



**M. TECH. FOOD TECHNOLOGY
BYE-LAWS & SYLLABUS
IMPLMENTED FROM 2019**

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 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.
- To promote R&D in the field and assist in the implementation of the food safety and quality management process of the food regulating bodies.

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
Prof. Afrozul Haq Dean, School of Interdisciplinary Sciences & Technology (SIST) & Head, Department of Food Technology	Food fortification, functional foods, drugs, Vitamin D, HPLC, Metabolomics, Nutrition, Food chemistry, Human health,
Dr. Sayeed Ahmad, Coordinator	Pharmacognosy, Quality Control of Herbal drugs and Botanicals: Chromatography, Metabolomics, HPLC, HPTLC, GCMS, LCMS
Dr. Z R A A Azad Assistant Professor	Meat and Meat Products Processing and Preservation, Meat based Functional Foods, Food Preservation.
Dr. Vasudha Sharma Assistant Professor	Probiotics, Fermented Functional Foods, Nutraceuticals, By-product utilization, food safety, food fermentation.
Dr. Khalid Bashir Assistant Professor	Gamma Irradiation, Starch and Protein Modification, Food Rheology, Drying, Food fortification, probiotics, powder engineering.
Dr. Sweta Joshi Assistant Professor	Food Chemistry, Functional foods, Nutraceutical, phytochemicals, extraction techniques, food additives, bioactive components, nanotechnology.
Dr. Kulsum Jan Assistant Professor	Cereal processing, Edible films, agricultural waste utilization, by-product utilization, starch and protein modification.
Er. Jinku Bora Assistant Professor	Food Engineering, Food Biotechnology, Food Chemistry, Starch modification, Nanotechnology
Er. Mifftha Yaseen Lecturer	Food Packaging, Food Product Development, Food Preservation, Meat technology
Er. Aastha Bhardwaj 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, Balatska N, Barbosa AP, Karonova T, Rudenka E, Misiorowski W, Zakharova I, Rudenka A, Łukaszkiwicz J, Marciniowska-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 (TaqI), rs2228570 (FokI) 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 γ -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). Physicochemical 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. cyminum*) 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, Vidyanath 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).

**M. TECH. PROGRAMME IN FOOD TECHNOLOGY
DEPARTMENT OF FOOD TECHNOLOGY**

BYE-LAWS

1. **Programme of study:** Master of Technology (M. Tech.) Food Technology
2. **Programme code:** 538
3. **Course abbreviation:** MFT
4. **Duration:** Two years spread over four semesters

M. Tech. Food Technology is a two-year full time academic program of study spread over four semesters. A candidate enrolled in M. Tech. Food Technology shall not be allowed to enroll for any other full-time programme of study and shall not appear in any other examination of a full time course of Jamia Hamdard (JH) or any other university. Each year, new session will start in July, and the four semesters will be as under,

Semester I	(1 st year)	July-Dec (Odd Semester)
Semester II	(1 st year)	Jan-Jun (Even Semester)
Semester III	(2 nd year)	July-Dec (Odd Semester)
Semester IV	(2 nd year)	Jan-Jun (Even Semester)

The number of teaching days in each semester shall not be less than 90 days.

5. **Medium of instruction:** English

6. **Eligibility for admission:**

Applicants seeking admission M. Tech. Food Technology must appear in the Entrance Test conducted by Jamia Hamdard each year in the month of May, and fulfill the following criteria,

“A candidate desirous of admission to the course must have passed B. Tech/M.Sc. in Food Science and Technology or allied disciplines including the Bachelors degree in Pharmacy with at least 55% marks in aggregate, and mathematics at 10 + 2 level”

7. Course Structure:

- (a) The course, as approved by the Board of Studies and reviewed regularly, shall be divided into no less than seven theory courses in Semester I, II and thesis/project in Semester III and IV. There may be 7 theory courses of at least 3 credits each and a lab course of 8 credits in each semester
- (b) A minimum of three credits shall be assigned for each theory paper and 8 for the lab work (practical). The lab work may also include a report or industrial visit.
- (c) One of the papers of at least 3 credits each in semester I and II 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.
- (d) One of the papers of at least 3 credits each in semester I and II will be Generic elective course which could be chosen from any discipline or subject.
- (e) 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.
- (f) There shall be no less than 36 credits for I and II Semesters and no less than 12 and 16 credits for III and IV semester respectively. This includes the lab work also.
- (g) There shall be a project/thesis work in the third and fourth 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 IV. 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 100 (for III SEM) and 150 (for IV SEM) marks and will comprise of submission of a project report after completion of the project. Part B will be assigned 200 (for III SEM) and 150 marks (for IV SEM) 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 50 (for III SEM) and 100 marks (for IV SEM) and will include viva voce examination.

(h) The project report of the fourth 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.

(i) A student shall have to score minimum pass marks (40%) separately in internal

assessment and semester examination for each paper.

8. Attendance

- (a) 100% attendance is desirable, but 75% attendance is mandatory in each paper for a student to enable him to appear in the Semester examination. In unforeseen contingencies, on the recommendation of the Dean of the Faculty/competent authority, 5% relaxation in attendance may be considered. This 5% condoning may be on account of sickness, provided the medical certificate, duly certified by a Registered Medical Practitioner/Public Hospital had been submitted in the office of the Head of the Department/Program Coordinator at the time of rejoining the classes immediately after the recovery from illness. Head of the Department/Program Coordinator shall forward such cases along with all related documents to the Dean. The relaxation may not be considered as the right of the student.
- (b) In order to maintain the attendance record of a particular course, a roll call will be taken by the teacher in every scheduled lecture and practical class. For the purpose of attendance, each practical class will count as one attendance unit, irrespective of the number of contact hours. Attendance on account of participation in the prescribed and notified activities such as, NCC, NSS, Inter-university sports, educational tours/field work, shall be granted provided the participation of the student is duly verified by the officer-in-charge and is sent to the Head of the Department/Program Coordinator within two weeks of the function/activity etc.
- (c) The subject teacher shall consolidate the attendance record for lectures and practical at the end of each month and submit to the Head of the Department/Program Coordinator. At the end of the semester, the teacher shall consolidate the attendance record for the whole semester and submit it to the Head of the Department/Program Coordinator. The statement of attendance of students shall be displayed by the Head of the Department/Program Coordinator on the Notice Board. A copy of the same shall be preserved as record. Attendance record displayed on the Notice Board shall deem to be a proper notification for the students and no individual notice shall be

sent to any student.

- (d) If a student is found to be continuously absent from the classes without any information for a period of 30 days, the concerned teacher shall report the matter to the Head of the Department/Program Coordinator who will report the matter to the Dean for appropriate action that may include striking off the name of such student(s) from the roll. Such a student may, however, apply for re-admission within 7 days from the date of issue of the notice of striking off the name from the rolls. Such a student may, however, apply for re-admission within 7 days from the date of issue of the notice of striking off the name. The request for re-admission may be considered by the Dean of the Faculty. Such a student shall not be eligible for re-admission after the prescribed period of 7 days. The re-admission shall be effected only after the payment of prescribed re-admission fee.
- (e) A student detained on account of shortage of attendance in any semester may be re-admitted to the same class in the subsequent academic year on payment of prescribed fees applicable in that year to complete the attendance requirement of that course.

9. Internal assessment

The performance of the student in each paper will be evaluated both continuously (Internal Assessment) and at the end of semester (Semester Examination). 25% marks for each theory paper will be allocated for internal assessment and 75% marks will be kept for semester examination at the end of each semester. For a paper carrying 100 marks, for example, 25% marks (= 25 marks) allocated for internal assessment will be divided as follows: There will be (i) **three sessional tests** for each paper, each of 5 marks, totalling 15 marks, (ii) an assignment of 5 marks, and (iii) 5 marks will be allocated to attendance as per the guidelines provided by the Office of the Controller of Examination. For practical courses, 50 marks will be allocated for the internal assessment and 100 marks will be kept for semester examination at the end of each semester. For the evaluation of the lab work, laboratory notebook, practical test/viva voce shall be taken into account. The marks shall be awarded by the respective teacher

conducting the practical course. For sessional test, discontinuance of classes will not be permitted and the teacher may take the test in his/her schedule class. Under the compelling circumstance such as sickness of the student or mourning in the family the candidate may be given another chance. For sickness only a credible medical certificate issued by a hospital shall be considered. In case of causalities a letter from the parents would be required.

10. Semester examination:

- a) Semester examination shall be held at the end of each semester as per schedule given in the Academic Calendar of the Faculty.
- b) Upto maximum of seven days preparatory holidays may be given to the examinees before the start of the semester examinations.
- c) Each theory paper having 03 credits shall be of 100 marks out of which 75% marks shall be for semester examination and 25% marks for internal assessment.
- d) Each practical paper having 08 credits shall be of 100 marks out of which 75% marks shall be for semester examination and 25% marks for internal assessment.
- e) The question paper for semester examinations shall be set either by the external examiner or an internal examiner. The Board of Studies of a department shall draw a panel of name of examiners, both internal and external, for approval by the Vice chancellor. If the external examiner is unable to send the question paper by the deadline set by the examination branch of the University, the Head of the Department after consultation with the examination branch shall get the paper set internally by a faculty. The papers set by the examiners can be moderated in consultation with the teacher who taught that course. Teachers appointed on contractual basis with appointment of less than one academic session, and temporary as well as ad-hoc teachers may not ordinarily be appointed as examiners. All such teachers, however, will be expected to assist in the practical examination.
- f) The question paper shall have five questions. There shall be one question from each

of the 4 units of the course and one question shall contain objective type/short answer questions covering all the units of the course. The candidate shall have to answer all the five questions. There shall, however, be internal choice within a unit. The choice shall be given by setting alternative questions from the same unit. The question paper should be such that it covers all the topics of that course.

- g) The duration of the semester examination of a theory course shall be three hours. Practical exams of a lab course shall be of at least four hours duration. The practical examination shall be conducted by an internal and external examiner assisted by other teachers.
- h) For projects, each student shall submit three typed bound copies of his/her project work to the supervisor(s) by the end of the 4th semester. A student shall not be entitled to submit the project report unless he/she has pursued project work during 4th semester under the guidance of a duly appointed supervisor(s). The report shall embody the candidates own work and an up-to-date review of the subject area. The write-up shall detail a critical assessment of the subject area and indicate in what respect the work appears to advance the knowledge of the subject concerned and future course of investigation required.
- i) The project report shall be examined by a Board of Examiners and the student shall have to appear for viva-voce. The Board of Examiners shall consist of the following,
- Two external examiners
 - Head of the Department/Program Coordinator
 - Supervisor(s)

The Board shall examine the project report of all the students and award the marks. A presentation by the student and the viva-voce shall be conducted by one of the external examiners along with the other members of the board by and marks shall be awarded by the external examiner for the same. All other teachers of the department will also be invited by the Head of the Department to be present during the examination. In case a student fails to secure the minimum pass marks, he/she may be asked to appear in the viva-voce again, or

he/she may be asked to revise the project report in the light of the suggestions of the examiners and resubmit. For this, he/she will have to enroll as an ex-student in the next session. A resubmitted project report will be examined as above and viva voce shall be conducted along with other students.

11. Classification of result:

Following grading system with 10 point scale shall be followed to represent performance of students in the examination:

%age marks	Grade	Grade Point	Performance level
>80	A +	10	Outstanding
75-<80	A	9	Excellent
70-<75	B +	8	Very good
60-<70	B	7	Good
50-<60	C	6	Average
45-<50	D	5	Below Average
40-<45	E	4	Marginal
<40	F	0	Fail
Absent	I	-	Incomplete

If a candidate does not write a paper, He/She will be awarded "I" grade. To pass the course, the student must obtain a minimum of 'E' grade. Minimum CGPA required for the award of degree shall be 5.

12. Earned credits (EC):

The credits for the courses in which a student has obtained E (minimum passing grade for a course) or a higher grade in the semester exam shall be counted as credits earned

by him/her. Any course in which a student has obtained 'F' or 'I' grade shall not be counted towards his/her earned credits.

13. Evaluation of Performance:

SGPA (Semester Grade Point Average) shall be awarded on successful completion of each semester. CGPA or Cumulative Grade Point Average, which is the Grade Point Average for all the completed semesters at any point in time shall be awarded in each semester on successful completion of the current semester as well as all of the previous semester. In 1st semester, CGPA is not applicable.

14. Calculation of SGPA and CGPA of A Student in a Semester:

$$\text{SGPA} = \frac{\sum (\text{Earned Credits} \times \text{Grade Point})}{\sum (\text{Total Course Credits in a Semester})}$$
$$\text{CGPA} = \frac{\sum (\text{Earned Credits} \times \text{grade point})_{j=1}}{\sum (\text{Total Course Credit in a Semester})}$$

where m is the number of semesters passed

15. Promotion

- Promotion from 1st semester to 2nd semester and from 3rd semester to 4th semester shall be automatic.
- A student shall be promoted to the 3rd semester of the programme if he/she has passed in each theory and practical courses separately of 1st and 2nd semesters. Provided that student may carry over a maximum of 8-9 credits (equivalent to two-three theory papers, which may be of 3 or 4 credits each) of courses uncleared, to the 3rd semester). A candidate will be given a total number of 2 attempts, inclusive of the first attempt, to clear the papers in which he/she fails. For such students, promotion to the next higher class will be considered subject to

rules relating to passing the 1st and 2nd semester examinations within two academic years, Award of degree shall be subject to successfully completing all the requirements of the programme of study within four years from admission. A student who fails in theory papers of end semester examination may be given a chance to appear in 3 papers in Make-up test to clear those papers. In no case shall it be allowed to the students who abstain from appearing in the semester examination.

- c) Candidates who are unable to appear in the examination because of serious illness at the time of examinations may be give another chance. The request has to be processed through the Head of the Department to the Vice Chancellor. The Vice chancellor may look into the merit of the case and decide accordingly.

16. Classification of Successful Candidates:

The result of successful candidates who fulfill the criteria for the award of M. Tech. shall be classified after the 4th semester, on the basis of his/her CGPA of all the four semesters. Classification shall be done on the basis of following criteria:

- a) S/he will be awarded “1st Division” if his/her final CGPA is 6.75 or above
b) S/he will be awarded “2nd Division” if his/her final CGPA is 6 or above but less than 6.75
c) S/he will be awarded “Pass” if his/her final CGPA is 5 or above but less than 6.
d) S/he will be treated as “fail” if his/her final CGPA is less than 5

17. Span Period:

- a. 1st and 2nd Semester Exams: Within two years from the first admission to the programme
b. All requirement of M. Tech. degree within a total period of four years from the date of their first admission.

18. Improvement:

A candidate who wishes to improve the previous performance will be allowed to do so as per the following regulation:

- a) A student shall be allowed only once to reappear in the semester examination of up

to four theory courses along with regular students of that semester to improve upon the previous performance. The examination fee charged from such candidates shall be double the current examination fee.

- b) Such a student shall inform the Head of the Department in writing of his/her intention to improve the performance two months before the date of semester examination is to be held.
- c) If the student improves the performance, he/she shall be required to submit the earlier mark-sheet/degree. A new mark-sheet and degree shall be issued. The new mark-sheet/degree shall bear the year in which the student improved the grade.
- d) In case the grade obtained in improvement is lower than the one obtained earlier, the higher grade shall be retained.



CURRICULUM OF M. TECH. PROGRAMME IN FOOD TECHNOLOGY
DEPARTMENT OF FOOD TECHNOLOGY
JAMIA HAMDARD

COURSE OF STUDY

SEMESTER– I (July-Dec)

S. No.	Paper Code	Paper Category	Paper Title	Marks	L	P	T	Credits
			Orientation Programme					
1.	MFTC-101	Core	Food Chemistry and Microbiology	100	3		1	4
2.	MFTC-102	Core	Food Processing and Preservation	100	3		1	4
3.	MFTC-103	Core	Meat Fish and Poultry Technology	100	3		1	4
4.	MFTC-104	Core	Advances in Cereal, Pulses & Oilseeds	100	3		1	4
5.	MFTC-105	Core	Food Engineering	100	3		1	4
6.	MFTC-106	Core	Lab-I	150		16		8
7.	MFTD-107	Discipline Specific Elective	Engineering Properties of Foods	100	3		1	4
8.	MFTD-108	Discipline Specific Elective	Unit Operations in Food Processing					
9.	MFTG-109	Generic Specific Elective	Plantation Crops and Spices	100	3		1	4
10.	MFTG-110	Generic Specific Elective	Fruits and Vegetable Processing					
11.	MFTC-V1	Compulsory	Industrial Visit	50				
	Total			900	21	16	7	36

SEMESTER – II (Jan-May)

S. No.	Paper Code	Paper Category	Paper Title	Marks	L	P	T	Credits
1.	MFTC-201	Core	Research Methodology	100	3		1	4
2.	MFTC-202	Core	Bakery & Confectionery Technology	100	3		1	4
3.	MFTC-203	Core	Food Safety & Quality Management	100	3		1	4
4.	MFTC-204	Core	Dairy Technology and Engineering	100	3		1	4
5.	MFTC-205	Core	Functional Food and Nutraceuticals	100	3		1	4
6.	MFTC-206	Core	Lab-II	150		16		8
7.	MFTD-207	Discipline Specific Elective	Food Rheology and Microstructure	100	3		1	4
8.	MFTD-208	Discipline Specific Elective	Advances in Drying Technology					
9.	MFTG-209	Generic Specific Elective	Advances in Food Packaging Technology	100	3		1	4
10.	MFTG-210	Generic Specific Elective	Modern Techniques in Food Analysis					
11.	MFTC-V2	Compulsory	Industrial Visit/Educational Tour	50				
	Total			900	21	16	7	36

SEMESTER –III (July-December)

S. No.	Paper Code	Paper Title	Marks	L	T	P	Credits
1.	MFTC-401	Industrial Training/Status Report/Minor Project Dissertation	100: Project 200: Report/Paper 50: Presentation		2	20	12
	Total		350				12

SEMESTER IV [Jan-May]

S. No.	Paper Code	Paper Title	Marks	L	T	P	Credits
1.	MFTC-401	Project Dissertation	150: Project 150: Thesis 100: Viva		4	24	16
	Total		400				16

-
1. Student is required to opt for one Discipline specific elective course of at least 03 credits each in semester I and Semester II.
 2. Student is required to opt for one Generic elective course of at least 03 credits each in semester I and Semester II from any discipline/subject of his or her choice offered in any department of the university including his or her own department towards award of M. Tech. in Food Technology.
 3. A Core Course offered in any discipline/department may be treated as an elective by the students of other disciplines/departments and such electives will also be referred to as Generic electives.
 4. A Discipline specific elective paper will be taught in the department if at least 5 students of the ongoing batch opt for it.
 5. A Generic elective course will be taught in the department if more than 5 students opt for it.

DETAILED SYLLABI OF M. TECH. (FOOD TECHNOLOGY)

FIRST YEAR

CORE SUBJECT

FIRST SEMESTER

Paper Title: Food Chemistry & Microbiology

Paper Code: MFTC-101

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

UNIT I

Introduction: Factors affecting microbial growth. Contamination, spoilage and preservation of fruit and vegetables, meat, egg, dairy products etc. Beneficial microorganisms and their utilization in food fermentation of bread, malt beverages, vinegar, fermented vegetables, fermented dairy and meat products. Food borne diseases, Rapid Methods of Detection of food borne pathogens. Mycotoxins.

Unit- II

Probiotics and prebiotics. Basics of Fermentation: Types of fermentors and applications-batch and continuous processes. Application of enzyme in food industries: milk and cheese industry, baking industry, alcoholic beverages (wine and beer) and fruit juices, starch and sugar industries.

Unit-III

Carbohydrates: Types, Functions, Reactions and properties; interactions of sugars and their role in various aspects of food like flavor, colour, aroma and taste; Enzymatic and Non enzymatic browning.

Lipids: Types, functions, reactions and properties: Lipolysis, Auto-oxidation, Rancidity, Role of food lipids in flavour

Proteins: Types, Functions, physical and chemical properties of proteins; Chemical reactions and interactions of amino acids and proteins; Denaturation and its implications.

Water in Foods, Ice: Structure, Properties, Interactions, Water activity, and stability.

Unit-IV

Vitamins, Minerals: General sources, functions and dietary requirements, deficiency symptoms, Stability and degradation in foods during processing. Enrichment and fortification. Food additives: definitions,

classification, functions, Types; Flavour technology: Types of flavours, flavours generated during processing, stability of flavours during food processing, essential oils and oleoresins.

References:

1. Banawart GJ. Basic Food Microbiology. 2nd Ed. AVI Publ.
2. Frazier J & Westhoff DC. Food Microbiology. 4th Ed. McGraw Hill.
3. Garbutt J. Essentials of Food Microbiology. Arnold Heinemann.
4. Jay JM, Loessner MJ & Golden DA. Modern Food Microbiology. 7thEd. Springer
5. Chakrabarty MM. Chemistry and Technology of Oils and Fats. Prentice Hall.
6. Dendy DAV & Dobraszczyk BJ. Cereal and Cereal Products. Aspen.
7. Hamilton RJ & Bhati A. Fats and Oils - Chemistry and Technology.App. Sci. Publ.

CORE SUBJECT

FIRST SEMESTER

Paper Title: Food Processing and Preservation

Paper Code: MFTC-102

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

UNIT-I Introduction to Food Processing and Preservation

Status of food preserving industry in India, National food processing policy of India, Importance and scope of food preservation, Principles of food processing and preservation.

UNIT-II Processing in High and Low Temperature

Processing and preservation by heat: blanching, pasteurization, sterilization and ultra high temperature (UHT), canning, extrusion processing, dielectric heating, microwave heating, baking, roasting and frying; Processing and preservation by low-temperature: refrigeration, freezing, controlled atmospheric storage and modified atmosphere.

UNIT-III Modern Processing Techniques – I

Membrane technology: microfiltration, ultrafiltration, nanofiltration and reverse osmosis and their industrial application, Supercritical fluid extraction, Radio frequency heating, Oscillating Magnetic Field, Ohmic heating, Infrared heating, Induction heating.

UNIT-IV Modern Processing Techniques - II

High Hydrostatic Pressure, Pulsed electric field, Ultrasound, Cold Atmospheric Plasma, High intensity light or Pulsed Light, Ultra Violet Light, Ozone in Food Processing, Food Irradiation, Electron beam Technology, Nanotechnology in food industry.

Suggested readings

1. Arsdel WB, Copley MJ & Morgan AI. Food Dehydration. 2nd Ed. Vols. I, II. AVI Publ.
2. Desrosier NW & James N. Technology of Food Preservation. 4th Ed AVI. Publ.
3. Fellows PJ. Food Processing Technology: Principle and Practice. 2nd Ed. CRC.
4. Jelen P. Introduction to Food Processing. Prentice Hall.
5. Potter NN & Hotchkiss Food Science. 5th Ed. CBS.
6. Potty VH & Mulky MJ. Food Processing. Oxford & IBH.
7. Ramaswamy H & Marcotte M. Food Processing: Principles and Applications. Taylor & Francis.

-
8. Shafiur Rahman M, Handbook of Food Preservation, 2nd edition, CRC.
 9. Gould GW, New Methods of Food Preservation, Springer

CORE SUBJECT

FIRST SEMESTER

Paper Title: Meat, Fish and Poultry Technology

Paper Code: MFTC-103

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

Unit –I

Meat: composition from different sources; Muscle structure and composition; Postmortem muscle chemistry; Meat colour and flavours; Meat microbiology and safety; Modern abattoirs, Stunning methods.

Unit- II

Steps in slaughtering and dressing; Operational factors affecting meat quality; effects of processing on meat tenderization; Halal, jhatka and kosher meat processing. Chilling and freezing of carcass and meat, Cold storage, freezing and preservation. Canning, cooking, drying, pickling, curing and smoking; Prepared meat products salami, kebabs, sausages, sliced, minced, corned.

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.
5. Levie A. Meat Hand Book. 4th Ed. AVI Publ.
6. Mead M. Poultry Meat Processing and Quality. Woodhead Publ.
7. Mead GC. Processing of Poultry. Elsevier.
8. Pearson AM & Gillett TA. Processed Meat. 3rd Ed. Chapman & Hall.
9. Stadelman WJ & Cotterill OJ. Egg Science and Technology. 4th Ed. CBS.

Paper Title: Advances in Cereal, Pulses and Oilseeds Technology

Paper Code: MFTC-104

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

Wheat: Structure, Milling; types of wheat, Wheat-based baked products: Bread, biscuit, cakes; Extruded products: pasta, noodles; 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.

UNIT- II

Sorghum, pearl millet, finger millet, and kodo millet: structure, composition; milling and malting; barley: milling and malting; Oats: Milling and processing.

UNIT -III

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

UNIT- IV

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.
9. Shakuntala Manay and Shadaksharaswamay. Foods Facts and Principles. New Age International (P) Ltd

Paper Title: Food Engineering

Paper Code: MFTC-105

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

Introduction to food engineering, Principles of mass transfer, mass balance calculations, Fluid flow, Reynolds Number, friction losses in pipes, measurement of fluid flow.

UNIT-II

Laws of thermodynamics, heat transfer Nature of heat flow, modes of heat transfer, steady state heat conduction equation, Heat conduction in slabs, cylinders & spheres heat generation inside solids, unsteady state heat conduction. Moisture content (wet and dry basis) theory and calculations.

UNIT III

Design of single & multi effect evaporators, mechanics of movements of air through stationary bed, thin layer and thick layer bed drying. Natural convection and its applications. Maintenance of equipments, Plant Layout and diagram codes.

Refrigeration cycles, performance of refrigeration compressors, refrigeration system balance and multiple evaporation systems.

References:

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.

Paper Title: Lab Course-I

Paper Code: MFTC- 106

Total Credits-08, Total Hours-100, Maximum Marks: 150 (Internal Assessment-50, Final Exam-100)

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.
10. Design of Cold storage.
11. Design of Grain storage and Silo.
12. Performance evaluation of different mills.
13. Material balance in food processes.
14. Comparison of tray dryer and vacuum tray drying of food and vegetable.
15. Freeze drying characteristic of food material
16. Particle size analysis of different flours.
17. Determination of viscosity of different foods.
18. To study the engineering properties of different food materials.
19. To calculate the angle of repose of different grains.
20. To calculate the heat penetration in foods.
21. To evaluate texture of raw and processed foods using texture analyser.
22. To analyse the flour quality by Falling Number.
23. To study the glass transition of foods.
24. To study the structure of grains.
25. Determination of TSS of different foods
26. Sensory evaluation: To perform recognition test for four basic tastes and determine sensitivity/threshold tests for four basic tastes.
27. To carry out microbiological assessment of indoor air quality
28. Preparation and quality evaluation of fruit jam / jelly, fruit marmalade; fruit preserve and candy; fruit RTS, squash, syrup;
29. Processing of tomato products;
30. Preparation of pickle/mixed pickle;
31. Physical-tests on wheat and rice;
32. Determination of gluten content in wheat flour;
33. Milling of wheat and rice by laboratory mill;
34. Assessment of degree of polishing;
35. Quality tests of rice; Amylose content determination in rice;
36. Malting of Barley,
37. Extraction of oil using expeller and solvent extraction methods.
38. Study of milling characteristics of Food by Ball mill.
39. Study of milling characteristics of Food by Hammer mill
40. Estimation of tannin content in different fruit products.

-
41. Determination of ascorbic acid content in the food samples.
 42. Study on Zero Energy Cooling Chamber for Shelf-life study of Fruits and Vegetable

Paper Title: Industrial Visit

Paper Code: MFTC- 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.

DISCIPLINE SPECIFIC ELECTIVE I

SEMESTER I

Paper Title: Engineering Properties of Foods

Paper Code: MFTD-107

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

UNIT-I

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

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: Unit Operation in Food Processing

Paper Code: MFTD-108

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

Material handling - Theory, classification of various material handling equipment -conveyors, elevators, trucks, cranes and hoists, Conveyance of food grain and powder in screw and vibratory conveyors. Selection of material handling equipments.

UNIT-II

Cleaning - Types, aims of cleaning, methods of cleaning, Dry cleaning methods: screening, aspiration, magnetic cleaning and abrasive cleaning. Wet cleaning methods: soaking, spray washing, flotation washing and ultrasonic washing. Sorting and Grading - Advantages of sorting and grading, grading factors, methods of sorting and grading.

UNIT III

Size Reduction: principles and laws of size reduction, energy calculations, equipment selection, Particle size analysis.

UNIT IV

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

UNIT V

Theory and equipment for filtration, Expression, Concentration and Evaporation, Distillation, Sedimentation fluidization and centrifugation

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

Paper Title: Fruits and Vegetable Processing

Paper Code: MFTG-109

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

Importance and scope of post-harvest management of fruits and vegetables. Maturity indices and standards for selected fruits and vegetables; Methods of maturity determinations; Quality requirements of raw material for processing; Post harvest losses

Unit- II

Controlled and modified atmosphere Storage, Hypobaric storage; Pre-cooling and cold storage; Prevention of post-harvest diseases and infestation, Fumigation; Minimal processing Hurdle technology. Non thermal processing.

Unit-III

Processing for pickles, chutneys, sauces, pulp, puree and concentrates, from different fruits, RTS fruit beverages; TSS calculations; individual quick freezing; Post-harvest physiological and biochemical changes in fruits and vegetables.

Unit-IV

Dehydration of fruits and vegetables, sun and solar drying, osmotic, tunnel drying, fluidized bed drying, freeze drying, spray drying. Production of fruit powders. Intermediate moisture fruits and vegetables. Canning, Blanching

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.

Paper Title: Plantation Crops and Spices

Paper Code: MFTG-110

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

Coffee: Occurrence, chemistry of chemical constituents; harvesting, dry and wet coffee processing ; flow sheet for conversion of coffee beans into beverage: fermentation of coffee beans; roasting , grinding, drying, extraction; decaffeinated coffee, instant coffee manufacturing; coffee-chicory mixture; quality grading ; FSSA standards for coffee

Tea: Occurrence, harvesting, chemistry of constituents: black tea and green tea; manufacturing of green and black tea, oolong; other tea-oolong, pickled, decaffeinated; instant tea manufacture; quality evaluation and grading of tea.

Unit- II

Cocoa: Occurrence, chemistry of the cocoa bean; processing of coffee beans ,changes taking place during fermentation of cocoa bean; manufacturing of cocoa powder, cocoa liquor, cocoa butter, chocolates; sugar bloom and fat bloom in chocolates; quality control of chocolates ;FSSA standards for cocoa products.

Unit-III

Spice processing: Definition of spice and classification, Processing and composition of major Indian spices and herbs: Pepper, cinnamon, cardamom, chillies, Turmeric and Ginger; Processing of dates, cashews, almond, raisins.

Unit-IV

Minor spices- ajowan, coriander, cumin, vanilla, asafoetida, cinnamon, fenugreek, garlic, mustard, mace and nutmeg, saffron, onion, tamarind, mint, cloves, leafy spices, bay; extraction of oleoresins and essential oils, spice adulteration; fumigation and irradiation of spices, microbial contamination

References:

1. Banerjee B. Tea Production and Processing. Oxford Univ. Press.
2. Minifie BW. Chocolate, Cocoa and Confectionery Technology. 3rd Ed. Aspen Publ.
3. NIIR. . Handbook on Spices. National Institute of Industrial Research Board, Asia Pacific Business Press Inc.
4. Sivetz M & Foote HE. Coffee Processing Technology. AVI Publ.
5. Varnam AH & Sutherland JP. 1994. Beverages: Technology, Chemistry and Microbiology. Chapman & Hall.
6. Woodroof JG & Phillips GF.1974. Beverages: Carbonated and Non-Carbonated. AVI Publ.

Paper Title: Research Methodology

Paper Code: MFTC-201

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

Paper Title: Bakery and Confectionery Technology

Paper Code: MFTC-202

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

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

UNIT-II

Technology for the manufacture of bakery products-bread, biscuits, crackers, cakes and the effect of variations in formulation on the quality of the finished product, characteristics, faults and corrective measures; types of icing; tools and equipments for Bakery products.

UNIT III

Quality characteristics of confectionery ingredients; technology for manufacture of chocolate and hard boiled candy; colour, flavour and texture of confectionary.

UNIT IV

General technical aspects of Industrial sugar confectionery; Boiled sweets, Caramel, toffee and fudge – Processing, 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

Paper Title: Food Safety and Quality Management

Paper Code: MFTC-203

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

Quality attributes of food, Gustation: Mechanism of taste perception, Difference tests for sensory evaluation; Olfaction, Colour: CIE (International Commission on Illumination) color system; Image processing techniques for Food Quality Evaluation; Texture.

UNIT –II

Food Toxicology: Definition, scope and general principles, Food toxicants: factors affecting toxicity of compounds, Methods used in safety evaluation-risk assessments, Natural toxic constituents in plant foods, Shellfish poisoning, Existing and emerging pathogens due to globalisation of food trade, Testing of food ingredients & additives, Animal studies including LD50, Ames test.

UNIT – III

Food Safety standards and regulation: Introduction; Food Safety Standards Authority of India; BIS, Ministry of Consumer Affairs, Codex Alimentarius, United States Food and Drug Administration, European Union norms, FSANZ.

UNIT – IV

Quality management systems, Good manufacturing practices; Good hygienic practices; ISO 22000; Good Agricultural Practices, Good Laboratory practices, Hazard analysis critical control points (HACCP); Safe quality food, Halal certification, Halal requirements.

Suggested reading:

1. Amerine MA, Pangborn RM & Rosslos EB. Principles of Sensory Evaluation of Food. Academic Press.
2. Early R. Guide to Quality Management Systems for Food Industries. Blackie Academic.
3. Furia TE. Regulatory status of Direct Food Additives. CRC Press.
4. Jellinek G. Sensory Evaluation of Food - Theory and Practice. Ellis Horwood.
5. Krammer A & Twigg BA. Quality Control in Food Industry. Vol. I, II. AVI Publ.
6. Macrae R, Roloson R & Sadlu MJ. Encyclopedia of Food Science & Technology & Nutrition. Vol. XVI. Academic Press.
7. Piggot J.R. Sensory Evaluation of Foods. Elbview Applied Science.
8. Ranganna S. Handbook of Analysis and Quality Control for Fruit and Vegetable Products. 2nd Ed. Tata-McGraw-Hill.

Paper Title: Dairy Technology and Engineering

Paper Code: MFTC-204

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

Status of dairy in India and worldwide. Quality evaluation and testing of milk; Procurement, and processing of market milk; flavoured, sterilized, recombined, full fat, reconstituted toned and double toned milk. Probiotic milk.

Unit- II

Milk products chemistry and microbiology processing: Condensed milk, Dried milk, Milk Cream, Butter, Ghee, Cheese, Ice cream, yoghurt, dahi, khoa, burfi, kalakand, gulabjamun, rosogolla, srikhand, chhana, paneer, lassi.

Unit-III

Principle of homogenization, single and double stage homogenizers, application of homogenization in dairy industry, design principles of homogenizers, types of tanks, pumps in dairy industry, Agitation and mixing, construction of agitators.

Unit-IV

Pasteurization of milk; batch, flash and continuous pasteurizer, HTST pasteurizer and design principle and thermal death kinetics, quality changes during processing of milk, Evaporator, types of evaporator, heat and mass balance in single and multiple effect evaporator, steam economy, estimation of drying rates and drying time, drying equipments, design of spray and drum dryer.

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.
3. Henderson JL. Fluid Milk Industry. AVI Publ.
4. Rathore NS et al. Fundamentals of Dairy Technology - Theory & Practices. Himanshu Publ
5. Spreer E. Milk and Dairy Products. Marcel Dekker.
6. Walstra P. Dairy Technology. Marcel Dekker.
7. Walstra P. (Ed.). Dairy Science and Technology. 2nd Ed. Taylor & Francis.
8. Web BH, Johnson AH & Lford JA. 1987. Fundamental of Dairy Chemistry. 3rd Ed. AVI Publ.

Paper Title: Functional Foods and Nutraceuticals

Paper Code: MFTC-205

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

Functional food: History and concepts, sources and classification; Pleiotropic Effects of Bioactive Phytochemicals. Nutraceuticals for infants, adolescent/ pregnant ladies and nursing mothers, geriatrics.

UNIT II

Food recommended and restricted in metabolic disorders : diabetes, obesity; gastrointestinal disorders; liver, and pancreatic disturbances; cardiovascular 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 of PUFA/ gamma linolenic acids, antioxidants (polyphenols), dietary fiber, oligosaccharides, sugar alcohols, peptides and proteins, glycosides, alcohols, iso-prenoides and vitamins, choline,

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

Paper Title: LAB II
Paper Code: MFTC-206Total Credits-08, Total Hours-100, Maximum Marks: 150 (Internal Assessment-50, Final Exam-100)**List of Experiments:**

1. Preparation of different bakery products.
2. Visit to a bakery plant.
3. Preparation of sensory score cards based on hedonic scale, paired comparison test, duo trio test.
4. To assess personal hygiene of food handlers.
5. To prepare a HACCP plan for a food processing unit.
6. Preparation of dried ginger; preparation of dried onion and garlic;
7. Preparation of banana and potato wafers; preparation of dehydrated vegetables.

-
8. Preparation of concentrated products by using Open Pan Evaporator and shelf life study.
 9. Determination of titrable acidity, pH and clot on boiling test in milk.
 10. Detection of added starch and cane sugar in milk
 11. Detection of preservatives: formalin, H₂O₂ in milk.
 12. Detection of presence of neutralizers in milk.
 13. Preparation of chana and paneer from milk.
 14. Preparation of flavored milk.
 15. Preparation of Ice cream.
 16. Estimation of salt in butter sample.
 17. Demonstration of AAS, GCMS, HPLC, NMR, FTIR, DSC, TGA
 18. Design and layout of Dairy plant.
 19. Demonstration to design of fermenter.
 20. Preparation of whey-based beverages
 21. Preparation of iced and flavoured tea beverage
 22. Preparation of carbonated and noncarbonated soft drinks
 23. To study the drying characteristics of different food materials.
 24. To plot drying curve for onion, potato, tomato slices.
 25. Moisture Sorption Isotherm of different foods.
 26. Calculation of moisture content on dry weight basis and wet weight basis.
 27. Model fitting to drying curves.
 28. To check the viscosity of different food materials.
 29. To prepare a HACCP plan for a dairy processing unit.
 30. Identification of different types of packaging and packaging materials
 31. Determination of tensile strength of given material
 32. Destructive and non-destructive test on glass container, drop test
 33. Determination of wax weights, tensile strength of papers, bursting strength
 34. WVTR of packaging materials
 35. Measurement of thickness of packaging materials
 36. Testing of chemical resistance of packaging materials
 37. Determination of shelf life of packaged foods; determination of ERH of foods.
 38. Introduction of students with the latest trends in packaging from websites and magazines.
 39. Shelf life and sensory study of Vacuum packed food products.
 40. Shelf life and sensory study of Shrinked packed food products.
 41. To determine adulteration in spices.
 42. To determine the adulteration in milk samples.
 43. Layout of different food processing industries.
 44. Design and Layout of Food Testing Labs.
 45. Visit to Silo, FCI Godowns.
 46. Visit to ISO 22000 certified Industries.

Paper Title: Food Rheology and Microstructure

Paper Code: MFTD-207

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

Introduction to rheology of foods, texture and microstructure. History of Food Microstructure, Light Microscopy, Transmission Electron Microscopy, Scanning Electron Microscopy.

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.

UNIT IV

Comparative assessment of different types of Viscometers, and their Merits and Limitations: Coaxial cylinders, Spindle- or Impeller-type viscometers, Cone-plate viscometer, Capillary viscometers, Falling-sphere viscometer, Vibratory viscometers, Extrusion viscometer, Orifice viscometer.

UNIT V

Modifying microstructure, glass transition (starch, proteins and fats), effects of processing on rheology and texture.

References:

1. Bourne, M. Food Viscosity and Texture, 2nd Edition, Academic Press, New York, 2002.
2. José Miguel Aguilera. Microstructural Principles of Food Processing Engineering.
3. Macosko, Ch.W. Rheology: Principles, Measurements, and Applications (Advances in Interfacial Engineering), Wiley-VCH, 1994.
4. Morrison, Faith. Understanding Rheology, Oxford University Press, 2001.
5. Donald B. Bechtel. New Frontiers in Food Microstructure.
6. Moskowitz. Food Texture.

Paper Title: Advances in Drying Technology

Paper Code: MFTD-208

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

Drying-Theory of drying, bound moisture, free moisture, equilibrium moisture content, critical moisture content, drying rate curves, 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

Psychometry, Moisture sorption curves, Drying rate periods – constant and falling rate periods and their calculation, Heat and mass transfer coefficient calculations, Capillary and diffusion theory, Thin layer and deep bed drying, Dryer performance indices – overall thermal efficiency, specific energy consumption, coefficient of performance.

Unit-III

Water activity, moisture content; wet basis and dry basis; calculations, Physical, chemical and microbiological characteristics of dehydrated foods, Rehydration ratio, size and density, shelf-life, Microbial stability of dried foods.

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.

Paper Title: Food Packaging Technology

Paper Code: MFTG-209

Total Credits: 4, Total Lectures 50, Maximum Marks 100 (Internal Assesment-25, Final Exam-75)**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, edible films, Biodegradable and recyclable packaging material.

UNIT-II

Active and intelligent packaging techniques, oxygen, ethylene and other scavengers: Oxygen scavenging technology, selection of right type of oxygen scavengers, ethylene scavenging technology, carbon dioxide and other scavengers, Time temperature indicators, freshness indicators, Pathogen indicators.

UNIT-III

Introduction to Non-migratory bioactive polymers in food packaging, Bioactive compounds in packaging, antimicrobial food packaging, antimicrobial packaging system, and effectiveness of antimicrobial packaging.

UNIT-IV

Modified atmosphere packaging (MAP), Controlled atmosphere packaging (CAP), combination of MAP and other preservative techniques. Aseptic packaging: Sterilization of packaging material.. Vacuum packaging in food products, seal and shrink packaging machine; form and fill sealing machines.

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.

Paper Title: Industrial Visit/Educational Tour**Paper Code: MFTC- 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: Modern Techniques in Food Analysis

Paper Code: MFTG-210

Total Credits: 4, Total Lectures 50, Maximum Marks 100 (Internal Assesment-25, Final Exam-75)**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, FTIR, photoionization, MS, electron capture, MALDI).

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, Spectroscopic techniques.

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.

SECOND YEAR

COMPULSORY COURSE

SEMESTER III

Paper Title: Industrial Training/Status Report

Paper Code: MFTC- 301

Total Credits 12

Maximum Marks: 350

The project shall comprise of the following three components viz Part A of 100, Part B of 200 and Part C of 50 marks respectively given as under.

PART A: Industrial training: Training will be of 4-6 weeks duration carried out during the summer break after the 2nd semester. The students will submit their reports, and make a presentation in the 3rd Semester.

OR

Status/Research Report: The students will write a Review/Research Paper on any topic relevant to Food Technology. The status paper should cover the Introduction, Review of Literature, Key findings, Conclusion and Inferences followed by References.

Part B: Each student will deliver a presentation on the topic of his/her project work carried out in department/industry/institute/research centre which will be evaluated by Departmental Research Committee (DRC) on the date and time fixed for the purpose

Part C: A viva voce examination will be conducted by an Expert (HOD nominee) on the date and time fixed for the purpose.

FOURTH SEMESTER

Paper Title: PROJECT DISSERTATION

Paper Code: MFTC- 401

Dissertation-150 Marks

Departmental Seminar-150

Project Presentation and Viva Voce-100 marks

Total credits: 16

Maximum marks: 400

The project shall comprise of the following three components viz Part A of 150, Part B of 150 and Part C of 100 marks respectively given as under.

Part A: Each student will undertake a project work in the fourth semester under the supervision of either a faculty from Jamia Hamdard or an expert from the industry/institute/research centre and under the overall supervision of Dean and Program Coordinator of the faculty. After the completion of project each student has to submit a project report by the deadline fixed for the same purpose.

Part B: Each student will deliver a presentation 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

Part C: A viva voce examination will be conducted by an external examiner on the date and time fixed for the purpose.