitation by Mariett NG; CBS Publication
3. Waste Treatment in the Food Processing Industry by Lawrence K.Wang, Yung-Tse Hung Howard H.Lo, constanitime Yapijakis.



**Paper Title: Food Additives****Paper Code: BFTG-709**

Total Credits: 4, Total Lectures-50, Maximum Marks: 100 (Internal Assesment-30, Final Exam-70)

---

**UNIT I**

Introduction, classification and functions of Preservatives, curing agents, sequesterants, humectants, hydrocolloids, non nutritive sweeteners (Acesulfame K, Aspartame, Saccharin , sucralose, stevia, neotame) anticaking agents, leavening agents,

**UNIT II**

Flavour technology: Types of flavours, Food flavor and its importance to consumers, flavours generated during manufacturing of cheese, chocolate, garlic, onion, tea, coffee, beer, bread, meat products, spices; extraction of essential oils and oleoresins: distillation, maceration, supercritical fluid extraction, ultrasound assisted extraction, microwave assisted extraction; flavour enhancer

**UNIT III**

Food colours: natural colours and synthetic colours, colour retention agents, antioxidants emulsifiers, flour improvers, stabilizers and thickeners, glazing agents- their types and applications in food

**UNIT IV**

Microencapsulation of food additives and flavours, encapsulating materials, importance of microencapsulation, toxicological evaluation of food additives

**References:**

1. Branen AL, Davidson PM & Salminen S. Food Additives. 2nd Ed. Marcel Dekker.
2. Gerorge AB. Encyclopedia of Food and Color Additives. Vol. III. CRC Press.
3. Gerorge AB. Fenaroli's Handbook of Flavor Ingredients. 5th Ed. CRC Press.
4. Madhavi DL, Deshpande SS & Salunkhe DK. Food Antioxidants: Technological, Toxicological and Health Perspective. Marcel Dekker.
5. Morton ID & Macleod A J Food Flavours. Part A, BC. Elsevier.

**Paper Title: Major Project/Dissertation****Paper Code: BFTC-801**

---

Total Credits: 12, Maximum Marks: 400 (Project report-150, Departmental Seminar-150, Viva 100)

---

The students will carry out project works in groups of 4 or 5 students each under the guidance of a faculty member. The project shall consist of research/design/development/ implementation work. It may also be a continuation of the project/industrial work carried out after the summer break of 6th semester, but to be evaluated separately based on similar criteria.

