FACULTY OF SCIENCES

SYLLABUS

For

B.TECH. (FOOD TECHNOLOGY)

(Credit Based Evaluation & Grading System)

(Semester: I - VIII)

Examinations: 2019–20

GURU NANAK DEV UNIVERSITY AMRITSAR.

B.TECH. (FOOD TECHNOLOGY) SEMESTER SYSTEM
(Credit Based Evaluation & Grading System)

FIRST SEMESTER

Course No.	C/E/I	Course Title	Credits			Total Credits
			L	T	P	
FTL-102	C	Manufacturing Processes	3	1	-	4
FTL-103	C	Grain Handling and Storage Technology	2	-	-	2
FTL-104	C	Principles of Food Preservation	3	-	-	3
CYL-197	C	Engineering Chemistry	2	1	-	3
ENL-101	C	Communicative English-I	2	-	-	2
	C	Punjabi Compulsory **OR**	2	-	-	2
PBL-121 / PBL-122/ HSL-101		*ਮੁੱਢਲੀ ਪੰਜਾਬੀ **OR** **Punjab History & Culture (Compulsory)**				
SOA -101	C	***Drug Abuse: Problem, Management and Prevention (Compulsory ID Course)	3	-	-	3
FTP-121	C	Manufacturing Processes	-	-	2	2
FTP-122	C	Principles of Food Preservation	-	-	2	2
CYP-196	C	Chemistry (Practical)	-	-	2	2
Total Credits:			**14**	**2**	**6**	**22**

Note:

1. ***Special Paper in lieu of Punjabi Compulsory.**
2. ****For those students who are not domicile of Punjab.**
3. *****Student can opt this Paper whether in 1st or 2nd Semester.**

Note : 2 PSL-053 ID Course Human Rights & Constitutional Duties (Compulsory ID Paper). Students can opt. this paper in any semester except the 1st Semester. This ID Paper is one of the total ID Papers of this course.

SECOND SEMESTER

Course No.	C/E/I	Course Title	Credits			Total Credits
			L	T	P	
FTL-152	**C**	Thermal Science	3	1	-	4
FTL-153	**C**	Food Chemistry	3	-	-	3
FTL-155	**C**	Applied Mathematics	3	1	-	4
ENL-151	**C**	Communicative English-II	2	-	-	2
PBL-131 / PBL-132 / HSL-102	**C**	Punjabi Compulsory **OR** *ਮੁੱਢਲੀ ਪੰਜਾਬੀ **OR** **Punjab History & Culture (Compulsory)**	2	-	-	2
SOA- 101	C	***Drug Abuse : Problem, Management and Prevention (Compulsory ID Course)	3	-	-	3
FTP-172	**C**	Food Chemistry	-	-	2	2
FTP-173	**C**	Engineering Graphics and Drafting	-	-	3	3
ID-1	**I**	Interdisciplinary (ID) course	-	-	-	-
		Total Credits:	**13**	**2**	**5**	**20+ID**

Note:

1. ***Special Paper in lieu of Punjabi Compulsory.**
2. ****For those students who are not domicile of Punjab.**
3. ***** Student can opt this Paper whether in 1st or 2nd Semester.**

B.TECH. (FOOD TECHNOLOGY) SEMESTER SYSTEM
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THIRD SEMESTER

Course No.	C/E/I	Course Title	Credits			Total
			L	T	P	
FTL-201	**C**	Basic Food Engineering	3	1	-	4
FTL-202	**C**	Basic Microbiology	3	-	-	3
FTL-203	**C**	Food Hygiene and Sanitation	3	-	-	3
FTL-206	**C**	Sugar Processing and Refining	3	-	-	3
*ESL-220	**A**	Environmental Studies (Compulsory)	4	-	-	4
ECL-210	**C**	Basic Electrical and Electronics Engineering	3	1	-	4
FTP-221	**C**	Basic Microbiology	-	-	2	2
FTP-224	**C**	Sugar Processing and Refining	-	-	2	2
ID-2	**I**	Interdisciplinary (ID) course OR MOOC Course	-	-	-	-
Total Credits:			**19**	**2**	**4**	**25+ID**

***Note : Credits will not be included in the total.**

FOURTH SEMESTER

Course No.	C/E/I	Course Title	Credits			Total Credits
			L	T	P	
FTL-252	**C**	Cereals and Legumes Technology	3	1	-	4
FTL-253	**C**	Fruits and Vegetables Technology	3	1	-	4
FTL-254 **OR** FTL-258	**E**	Industrial Microbiology **OR** Sugar Industry Co-Products	3	-	-	3
FTL-255	**C**	Fluid Flow and Heat Transfer	3	1	-	4
FTL-256 FTP-271	**C** **C**	Mechanical Operations Cereals and Legumes Technology (Lab)	3 -	1 -	- 2	4 2
FTP-272	**C**	Fruits and Vegetables Technology (Lab)	-	-	2	2
FTP-273 **OR** FTP-276	**E**	Industrial Microbiology (Lab) **OR** Sugar Industry Co-Products (Lab)	-	-	2	2
FTP-274 ID-3	**C** **I**	Mechanical Operations (Lab) Interdisciplinary (ID) course OR MOOC Course	- -	- -	2 -	2 -
Total Credits:			**15**	**4**	**8**	**27+ID**

For elective courses: The students can opt **any one** combination from the following:

Combination 1: FTL-254 + FTP-273 (Industrial Microbiology)

OR

Combination 2: FTL-258 + FTP-276 (Sugar Industry Co-Products)

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FIFTH SEMESTER

Course No.	C/E/I	Course Title	Credits			Total Credits
			L	T	P	
FTL-301	**C**	Dairy Technology	3	1	-	4
FTL-302	**C**	Fish, Meat and Poultry Technology	3	1	-	4
FTL-303	**C**	Fats and Oil Technology	3	-	-	3
FTL-306	**C**	Mass Transfer	3	-	-	3
FTL-307	**C**	Computer Applications in Food Industry	3	1	-	4
FTP-321	**C**	Dairy Technology (Lab)	-	-	2	2
FTP-322	**C**	Fish, Meat and Poultry Technology (Lab)	-	-	2	2
FTP-323	**C**	Fats and Oil Technology (Lab)	-	-	2	2
FTP-326	**C**	Computer Applications in Food Industry (Lab)	-	-	2	2
ID-4	**I**	Interdisciplinary (ID) Course OR MOOC Course	-	-	-	-
Total Credits:			**15**	**3**	**8**	**26+ID**

SIXTH SEMESTER

Course No.	C/E/I	Course Title	Credits			Total Credit
			L	T	P	
FTL-351	C	Food Regulations and Quality Control	3	1	-	4
FTL-352	C	Applications of Enzymes in Food Industry	3	-	-	3
FTL-353	C	Biochemical Engineering	2	-	-	2
FTL-354	C	Packaging Technology	3	1	-	4
FTL-357	C	Human Resources Management in Food Industry	3	-	-	3
FTL-358	C	Sugar Industry (Technical Control and Design)	3	1	-	4
FTP-371	C	Food Regulations and Quality Control	-	-	2	2
FTP-372	C	Biochemical Engineering	-	-	2	2
FTP-373	C	Packaging Technology	-	-	2	2
FTP-374	C	Sugar Industry Design Lab	-	-	2	2
Total Credits:			**17**	**3**	**8**	**28**

B.TECH. (FOOD TECHNOLOGY) SEMESTER SYSTEM
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SEVENTH SEMESTER

Course No.	C/E/I	Course Title	Credits			Total Credits
			L	T	P	
FTL-401	C	Food Process Engineering	3	1	-	4
FTL-402	C	Confectionery Technology	3	1	-	4
FTL-403	C	Spices and Flavour Technology	3	-	-	3
FTL-404	C	Food Processing Plant Layout and Design	3	-	-	3
FTP-421	C	Food Process Engineering (Lab)	-	-	2	2
FTP-422	C	Confectionery Technology (Lab)	-	-	2	2
FTP-423	C	Spices and Flavour Technology (Lab)	-	-	2	2
FTP-424	C	Seminar and Group Discussion	-	-	2	2
ID-5	I	Interdisciplinary (ID) course OR MOOC Course	-	-	-	-
Total Credits:			**12**	**2**	**8**	**22+ID**

EIGHTH SEMESTER

Course No.	C/E/I	Course Title	Credits			Total Credits
			L	T	P	
FTP-451	**A**	Industrial Training (4 months i.e. Jan-April)	-	-	16	16
FTP-452	A	Research Project	-	-	4	4
Total Credits:			-	-	**20**	**20**

Last date for Submission of :

i) Training report within two weeks after coming from training.
ii) Research Project to be submitted by 15th June.
iii) Defence of the Project Report : 30th June.

B.TECH. (FOOD TECHNOLOGY) SEMESTER-I
(Credit Based Evaluation & Grading System)

FTL-102: MANUFACTURING PROCESSES

Credits: 3-1-0

Time: 3 Hours **Max. Marks: 100**
Mid Semester Marks : 20
End Semester Marks : 80

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Note : Students can use the Non-Programmable scientific calculator.

SECTION-A

Plastics and their Processing: Introduction, Types of Plastics, Thermo-plastics, Materials for processing plastics, Moulding processes compression moulding, Transfer Moulding, Injection moulding, Extrusion, Calendering, Thermo forming, Blow moulding, Casting, Laminating and Reinforcing, foamed plastics, Fastening and machine plastics.

Ferrous Metal and Alloys: Introduction, Pig iron, cast iron, wrought iron, carbon steel, alloy steel, blast furnace, modern development, electric furnace process, classification of steel, unalloyed steels and alloy steels.

Non-Ferrous Metals and Alloys: Introduction, Aluminum and its alloys, copper and its alloys, lead and its alloys, phosphors Bronze gun metal.

SECTION-B

Joint Processes: Introduction, weldability, types of welding, welding processes, use of electricity in welding, formation and characteristics of electric Arc, Four positions of Arc, welding, types of joints and types of applicable welds, Arc. Welding machine. TIG welding MIG welding, submerged welding, laser welding, spot welding etc. gas welding, Oxyacetylene welding, types of gas flame welding equipments, relative merits of AC and DC welding, welding defects, soldering and Brazing. Welding technique for Pipes.

Carpentry: Introduction, structure of wood, grain in wood, seasoning of wood, classification of wood, common varieties of Indian timber, carpentry tools marking and measuring tools, cutting tools, boring tools, striking tools, holding tools, miscellaneous tools, carpentry processes marking, sawing, planning, chiseling, boring, grooving, rebating, moulding, carpentry joints, wood working lathe, circular saw, band saw, wood planer, joint, mortiser.

SECTION-C

Foundry: Introduction, pattern making pattern materials, types of pattern, solid pattern, split pattern, match plate pattern, three piece split pattern, etc. Pattern making allowances moulding tools and equipments. Moulding sand, types of moulding sands, properties of moulding sand casting defects.

Mechanical Working of Metals (Metal Forming) : Introduction, hot working, rolling, forgoing, piercing, Drawing, Spinning, extruding, cold working, metallurgical advantages of hot working over cold working processes.

SECTION-D

Machine Process: Introduction, function of the lathe, types of lathe, speed lathe, engine lathe, bench lathe, tool room lathe, capstan and turret lathe, special purpose lathe, automatic lathe, size of lathe, list of lathe operations. Difference between Capstan and Turret and an Engine lathe.

Drilling Machine: Introduction, types of drilling machine, work holding devices, list of drilling machine operation, twist drill nomenclature.

Shaper and Planning Machines: Introduction, types of shaper and planner, list of shaper and planer operations, Planner vs shaper machine.

Grinding Machines : Introduction, kinds of grinding, types of grinding machines, rough grinding and precision grinding, potable and flexible shaft grinders, swing frame grinders, surface grinders etc. size and capacities of the grinder.

Recommended Books:

1. Workshop Technology by Hazra Chaudhary, Latest Edition, Volumes I, II
2. Workshop Technology by W.A.J. Chapman, Part I and

B.TECH. (FOOD TECHNOLOGY) SEMESTER-I
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FTL-103: GRAIN HANDLING AND STORAGE TECHNOLOGY

Credits: 2-0-0

Time: 3 Hours **Max. Marks: 100**

Mid Semester Marks : 20
End Semester Marks : 80

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Note : Students can use the Non-Programmable scientific calculator.

SECTION-A

Principles of grain storage

Grain storage structures

Stored product pests- insects, rodents, fungi, their nature

and occurrence

SECTION-B

Pest control- Techniques of pesticides application and fumigations

Pesticide chemistry, their toxicology and residual analysis

Pest control measures and sanitation of mills

SECTION-C

Grain procurement and handling

Modern techniques of infestation control

SECTION-D

Pesticides and health hazards

MAS / CAS, Hypobaric storage

Recommended Books:

1. Pesticides and Pollution by Mollan
2. Systematic Fungicide by Marsh (1973)
3. Introduction of Insect by Metalf and Lukemann (1994)
4. Pesticides Formulations by Woods.

B.TECH. (FOOD TECHNOLOGY) SEMESTER-I
(Credit Based Evaluation & Grading System)

FTL-104: PRINCIPLES OF FOOD PRESERVATION

Credits: 3-0-0

Time: 3 Hours **Max. Marks: 100**

Mid Semester Marks : 20
End Semester Marks : 80

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Note : Students can use the Non-Programmable scientific calculator.

SECTION-A

General introduction of food preservation
Historical development in food preservation
Characteristics of foods
Causes of quality deterioration of foods and methods of its prevention
Preparation of food for processing
Canning

SECTION-B

Drying /dehydration, types of dryers
Irradiations, sources and mechanism and Microwave heating (Principle and working)
Additives and chemical preservative

SECTION-C

Enzymes in Food processing
Freezing and cold storage of foods, factors effecting freezing types of freezing and freezers
Food Processing and malnutrition, restoration, enrichment, fortification and supplementation of foods

SECTION-D

Pickling and fermented products
Intermediate moisture foods
Food packaging – rigid and flexible, corrosion of container

Recommended Books:

1. Food Science – Potter.

2. Technology of Food Preservation – Dessrosier and Dessrosier

3. A Complete Course in Canning – Lopez.

4. Preservation of Fruits and Vegetables – Girdhari Lal, Siddapa, Tandon. ICAR, New Delhi

B.TECH. (FOOD TECHNOLOGY) SEMESTER-I
(Credit Based Evaluation & Grading System)

CYL–197 ENGINEERING CHEMISTRY Credits: 2-1-1

Time: 3 Hours **Max. Marks: 100**
Mid Semester Marks : 20
End Semester Marks : 80

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.
Students can use the Non-Programmable scientific calculator.

Section – A

Water Hardness: Common Impurities of water, methods of determination of hardness, clark's test and complex metric (EDTA) method, Degree of hardness. Numerical based on hardness and EDTA method.
Water Hardness Related problems: Boiler troubles their causes, disadvantages and prevention: Formation of solids (Scale and Sludge), Carry over (Priming and Foaming), Corrosion and Caustic (Scale and Sludge) Embrittlement.
Water Treatment Techniques: Introduction about water purification techniques, steps involved in purification of water, Sedimentation, coagulation, Filtration and Sterilization, Chlorination Water Treatment.
Softening of Water: Lime-Soda Method, Zeolite Method and Deionization/Demineralization Methods, Numerical Problems based on Lime-Soda and Zeolite softening methods.

Section – B

Glass: Definition, Properties, Manufacturing of glass, Types of silicate glasses and their commercial uses, Importance of annealing in glass making

Refractories: Definition, classification, properties, Requisites of good refractory and manufacturing of refractory, detailed study of silica and fire clay refractory and their uses. Seger's (Pyrometric) Cone Test and RUL Test

Section – C

Polymers: Introduction about polymers, different types of polymers, Different methods of classification and constituents of polymers, Thermosets and Thermoplastics, Preparation, Properties and uses of polyethylene, PP, Bakelite, polyester and Nylon
Elastomers: Introduction about elastomers, different types of elastomers, vulcanization, Synthesis Rubbers viz. Buna-S, Buna-N, Buty1 and neoprene rubbers.
Silicone Based Compounds: Introduction, Preparation of silicones, cross linked silicones, Silicon fluids or oils, Silicon elastomers, Silicon resins and their applications.

Section – D

Electrochemistry: Faraday's Laws, conductance, Arhemnium theory of ionization, molar conductance, transport numbers, electric potential difference for a galvanic cell, types of half cells, standard electrode potential, concentration cells.

Metal Ions in Biological Systems: Introduction, energy sources for life, non-photosynthetic processes Essential and trace elements on biological processes, Biological role of alkali and alkaline earth metal ions with special reference of Na^+-K^+ Pump.

References:

1. Casetllan, G.W. Physical Chemistry 4th Edition Narosa, 2004.
2. Peter A. and Paula, J.de Physical Chemistry 10th Edition Oxford University Press (2014).
3. Concise Inorganic Chemistry by J. D. Lee, Fifth Edition
4. Engineering Chemistry by P.C. Jain & Monica Jain Dhanpat Rai Publishers, New Delhi.
5. Chemical Process Industries by R. Norris Shrive, Mcgraw Hill Ltd., New Delhi.

List of Practicals:

1. Find the strength of KMnO4 solution.
2. Determine number of water molecules in Mohr salt by titration method.
3. Determine percentage of sodium carbonate in given sample of washing soda.
4. Determine percentage of sodium carbonate and sodium hydroxide in given sample of caustic soda.
5. Determine percentage of acetic acid in given sample of vinegar.
6. Determination of total Hardness of Water.
7. Determine the permanent and temporary hardness in the given sample of water.
8. Determination of coefficient of viscosity of a given liquid by viscometer.
9. To determine the unknown composition of a given mixture of two liquids by viscosity method.
10. Determination of Chlorine in bleaching powder.
11. To determine the strength of HCL by conductometrically.
12. To determine the strength of strong and weak acid conductometrically.
13. To determine the distribution coefficient of iodine between Cyclohexane and water
14. Determination of surface tension of a given liquid by drop number method by stalagmometer.
15. To Determine The Critical Micelle Concentration of A Soap (Sodium Laurate) by surface tension measurements.

References:

1. Findlay's Practical Physical Chemistry.
2. Advanced Practical Physical Chemistry by J.B. Jadav.
3. Quantitative Organic Analysis by Vogel

B.TECH. (FOOD TECHNOLOGY) SEMESTER-I
(Credit Based Evaluation & Grading System)

ENL-101 : COMMUNICATIVE ENGLISH–I

Credits: 02 (L= 2, T=0, U=0)

Time: 3 Hours **Max. Marks: 100**
Mid Semester Marks : 20
End Semester Marks : 80

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Objective: To introduce students to the skills and strategies of reading and writing by identifying organizational patterns, spotting classification systems and understanding associations between ideas. This course will prepare students to read a variety of texts and also to communicate more effectively through writing. The course will also pay special attention to vocabulary building.

Prescribed Text books:

- *The Written Word* by Vandana R. Singh, Oxford University Press, New Delhi.
- *Making Connections: A Strategic Approach to Academic Reading* by Kenneth J. Pakenham, Second Edition.

Section–A

"Word List", "Correct Usage of Commonly used words and Phrases" from the chapter "Vocabulary" given in ***The Written Word*** by Vandana R. Singh.

Section–B

Letter- writing as prescribed in ***The Written Word*** by Vandana R. Singh.
Report writing as prescribed in ***The Written Word*** by Vandana R. Singh.

Section–C

Section 1 from ***Making Connections: A Strategic Approach to Academic Reading*** by Kenneth J. Pakenham, Second Edition.

Section–D

Section 2 from ***Making Connections: A Strategic Approach to Academic Reading*** by Kenneth J. Pakenham, Second Edition.

B.TECH. (FOOD TECHNOLOGY) SEMESTER-I
(Credit Based Evaluation & Grading System)

PBL 121 : ਪੰਜਾਬੀ ਲਾਜ਼ਮੀ - I

Credit : 2-0-0
Time: 3 Hours **Max. Marks: 100**
Mid Semester Marks : 20
End Semester Marks : 80
Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

ਅੰਕ-ਵੰਡ ਅਤੇ ਪਰੀਖਿਅਕ ਲਈ ਹਦਾਇਤਾਂ

1. ਪ੍ਰਸ਼ਨ ਪੱਤਰ ਦੇ ਚਾਰ ਭਾਗ ਹੋਣਗੇ। ਹਰ ਭਾਗ ਵਿਚੋਂ ਦੋ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ।
2. ਵਿਦਿਆਰਥੀ ਨੇ ਕੁੱਲ ਪੰਜ ਪ੍ਰਸ਼ਨ ਕਰਨੇ ਹਨ। ਹਰ ਭਾਗ ਵਿਚੋਂ ਇਕ ਪ੍ਰਸ਼ਨ ਲਾਜ਼ਮੀ ਹੈ। ਪੰਜਵਾਂ ਪ੍ਰਸ਼ਨ ਕਿਸੇ ਵੀ ਭਾਗ ਵਿਚੋਂ ਕੀਤਾ ਜਾ ਸਕਦਾ ਹੈ।
3. ਹਰੇਕ ਪ੍ਰਸ਼ਨ ਦੇ ਬਰਾਬਰ ਅੰਕ ਹਨ।
4. ਪੇਪਰ ਸੈੱਟ ਕਰਨ ਵਾਲਾ ਜੇਕਰ ਚਾਹੇ ਤਾਂ ਪ੍ਰਸ਼ਨਾਂ ਦੀ ਵੰਡ ਅੱਗੋਂ ਵੱਧ ਤੋਂ ਵੱਧ ਚਾਰ ਉਪ-ਪ੍ਰਸ਼ਨਾਂ ਵਿਚ ਕਰ ਸਕਦਾ ਹੈ।

ਸੈਕਸ਼ਨ-ਏ

I. **ਦੋ ਰੰਗ** (ਸੰਪਾ. ਹਰਜਿੰਦਰ ਸਿੰਘ ਢਿੱਲੋਂ, ਪ੍ਰੀਤਮ ਸਿੰਘ ਸਰਗੋਧੀਆ)
ਗੁਰੂ ਨਾਨਕ ਦੇਵ ਯੂਨੀਵਰਸਿਟੀ, ਅੰਮ੍ਰਿਤਸਰ ਵਿਚੋਂ ਹੇਠ ਲਿਖੇ ਕਵੀ :
(ੳ) ਭਾਈ ਵੀਰ ਸਿੰਘ
(ਅ) ਧਨੀ ਰਾਮ ਚਾਤ੍ਰਿਕ
(ੲ) ਪ੍ਰੋ. ਪੂਰਨ ਸਿੰਘ
(ਕਵੀ ਦਾ ਜੀਵਨ, ਕਵਿਤਾ-ਸਾਰ, ਵਿਸ਼ਾ-ਵਸਤੂ, ਕਾਵਿ-ਕਲਾ)

II. ਗੁਰਮੁਖੀ ਔਰਥੋਗਰਾਫੀ ਦੀ ਜੁਗਤ (ਪੈਂਤੀ, ਮੁਹਾਰਨੀ, ਬਿੰਦੀ, ਟਿੱਪੀ ਤੇ ਅੱਧਕ); ਵਿਸ਼ਰਾਮ ਚਿੰਨ੍ਹ, ਸ਼ਬਦ ਜੋੜ (ਸ਼ੁਧ-ਅਸ਼ੁਧ)

ਸੈਕਸ਼ਨ-ਬੀ

I. **ਦੋ ਰੰਗ** (ਸੰਪਾ. ਹਰਜਿੰਦਰ ਸਿੰਘ ਢਿੱਲੋਂ, ਪ੍ਰੀਤਮ ਸਿੰਘ ਸਰਗੋਧੀਆ)
ਗੁਰੂ ਨਾਨਕ ਦੇਵ ਯੂਨੀਵਰਸਿਟੀ, ਅੰਮ੍ਰਿਤਸਰ ਵਿਚੋਂ ਹੇਠ ਲਿਖੇ ਕਵੀ :
(ੳ) ਫਿਰੋਜ਼ਦੀਨ ਸ਼ਰਫ
(ਅ) ਪ੍ਰੋ. ਮੋਹਨ ਸਿੰਘ
(ਕਵੀ ਦਾ ਜੀਵਨ, ਕਵਿਤਾ-ਸਾਰ, ਵਿਸ਼ਾ-ਵਸਤੂ, ਕਾਵਿ-ਕਲਾ)

II. ਲੇਖ ਰਚਨਾ (ਜੀਵਨੀ-ਪਰਕ, ਸਮਾਜਕ ਅਤੇ ਚਲੰਤ ਵਿਸ਼ਿਆਂ ਉੱਤੇ) : 10 ਲੇਖ ਲਿਖਵਾਉਣੇ
(ਕਲਾਸ ਵਿਚ ਅਤੇ ਘਰ ਲਈ ਅਭਿਆਸ)

ਸੈਕਸ਼ਨ-ਸੀ

I. **ਦੋ ਰੰਗ** (ਸੰਪਾ. ਹਰਜਿੰਦਰ ਸਿੰਘ ਢਿੱਲੋਂ, ਪ੍ਰੀਤਮ ਸਿੰਘ ਸਰਗੋਧੀਆ)
ਗੁਰੂ ਨਾਨਕ ਦੇਵ ਯੂਨੀਵਰਸਿਟੀ, ਅੰਮ੍ਰਿਤਸਰ ਵਿਚੋਂ ਹੇਠ ਲਿਖੇ ਕਵੀ :
(ੳ) ਨੰਦ ਲਾਲ ਨੂਰਪੁਰੀ
(ਅ) ਅਮ੍ਰਿਤਾ ਪ੍ਰੀਤਮ
(ੲ) ਡਾ. ਹਰਿਭਜਨ ਸਿੰਘ
(ਕਵੀ ਦਾ ਜੀਵਨ, ਕਵਿਤਾ-ਸਾਰ, ਵਿਸ਼ਾ-ਵਸਤੂ, ਕਾਵਿ-ਕਲਾ)

II. ਸ਼ੁੱਧ, ਅਸ਼ੁੱਧ : ਦਿੱਤੇ ਪੈਰ੍ਹੇ ਵਿਚੋਂ ਅਸ਼ੁੱਧ ਸ਼ਬਦਾਂ ਨੂੰ ਸ਼ੁੱਧ ਕਰਨਾ
(15 ਪੈਰ੍ਹਿਆਂ ਦੇ ਸ਼ੁੱਧ ਅਸ਼ੁੱਧ ਅਭਿਆਸ ਕਰਵਾਉਣੇ)

ਸੈਕਸ਼ਨ-ਡੀ

I. **ਦੋ ਰੰਗ** (ਸੰਪਾ. ਹਰਜਿੰਦਰ ਸਿੰਘ ਢਿੱਲੋਂ, ਪ੍ਰੀਤਮ ਸਿੰਘ ਸਰਗੋਧੀਆ)
ਗੁਰੂ ਨਾਨਕ ਦੇਵ ਯੂਨੀਵਰਸਿਟੀ, ਅੰਮ੍ਰਿਤਸਰ ਵਿਚੋਂ ਹੇਠ ਲਿਖੇ ਕਵੀ :
(ੳ) ਸ਼ਿਵ ਕੁਮਾਰ ਬਟਾਲਵੀ
(ਅ) ਸੁਰਜੀਤ ਪਾਤਰ
(ਕਵੀ ਦਾ ਜੀਵਨ, ਕਵਿਤਾ-ਸਾਰ, ਵਿਸ਼ਾ-ਵਸਤੂ, ਕਾਵਿ-ਕਲਾ)

II. ਅਖ਼ਬਾਰੀ ਇਸ਼ਤਿਹਾਰ : ਨਿੱਜੀ, ਦਫ਼ਤਰੀ ਤੇ ਸਮਾਜਕ ਗਤੀਵਿਧੀਆਂ ਨਾਲ ਸੰਬੰਧਤ

B.TECH. (FOOD TECHNOLOGY) SEMESTER-I
(Credit Based Evaluation & Grading System)

PBL-122: ਮੁੱਢਲੀ ਪੰਜਾਬੀ
(In lieu of Punjabi Compulsory)

Credits: 2-0-0
Time: 3 Hours **Max. Marks: 100**
Mid Semester Marks : 20
End Semester Marks : 80
Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

ਅੰਕ-ਵੰਡ ਅਤੇ ਪਰੀਖਿਅਕ ਲਈ ਹਦਾਇਤਾਂ

1. ਪ੍ਰਸ਼ਨ ਪੱਤਰ ਦੇ ਚਾਰ ਭਾਗ ਹੋਣਗੇ। ਹਰ ਭਾਗ ਵਿਚੋਂ ਦੋ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ।
2. ਵਿਦਿਆਰਥੀ ਨੇ ਕੁੱਲ ਪੰਜ ਪ੍ਰਸ਼ਨ ਕਰਨੇ ਹਨ। ਹਰ ਭਾਗ ਵਿਚੋਂ ਇਕ ਪ੍ਰਸ਼ਨ ਲਾਜ਼ਮੀ ਹੈ। ਪੰਜਵਾਂ ਪ੍ਰਸ਼ਨ ਕਿਸੇ ਵੀ ਭਾਗ ਵਿਚੋਂ ਕੀਤਾ ਜਾ ਸਕਦਾ ਹੈ।
3. ਹਰੇਕ ਪ੍ਰਸ਼ਨ ਦੇ ਬਰਾਬਰ ਅੰਕ ਹਨ।
4. ਪੇਪਰ ਸੈੱਟ ਕਰਨ ਵਾਲਾ ਜੇਕਰ ਚਾਹੇ ਤਾਂ ਪ੍ਰਸ਼ਨਾਂ ਦੀ ਵੰਡ ਅੱਗੋਂ ਵੱਧ ਤੋਂ ਵੱਧ ਚਾਰ ਉਪ-ਪ੍ਰਸ਼ਨਾਂ ਵਿਚ ਕਰ ਸਕਦਾ ਹੈ।

ਪਾਠ-ਕ੍ਰਮ

ਸੈਕਸ਼ਨ-ਏ

ਪੈਂਤੀ ਅੱਖਰੀ, ਅੱਖਰ ਕ੍ਰਮ,
ਮਾਤ੍ਰਾਵਾਂ (ਮੁਢਲੀ ਜਾਣ-ਪਛਾਣ)
ਲਗਾਖਰ (ਬਿੰਦੀ, ਟਿੱਪੀ, ਅੱਧਕ) : ਪਛਾਣ ਤੇ ਵਰਤੋਂ

ਸੈਕਸ਼ਨ-ਬੀ

ਪੰਜਾਬੀ ਸ਼ਬਦ ਬਣਤਰ : ਮੁੱਢਲੀ ਜਾਣ-ਪਛਾਣ
ਸਾਧਾਰਨ ਸ਼ਬਦ, ਸੰਯੁਕਤ ਸ਼ਬਦ, ਮਿਸ਼ਰਤ ਸ਼ਬਦ
ਮੂਲ ਸ਼ਬਦ, ਅਗੇਤਰ ਅਤੇ ਪਿਛੇਤਰ

ਸੈਕਸ਼ਨ-ਸੀ

ਸ਼ੁੱਧ ਅਸ਼ੁੱਧ : ਦਿੱਤੇ ਪੈਰ੍ਹੇ ਵਿਚੋਂ ਅਸ਼ੁੱਧ ਸ਼ਬਦ ਨੂੰ ਸ਼ੁੱਧ ਕਰਨਾ।
ਸਮਾਨਾਰਥਕ ਤੇ ਵਿਰੋਧਾਰਥਕ ਸ਼ਬਦ

ਸੈਕਸ਼ਨ-ਡੀ

ਹਫਤੇ ਦੇ ਸੱਤ ਦਿਨਾਂ ਦੇ ਨਾਂ, ਬਾਰ੍ਹਾਂ ਮਹੀਨਿਆਂ ਦੇ ਨਾਂ, ਰੁੱਤਾਂ ਦੇ ਨਾਮ, ਇਕ ਤੋਂ ਸੌ ਤੱਕ ਗਿਣਤੀ ਸ਼ਬਦਾਂ ਵਿੱਚ।

B.TECH. (FOOD TECHNOLOGY) SEMESTER-I
(Credit Based Evaluation & Grading System)

HSL-101 : Punjab History & Culture (1450-1716)
(Special paper in lieu of Punjabi Compulsory)
(For those students who are not domicile of Punjab)

Credits: 2-0-0
Time: 3 Hours **Max. Marks: 100**
Mid Semester Marks : 20
End Semester Marks : 80

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Section-A

1. Land and the People.
2. Bhakti Movement

Section-B

3. Life and Teaching of Guru Nanak Dev.
4. Contribution of Guru Angad Dev, Guru Arjun Dev ,Guru Amar Das and Guru Ram Das.

Section-C

5. Guru Hargobind.
6. Martyrdom of Guru Teg Bahadur

Section-D

7. Guru Gobind Singh and the Khalsa.
8. Banda Singh Bahadur: Conquests and Execution.

Suggested Reading

1. Kirpal Singh(ed.), *History and Culture of the Punjab, Part-ii, Punjabi University,* Patiala, 1990.
2. Fauja Singh (ed.), *History of Punjab, Vol, III Punjabi University, Patiala, 1987.*
3. J.S. Grewal, *The Sikhs of the Punjab, Cup, Cambridge, 1991.*
4. Khushwant Singh, *A History of the Sikhs,* Vol. I, OUP, New Delhi, 1990

B.TECH. (FOOD TECHNOLOGY) SEMESTER-I
(Credit Based Evaluation & Grading System)

SOA-101 : DRUG ABUSE: PROBLEM, MANAGEMENT AND PREVENTION
(COMPULSORY ID COURSE)
(Student can opt. this paper whether in 1st or 2nd semester)

PROBLEM OF DRUG ABUSE

Credit 3-0-0
Time: 3 Hours **Max. Marks: 100**
Mid Semester Marks : 20
End Semester Marks : 80

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Section – A

Meaning of Drug Abuse:

1) Meaning, Nature and Extent of Drug Abuse in India and Punjab.

2) Consequences of Drug Abuse for:

Individual	:	Education, Employment, Income.
Family	:	Violence.
Society	:	Crime.
Nation	:	Law and Order problem.

Section – B

Management of Drug Abuse:

(i) Medical Management: Medication for treatment and to reduce withdrawal effects.
(ii) Psychiatric Management: Counselling, Behavioural and Cognitive therapy.
(iii) Social Management: Family, Group therapy and Environmental Intervention.

Section – C

Prevention of Drug abuse:

(i) Role of family: Parent child relationship, Family support, Supervision, Shaping values, Active Scrutiny.
(ii) School: Counselling, Teacher as role-model. Parent-teacher-Health Professional Coordination, Random testing on students.

Section – D

Controlling Drug Abuse:

(i) Media: Restraint on advertisements of drugs, advertisements on bad effects of drugs, Publicity and media, Campaigns against drug abuse, Educational and awareness program

(ii) Legislation: NDPs act, Statutory warnings, Policing of Borders, Checking Supply/Smuggling of Drugs, Strict enforcement of laws, Time bound trials.

References:

1. Ahuja, Ram (2003), *Social Problems in India*, Rawat Publication, Jaipur.
2. Extent, Pattern and Trend of Drug Use in India, Ministry of Social Justice and Empowerment, Government of India, 2004.
3. Inciardi, J.A. 1981. *The Drug Crime Connection.* Beverly Hills: Sage Publications.
4. Kapoor. T. (1985) *Drug epidemic among Indian Youth*, New Delhi: Mittal Pub.
5. Kessel, Neil and Henry Walton. 1982, *Alcohalism. Harmond Worth:* Penguin Books.
6. Modi, Ishwar and Modi, Shalini (1997) *Drugs: Addiction and Prevention*, Jaipur: Rawat Publication.
7. National Household Survey of Alcohol and Drug abuse. (2003) New Delhi, Clinical Epidemiological Unit, All India Institute of Medical Sciences, 2004.
8. Ross Coomber and Others. 2013, *Key Concept in Drugs and Society.* New Delhi: Sage Publications.
9. Sain, Bhim 1991, *Drug Addiction Alcoholism,* Smoking obscenity New Delhi: Mittal Publications.
10. Sandhu, Ranvinder Singh, 2009, *Drug Addiction in Punjab*: A Sociological Study. Amritsar: Guru Nanak Dev University.
11. Singh, Chandra Paul 2000. *Alcohol and Dependence among Industrial Workers*: Delhi: Shipra.
12. Sussman, S and Ames, S.L. (2008). *Drug Abuse: Concepts, Prevention and Cessation,* Cambridge University Press.
13. Verma, P.S. 2017, *"Punjab's Drug Problem: Contours and Characterstics",* Economic and Political Weekly, Vol. LII, No. 3, P.P. 40-43.
14. World Drug Report 2016, United Nations office of Drug and Crime.
15. World Drug Report 2017, United Nations office of Drug and Crime.

B.TECH. (FOOD TECHNOLOGY) SEMESTER-I
(Credit Based Evaluation & Grading System)

FTP-121: MANUFACTURING PROCESSES

Credits: 0-0-2

Note: Students can use the Non-Programmable scientific calculator.

1. Machine Shop

Machine shop practice on Lathe, Milling machine and sharper simple jobs.

2. Carpentry Shop

Simple, jobs on sawing, ripping, planning and chieslling, wood turning, practice in carpentry shop.

3. Foundry Shop

Sand mixing and meld making of simple jobs practice in foundry shop.

4. Fitting Shop

Simple jobs on fitting, sawing, tapping and dieing practice in fitting shop.

5. Sheet Metal Shop

Cutting and joining of sheet metal jobs, simple cylindrical jobs, Practice in sheet metal shop.

6. Smithy Shop

Simple jobs practice in smithy shop.

7. Welding Shop

Fillet joint welding and corner joint welding – practice in welding shop.

8. Electrical shop

Single switch wiring for house hold and winding of coils practice in electrical shop.

B.TECH. (FOOD TECHNOLOGY) SEMESTER-I
(Credit Based Evaluation & Grading System)

FTP-122: PRINCIPLES OF FOOD PRESERVATION

Credits: 0-0-2

Note: Students can use the Non-Programmable scientific calculator.

1. Demonstration of different machinery used in food processing.
2. Canning operations.
3. Cut out analysis of canned product.
4. Preparation and analysis of syrups and brines.
5. Blanching of fruits and vegetables.
6. Chemical preservation of processed foods.
7. Evaluation of ingredients used in food processing.
8. Dehydration of food.
9. Refrigeration/cold storage of food.
10. Mold inhibitor in bakery products.
11. Fermented products: dairy, cereals, fruits and vegetables, meat.
12. Freezing of foods.
13. Intermediate moisture foods.

B.TECH. (FOOD TECHNOLOGY) SEMESTER-I
(Credit Based Evaluation & Grading System)

CYP-197: CHEMISTRY (PRACTICAL)

Credits: 0-0-2

1. Find the strength of KMnO4 solution.
2. Determine number of water molecules in Mohr salt by titration method.
3. Determine percentage of sodium carbonate in given sample of washing soda.
4. Determine percentage of sodium carbonate and sodium hydroxide in given sample of caustic soda.
5. Determination of total Hardness of Water.
6. Determine the percentage of Ca^{2+} and Mg^{2+} in the given sample of water.
7. To determine the molecular weight of a compound by Rast's micro method.
8. Determination of coefficient of viscosity of a given liquid by viscometer.
9. To determine the unknown composition of a given mixture of two liquids by viscosity method.
10. To find the mol. wt. of high polymer by using viscosity measurements.
11. Determination of surface tension of a given liquid by drop number method by stalagmometer.
12. To determine the critical micelle concentration of a soap (sodium laurate) by surface tension measurements.
13. To determine the distribution coefficient of I2 between CCl4 and water.
14. To determine refractive index of a liquid by Abbe's refractometer and hence the specific and molar refraction.
15. Determination of Chlorine in bleaching powder.

Recommended Books:

1. Findlay's Practical Physical Chemistry.
2. Advanced Practical Physical Chemistry by J.B. Jadav.
3. Quantitative Organic Analysis by Vogel.

B.TECH. (FOOD TECHNOLOGY) SEMESTER-II
(Credit Based Evaluation & Grading System)

FTL-152: THERMAL SCIENCE

Credits: 3-1-0

Time: 3 Hours **Max. Marks: 100**

Mid Semester Marks : 20
End Semester Marks : 80

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Note : Students can use the Non-Programmable scientific calculator.

SECTION-A

Basic Concepts: Thermodynamic system, boundary and surroundings; open, closed and isolated systems. State, property, process and cycles.Energy and its forms. Energy transfer across system boundaries; heat and work. Point and path functions. Pure substances and their phases. Zeroth Law, concept of thermal equilibrium and principle of thermometry. Ideal gas and characteristic gas equation. Analysis ofnon- flow and flow processes for an ideal gas under constant volume (Isochoric), constant pressure (isobaric), constant temperature (isothermal), adiabatic and polytropic conditions. Property changes, work done and heat exchange during these processes. Free expansion and throttling processes.

SECTION-B

First Law of Thermodynamics: Introduction to first law of thermodynamics, heat transfer, work. Internal energy, enthalpy and specific heat of ideal gases, solids and liquids. First law analysis of steady flow, applications of steady flow energy equation to engineering devices. Thermodynamic aspects of biological systems.

SECTION-C

Second Law of Thermodynamics: Limitations of first law. Kelvin Plank and Clausius statements of second law and their equivalence; their applications to a refrigerator, heat pump and heat engines. Reversible and irreversible processes, conditions for reversibility.

SECTION-D

Gas Power Cycles: Piston cylinder arrangement, philosophy of Otto and Diesel combustion cycle; their compression ratio, mean effective pressure, power output and efficiency; comparison between the two cycles.

Internal Combustion Engines: Classification and application, constructional and working details of two stroke and four stroke cycle engines.

Recommended Books:

1. Basic Engineering Thermodynamics by MW Zemansky and HC Vaness. McGraw Hill Book Co., Tokyo International Student Edition.
2. Applied Thermodynamics for Engineers and Technologists by TD Estop and A McConkey; Longman Scientific and Technical.
3. Heat Engineering by VP Vasandani and BS Kumar; Metropolitan Book Company Pvt. Ltd., 1, NetajiSubhashMarg, New Delhi.
4. Thermodynamics by JP Helman; McGraw Hill.
5. Engineering Thermodynamics by DB Spalding and DH Cole; ELBS and Edward Arnold Pub. Ltd., (Low Priced Ed.).
6. Introduction to Thermodynamics and Heat Transfer by Y.A. Cengel. McGraw Hill Companies, Inc.

B.TECH. (FOOD TECHNOLOGY) SEMESTER-II
(Credit Based Evaluation & Grading System)

FTL-153: FOOD CHEMISTRY

Credits: 3-0-0

Time: 3 Hours **Max. Marks: 100**

Mid Semester Marks : 20
End Semester Marks : 80

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Note : Students can use the Non-Programmable scientific calculator.

SECTION-A

Food Constituents: Proximate composition of foods, water in foods, Carbohydrate. Introduction, Definition nomenclature, classification. General properties of sugar (physical and chemical) identification of common mono saccharides, disaccharides and polysaccharides, determination of the amount of reducing and non – reducing sugars. Chemistry of starch, glycogen, cellulose, gums and mucilage, crude fibre. Physiological functions of characteristics.

SECTION-B

Protein: Physical and Chemical properties of amino acids, chromatographic separation of amino acids. Classification of proteins, amino acid sequence in proteins, pleated sheet and helix structure of protein tertiary structure and conformation of proteins. Physical and chemical properties of proteins, molecular weight of proteins and ultracentrifuge preparation and purification of proteins, protein denaturation, food proteins and their characteristics.

SECTION-C

Lipids: Classification of lipids, fatty acid, soap and detergent, essential fatty acids, fats and oils saponification number acid numbers iodine value, acetyl value, Reichart – Meissl number, Oxidative and hydrolytic rancidity, reversion, waxes phosphoglycerides, sphignolipids, non – saponifiable lipids, cholesterol, prostaglandins, lipis billayers, monolayers and micelles, structure of cell membrane.

SECTION-D

Natural Pigments and Flavouring Agents: Chlorophyll, carotonoids, anthocyannics, anthoxanthins, flavonoids, tannins. Natural flavour constituents.

Vitamins: Occurrence, chemistry, loss during storage, transport and processing of foods of provitamins. A and D, vitamin A, D, E, K, C, B1, B2, Niacin, pyridoxin, cyanocobalamine, folic acids. P – aminobenzoic acid, biotin, cholined.

Recommended Books:

1. Food Chemistry – Meyar.
2. Food Chemistry – Fenamma.
3. Physiological Chemistry – Lehnigar.
4. Fudamentals of Food Chemistry Laboratory- J. Kaur, Houghton Mifflin Company, New York (2006)

B.TECH. (FOOD TECHNOLOGY) SEMESTER-II
(Credit Based Evaluation & Grading System)

FTL-155: Applied Mathematics

Credits: 3-1-0

Time: 3 Hours **Max. Marks: 100**

Mid Semester Marks : 20
End Semester Marks : 80

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Note : Students can use the Non-Programmable scientific calculator.

SECTION-A

Differential Calculus: Partial derivatives, Euler's theorem for homogeneous functions, total derivative, change of variables, Lagrange's methods of undetermined multipliers.

SECTION-B

Exact differential equations, integrating factors, Linear differential equations, Cauchy's form, Legendre linear equations, simultaneous linear equations with constant coefficients, Total differential equations.

SECTION-C

Statistical Methods: A general introduction about the role of statistics in science and technology, Classification and tabulation of frequency distribution, Diagrametic and graphical representation of frequency distribution data, Measures of central tendency, dispersion, skewness and kurtosis. Correlation and regression analysis for bivariate data, partial and multiple correlations (for three variables only).

SECTION-D

Probability and Statistical Inference: An introduction to probablility and random variables, Binomial, Poisson and Normal probability distributions, their definitions and important applications in the industry. Random sample, Tests of hypothesis and level of significance. Chi-square, t and Z tests: their applications in industry.

Recommended Books

1. N.P. Bali: A text book of Engineering Mathematics.
2. B.S. Grewal: Higher Engineering Mathematics.
3. Fundamentals of Statistics by S.C. Gupta, Himalaya Publishing House.

B.TECH. (FOOD TECHNOLOGY) SEMESTER-II
(Credit Based Evaluation & Grading System)

ENL-151 :COMMUNICATIVE ENGLISH–II

Credits: 02 (L= 2, T=0, U=0)
Time: 3 Hours **Max. Marks: 100**
Mid Semester Marks : 20
End Semester Marks : 80

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Objective: To introduce students to the skills and strategies of reading and writing by identifying organizational patterns, spotting classification systems and understanding associations between ideas. This course will prepare students to read a variety of texts and also to communicate more effectively through writing. The course will also pay special attention to vocabulary building.

Prescribed Text books:
- *The Written Word* by Vandana R. Singh, Oxford University Press, New Delhi.
- *Making Connections: A Strategic Approach to Academic Reading* by Kenneth J. Pakenham, Second Edition.

SECTION–A
Practical question on Note Making, Summarizing and Abstracting as given in ***The Written Word*** by Vandana R. Singh

SECTION–B
Practical question on Paragraph writing as prescribed in ***The Written Word*** by Vandana R. Singh

SECTION–C
Theoretical questions based on ABC of Good Notes as prescribed in ***The Written Word*** by Vandana R. Singh.

Section C from ***Making Connections: A Strategic Approach to Academic Reading*** by Kenneth J. Pakenham, Second Edition.

SECTION–D
Practical question on Essay writing from ***The Written Word*** by Vandana R. Singh
Section 4 from ***Making Connections: A Strategic Approach to Academic Reading*** by Kenneth J. Pakenham, Second Edition.

B.TECH. (FOOD TECHNOLOGY) SEMESTER-II
(Credit Based Evaluation & Grading System)

PBL 131 : ਪੰਜਾਬੀ ਲਾਜ਼ਮੀ - II

Credit : 2-0-0
Time: 3 Hours **Max. Marks: 100**
Mid Semester Marks : 20
End Semester Marks : 80

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

ਅੰਕ-ਵੰਡ ਅਤੇ ਪਰੀਖਿਅਕ ਲਈ ਹਦਾਇਤਾਂ

1. ਪ੍ਰਸ਼ਨ ਪੱਤਰ ਦੇ ਚਾਰ ਭਾਗ ਹੋਣਗੇ। ਹਰ ਭਾਗ ਵਿਚੋਂ ਦੋ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ।
2. ਵਿਦਿਆਰਥੀ ਨੇ ਕੁੱਲ ਪੰਜ ਪ੍ਰਸ਼ਨ ਕਰਨੇ ਹਨ। ਹਰ ਭਾਗ ਵਿਚੋਂ ਇਕ ਪ੍ਰਸ਼ਨ ਲਾਜ਼ਮੀ ਹੈ। ਪੰਜਵਾਂ ਪ੍ਰਸ਼ਨ ਕਿਸੇ ਵੀ ਭਾਗ ਵਿਚੋਂ ਕੀਤਾ ਜਾ ਸਕਦਾ ਹੈ।
3. ਹਰੇਕ ਪ੍ਰਸ਼ਨ ਦੇ ਬਰਾਬਰ ਅੰਕ ਹਨ।
4. ਪੇਪਰ ਸੈੱਟ ਕਰਨ ਵਾਲਾ ਜੇਕਰ ਚਾਹੇ ਤਾਂ ਪ੍ਰਸ਼ਨਾਂ ਦੀ ਵੰਡ ਅੱਗੋਂ ਵੱਧ ਤੋਂ ਵੱਧ ਚਾਰ ਉਪ-ਪ੍ਰਸ਼ਨਾਂ ਵਿਚ ਕਰ ਸਕਦਾ ਹੈ।

ਸੈਕਸ਼ਨ-ਏ

I. **ਦੋ ਰੰਗ** (ਸੰਪਾ. ਹਰਜਿੰਦਰ ਸਿੰਘ ਢਿੱਲੋਂ, ਪ੍ਰੀਤਮ ਸਿੰਘ ਸਰਗੋਧੀਆ)
ਗੁਰੂ ਨਾਨਕ ਦੇਵ ਯੂਨੀਵਰਸਿਟੀ, ਅੰਮ੍ਰਿਤਸਰ ਵਿਚੋਂ ਹੇਠ ਲਿਖੇ ਕਹਾਣੀਕਾਰ :
(ੳ) ਨਾਨਕ ਸਿੰਘ : **ਭੂਆ**
(ਅ) ਗੁਰਮੁਖ ਸਿੰਘ ਮੁਸਾਫਿਰ : **ਬਾਗੀ ਦੀ ਧੀ**
(ਇ) ਸੰਤ ਸਿੰਘ ਸੇਖੋਂ : **ਪੇਮੀ ਦੇ ਨਿਆਣੇ**
(ਕਹਾਣੀਕਾਰ ਦਾ ਜੀਵਨ, ਕਹਾਣੀ ਸਾਰ, ਵਿਸ਼ਾ-ਵਸਤੂ, ਕਹਾਣੀ ਕਲਾ)

II. ਪੰਜਾਬੀ ਸ਼ਬਦ ਬਣਤਰ : ਧਾਤੂ/ਮੂਲ, ਵਧੇਤਰ (ਅਗੇਤਰ, ਪਿਛੇਤਰ, ਵਿਉਂਤਪਤ ਅਤੇ ਰੁਪਾਂਤਰੀ), ਸਮਾਸ।

ਸੈਕਸ਼ਨ-ਬੀ

I. **ਦੋ ਰੰਗ** (ਸੰਪਾ. ਹਰਜਿੰਦਰ ਸਿੰਘ ਢਿੱਲੋਂ, ਪ੍ਰੀਤਮ ਸਿੰਘ ਸਰਗੋਧੀਆ)
ਗੁਰੂ ਨਾਨਕ ਦੇਵ ਯੂਨੀਵਰਸਿਟੀ, ਅੰਮ੍ਰਿਤਸਰ ਵਿਚੋਂ ਹੇਠ ਲਿਖੇ ਕਹਾਣੀਕਾਰ :
(ੳ) ਸੁਜਾਨ ਸਿੰਘ : **ਬਾਗਾਂ ਦਾ ਰਾਖਾ**
(ਅ) ਕਰਤਾਰ ਸਿੰਘ ਦੁੱਗਲ : **ਤੈਂ ਕੀ ਦਰਦ ਨਾ ਆਇਆ**
(ਕਹਾਣੀਕਾਰ ਦਾ ਜੀਵਨ, ਕਹਾਣੀ ਸਾਰ, ਵਿਸ਼ਾ-ਵਸਤੂ, ਕਹਾਣੀ ਕਲਾ)

II. ਪੈਰ੍ਹਾ ਰਚਨਾ : ਕਲਾਸ ਵਿਚ 10 ਵਿਸ਼ਿਆਂ (ਸਭਿਆਚਾਰ, ਧਾਰਮਕ ਅਤੇ ਰਾਜਨੀਤਕ) 'ਤੇ ਪੈਰ੍ਹਾ ਰਚਨਾ ਦੇ ਅਭਿਆਸ ਕਰਵਾਉਣੇ।

ਸੈਕਸ਼ਨ-ਸੀ

I. **ਦੋ ਰੰਗ** (ਸੰਪਾ. ਹਰਜਿੰਦਰ ਸਿੰਘ ਢਿੱਲੋਂ, ਪ੍ਰੀਤਮ ਸਿੰਘ ਸਰਗੋਧੀਆ)
ਗੁਰੂ ਨਾਨਕ ਦੇਵ ਯੂਨੀਵਰਸਿਟੀ, ਅੰਮ੍ਰਿਤਸਰ ਵਿਚੋਂ ਹੇਠ ਲਿਖੇ ਕਹਾਣੀਕਾਰ :
(ੳ) ਕੁਲਵੰਤ ਸਿੰਘ ਵਿਰਕ : **ਧਰਤੀ ਹੇਠਲਾ ਬੌਲਦ**
(ਅ) ਨਵਤੇਜ ਸਿੰਘ : **ਦੂਜੀ ਵਾਰ ਜੇਬ ਕੱਟੀ ਗਈ**
(ਇ) ਪ੍ਰੇਮ ਪ੍ਰਕਾਸ਼ : **ਲੱਛਮੀ**
(ਕਹਾਣੀਕਾਰ ਦਾ ਜੀਵਨ, ਕਹਾਣੀ ਸਾਰ, ਵਿਸ਼ਾ-ਵਸਤੂ, ਕਹਾਣੀ ਕਲਾ)

II. ਮੁਹਾਵਰੇ ਤੇ ਅਖਾਣ (ਅਖਾਣ ਤੇ ਮੁਹਾਵਰਾ ਕੋਸ਼ ਵਿਚ) 200 ਮੁਹਾਵਰਿਆਂ ਅਤੇ 100 ਅਖਾਣਾਂ ਨੂੰ ਵਾਕਾਂ ਵਿਚ ਵਰਤਣ ਦੇ ਅਭਿਆਸ ਕਰਵਾਉਣੇ (ਕਲਾਸ ਵਿਚ ਤੇ ਘਰ ਲਈ)।

ਸੈਕਸ਼ਨ-ਡੀ

I. **ਦੋ ਰੰਗ** (ਸੰਪਾ. ਹਰਜਿੰਦਰ ਸਿੰਘ ਢਿੱਲੋਂ, ਪ੍ਰੀਤਮ ਸਿੰਘ ਸਰਗੋਧੀਆ)
ਗੁਰੂ ਨਾਨਕ ਦੇਵ ਯੂਨੀਵਰਸਿਟੀ, ਅੰਮ੍ਰਿਤਸਰ ਵਿਚੋਂ ਹੇਠ ਲਿਖੇ ਕਹਾਣੀਕਾਰ :
(ੳ) ਅਜੀਤ ਕੌਰ : **ਬੁੱਤ ਸ਼ਿਕਨ**
(ਅ) ਦਲੀਪ ਕੌਰ ਟਿਵਾਣਾ : **ਬੱਸ ਕੰਡਕਟਰ**
(ਕਹਾਣੀਕਾਰ ਦਾ ਜੀਵਨ, ਕਹਾਣੀ ਸਾਰ, ਵਿਸ਼ਾ-ਵਸਤੂ, ਕਹਾਣੀ ਕਲਾ)

II. ਸ਼ਬਦ ਸ਼੍ਰੇਣੀਆਂ : ਨਾਂਵ, ਪੜਨਾਂਵ, ਵਿਸ਼ੇਸ਼ਣ, ਕਿਰਿਆ, ਕਿਰਿਆ ਵਿਸ਼ੇਸ਼ਣ, ਸੰਬੰਧਕ

B.TECH. (FOOD TECHNOLOGY) SEMESTER-II
(Credit Based Evaluation & Grading System)

PBL-132: ਮੁੱਢਲੀ ਪੰਜਾਬੀ

(In lieu of Punjabi Compulsory)

Credits: 2-0-0

Time: 3 Hours **Max. Marks: 100**

Mid Semester Marks : 20

End Semester Marks : 80

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

ਅੰਕ-ਵੰਡ ਅਤੇ ਪਰੀਖਿਅਕ ਲਈ ਹਦਾਇਤਾਂ

1. ਪ੍ਰਸ਼ਨ ਪੱਤਰ ਦੇ ਚਾਰ ਭਾਗ ਹੋਣਗੇ। ਹਰ ਭਾਗ ਵਿਚੋਂ ਦੋ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ।
2. ਵਿਦਿਆਰਥੀ ਨੇ ਕੁੱਲ ਪੰਜ ਪ੍ਰਸ਼ਨ ਕਰਨੇ ਹਨ। ਹਰ ਭਾਗ ਵਿਚੋਂ ਇਕ ਪ੍ਰਸ਼ਨ ਲਾਜ਼ਮੀ ਹੈ। ਪੰਜਵਾਂ ਪ੍ਰਸ਼ਨ ਕਿਸੇ ਵੀ ਭਾਗ ਵਿਚੋਂ ਕੀਤਾ ਜਾ ਸਕਦਾ ਹੈ।
3. ਹਰੇਕ ਪ੍ਰਸ਼ਨ ਦੇ ਬਰਾਬਰ ਅੰਕ ਹਨ।
4. ਪੇਪਰ ਸੈੱਟ ਕਰਨ ਵਾਲਾ ਜੇਕਰ ਚਾਹੇ ਤਾਂ ਪ੍ਰਸ਼ਨਾਂ ਦੀ ਵੰਡ ਅੱਗੋਂ ਵੱਧ ਤੋਂ ਵੱਧ ਚਾਰ ਉਪ-ਪ੍ਰਸ਼ਨਾਂ ਵਿਚ ਕਰ ਸਕਦਾ ਹੈ।

ਪਾਠ-ਕ੍ਰਮ

ਸੈਕਸ਼ਨ-ਏ

ਸਬਦ ਸ਼੍ਰੇਣੀਆ : ਪਛਾਣ ਅਤ ਵਰਤ

(ਨਾਂਵ, ਪੜਨਾਂਵ, ਵਿਸ਼ੇਸ਼ਣ, ਕਿਰਿਆ, ਕਿਰਿਆ ਵਿਸ਼ੇਸ਼ਣ)

ਸੈਕਸ਼ਨ-ਬੀ

ਨਿਤ ਵਰਤ ਦਾ ਪਜਾਬੀ ਸ਼ਬਦਾਵਲੀ : ਬਾਜ਼ਾਰ, ਵਪਾਰ, ਰਿਸ਼ਤੇ-ਨਾਤੇ, ਖੇਤੀ ਅਤੇ ਹੋਰ ਧੰਦਿਆਂ ਨਾਲ ਸਬੰਧਤ ।

ਸੈਕਸ਼ਨ-ਸੀ

ਪੰਜਾਬੀ ਵਾਕ-ਬਣਤਰ

ਸਾਧਾਰਨ-ਵਾਕ (ਪਛਾਣ ਅਤ ਵਰਤ)

ਸੰਯੁਕਤ-ਵਾਕ (ਪਛਾਣ ਅਤੇ ਵਰਤੋਂ)

ਮਿਸ਼ਰਤ-ਵਾਕ (ਪਛਾਣ ਅਤੇ ਵਰਤੋਂ)

ਸੈਕਸ਼ਨ-ਡੀ

ਪਰ੍ਹਾ ਰਚਨਾ

ਸੰਖੇਪ ਰਚਨਾ

B.TECH. (FOOD TECHNOLOGY) SEMESTER-II
(Credit Based Evaluation & Grading System)

HSL-102 : Punjab History & Culture (1717-1947)
(Special paper in lieu of Punjabi Compulsory)
(For those students who are not domicile of Punjab)

Credits: 2-0-0
Time: 3 Hours **Max. Marks: 100**
Mid Semester Marks : 20
End Semester Marks : 80

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Section-A

1. Sikh Struggle for Sovereignty.
2. Ranjit Singh : Conquests, Administration and the Anglo-Sikh Relations.

Section-B

3. Anglo-Sikh Wars and the Annexation.
4. The Punjab under the British: New Administration, Education and social Change.

Section-C

5. Economic Changes: Agricultural
6. Socio-Religious Reform Movements.

Section-D

7. Role of Punjab in the Freedom Struggle.
8. Fairs and Festivals.

Suggested Reading

1. Kirpal Singh (ed.), *History and Culture of the Punjab,* Part-II, Punjabi University, Patiala, 1990.
2. Fauja Singh (ed.), *History of Punjab,* Vol, III, Punjabi University, Patiala, 1987.
3. J.S. Grewal, *The Sikhs of the Punjab, Cup, Cambridge, 1991.*
4. Khushwant Singh, *A History of the Sikhs,* Vol. I, OUP, New Delhi, 1990

B.TECH. (FOOD TECHNOLOGY) SEMESTER-II
(Credit Based Evaluation & Grading System)

SOA-101 : DRUG ABUSE: PROBLEM, MANAGEMENT AND PREVENTION
(COMPULSORY ID COURSE)
(Student can opt. this paper whether in 1st or 2nd semester)

PROBLEM OF DRUG ABUSE

Credit 3-0-0
Time: 3 Hours **Max. Marks: 100**
Mid Semester Marks : 20
End Semester Marks : 80

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Section – A

Meaning of Drug Abuse:

3) Meaning, Nature and Extent of Drug Abuse in India and Punjab.

4) Consequences of Drug Abuse for:

Individual	:	Education, Employment, Income.
Family	:	Violence.
Society	:	Crime.
Nation	:	Law and Order problem.

Section – B

Management of Drug Abuse:

(iv) Medical Management: Medication for treatment and to reduce withdrawal effects.
(v) Psychiatric Management: Counselling, Behavioural and Cognitive therapy.
(vi) Social Management: Family, Group therapy and Environmental Intervention.

Section – C

Prevention of Drug abuse:

(iii) Role of family: Parent child relationship, Family support, Supervision, Shaping values, Active Scrutiny.
(iv) School: Counselling, Teacher as role-model. Parent-teacher-Health Professional Coordination, Random testing on students.

Section – D

Controlling Drug Abuse:

(iii) Media: Restraint on advertisements of drugs, advertisements on bad effects of drugs, Publicity and media, Campaigns against drug abuse, Educational and awareness program

(iv) Legislation: NDPs act, Statutory warnings, Policing of Borders, Checking Supply/Smuggling of Drugs, Strict enforcement of laws, Time bound trials.

References:

1. Ahuja, Ram (2003), *Social Problems in India*, Rawat Publication, Jaipur.
2. Extent, Pattern and Trend of Drug Use in India, Ministry of Social Justice and Empowerment, Government of India, 2004.
3. Inciardi, J.A. 1981. *The Drug Crime Connection.* Beverly Hills: Sage Publications.
4. Kapoor. T. (1985) *Drug epidemic among Indian Youth*, New Delhi: Mittal Pub.
5. Kessel, Neil and Henry Walton. 1982, *Alcohalism. Harmond Worth:* Penguin Books.
6. Modi, Ishwar and Modi, Shalini (1997) *Drugs: Addiction and Prevention*, Jaipur: Rawat Publication.
7. National Household Survey of Alcohol and Drug abuse. (2003) New Delhi, Clinical Epidemiological Unit, All India Institute of Medical Sciences, 2004.
8. Ross Coomber and Others. 2013, *Key Concept in Drugs and Society.* New Delhi: Sage Publications.
9. Sain, Bhim 1991, *Drug Addiction Alcoholism,* Smoking obscenity New Delhi: Mittal Publications.
10. Sandhu, Ranvinder Singh, 2009, *Drug Addiction in Punjab*: A Sociological Study. Amritsar: Guru Nanak Dev University.
11. Singh, Chandra Paul 2000. *Alcohol and Dependence among Industrial Workers*: Delhi: Shipra.
12. Sussman, S and Ames, S.L. (2008). *Drug Abuse: Concepts, Prevention and Cessation,* Cambridge University Press.
13. Verma, P.S. 2017, *"Punjab's Drug Problem: Contours and Characterstics",* Economic and Political Weekly, Vol. LII, No. 3, P.P. 40-43.
14. World Drug Report 2016, United Nations office of Drug and Crime.
15. World Drug Report 2017, United Nations office of Drug and Crime.

B.TECH. (FOOD TECHNOLOGY) SEMESTER-II
(Credit Based Evaluation & Grading System)

FTP-172: FOOD CHEMISTRY

Credits: 0-0-2
Max. Marks : 100

Note: Students can use the Non-Programmable scientific calculator.

1. Preparation of sample for analysis.

2. Determination of acidity/ pH in food.

3. Preparation of standard solutions.

4. Determination of moisture, ash, lipids, protein.

5. Crude fiber, reducing and non – reducing sugar.

6. Estimation of minerals such Ca, Mg, K, Fe, Cu, etc.

7. Estimation of ascorbic acid.

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B.TECH. (FOOD TECHNOLOGY) SEMESTER-II
(Credit Based Evaluation & Grading System)

FTP-173: ENGINEERING GRAPHICS AND DRAFTING

Credits: 0-0-3
Max. Marks : 100

Note: Students can use the Non-Programmable scientific calculator.

Drawing Practice based on problems on topic covered in Engineering Graphics.

FTL–201: BASIC FOOD ENGINEERING

Credits: 3-1-0

Time: 3 Hours **Max. Marks: 100**
Mid Semester Marks : 20
End Semester Marks : 80

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.
Note : Students can use the Non-Programmable scientific calculator

Section -A

1. **Dimensions and engineering units:** Definition of terms, base, derived and supplementary units, different systems of measurement, dimensional equations, conversion of units using dimensional equations.
2. **Properties of fluids and solids:** State of a system, definition of extensive and intensive properties, density, concentration, moisture content, pressure, temperature, viscosity, enthalpy, equation of state and perfect gas law, phase diagram of water.

Section -B

3. **Material balances:** Principles of material and component balance, steady state and unsteady state processes. Material balance problems in drying, evaporation, dilution, mixing, separation and combined processes with and without recycle.

Section -C

4. **Energy balance:** Principles of energy conversion and conservation, energy balance problems with and without material balance. Typical industrial problems of combined material and energy balances.

Section -D

5. **Preservation processes:** Microbial survivor curves, thermal death time, spoilage probability, general method for process calculations: applications to pasteurization, sterilization, aseptic processing and packaging.

Recommended Books:

1. Fundamentals of Food Engineering by R. C. Verma and S. K. Jain, Himanshu Publications, Udaipur, 2002.
2. Fundamentals of Food Process Engineering by R.T. Toledo, CBS Publishers and Distributors, New Delhi, 2000.
3. Introduction to Food Engineering by R.P. Singh and D.R. Heldman, Academic Press, London, 2004.
4. Food Processing Technology Principles and Practices by P.J. Fellows, Woodhead Publishing Limited, Cambridge, 2005.

FTL–202: BASIC MICROBIOLOGY

Credits: 3-0-0

Time: 3 Hours **Max. Marks: 100**

Mid Semester Marks : 20
End Semester Marks : 80

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Note : Students can use the Non-Programmable scientific calculator

Section-A

Microbiology and its scope.
Microscopy, classification.
Pure cultures and their characteristics.
Maintenance of cultures, culture techniques, enumeration techniques.

Section-B

Morphology and physiology of bacteria, yeast, molds and algae growth.
Nutrition and reproduction, isolation and identification of micro organisms.
Microbial ecology.
Microbial interactions.

Section-C

Physical and chemical methods of control of micro organisms.
Virus, common pathogenic organisms, immune response.
Antigen - antibody interaction and antibodies.

Section-D

Incidences of micro-organisms in soil, water, air, food and sewage.
Food spoilage organisms.
Food borne infections and poisoNing organisms, sanitation and Hygiene.

Recommended Books:

1. Bacteriology - A.J. Salley, 2007.
2. Microbiology - Palczer, Chan and Creig.
3. Modern Food Microbiology – Jay, 2000.
4. Basic Food Microbiology – Banwart, 1981.
5. Food Microbiology - Frazier and Westhoff, 2008.

FTL–203: FOOD HYGIENE AND SANITATION

Credits: 3-0-0
Time: 3 Hours **Max. Marks: 100**
Mid Semester Marks : 20
End Semester Marks : 80

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.
Note : Students can use the Non-Programmable scientific calculator

Section-A

General principles of food hygiene. Personal hygiene. Food handling habits, water sources and impurities in water supply and treatment. Sanitation facilities and procedures in food plant operation.

Section-B

Good Manufacturing Practices. Good Laboraties Practices. Quality Circles and Quality Culture Concept

Section-C

Quality standards for potable water supply. Microbial standards for foods. Sanitation in food service institution.

Section-D

Method of cleaNing and disinfection. Detergents and Sanitizer. Recommended International code of hygiene for food products.

Recommended Books:

1. Guide to improving Food Hygiene - Ed Gaston and Tiffney.
2. Practical Food Microbiology and Technology (2nd edition) – J. Mountney and W.A. Gould, 1988.
3. Food PoisoNing and Food Hygiene - Betty C. Hobbs (3rd Edition).

FTL-206: SUGAR PROCESSING AND REFINING

Credits: 3-0-0

Time: 3 Hours **Max. Marks: 100**
Mid Semester Marks : 20
End Semester Marks : 80

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.
Note : Students can use the Non-Programmable scientific calculator

Section-A

1. Juice extraction, maceration and imbibitions, mill sanitation. Color and coloured Nin-sugars, removal of color by precipitates and adsorbents. Composition of cane and beet juice- their differences, principles of cane juice clarification, different processes of cane juice clarification.

2. Ion exchange process, role of Ion exchange resins, Application of Ion exchange, different techniques of Ion exchange, regeneration of resins, plant requirement-operation and economics.

3. Settling tank, and different types of clarifier. Plate and frame type filter presses, continuous filter. Juice heaters, heat exchangers, use of vapours and steam economy.

4. Evaporation-study of different types of evaporators multiple effect, vapour cell/preevaporators-Vapour bleeding systems, condenser barometric, multijet.

Section-B

5. Syrup: Syrup brix and pH and their role in pan boiling, treatment/clarification of syrup.
6. Classien's theory of pan boiling. Concept or Massecuite boiling, different types of massecuite boiling i.e., 2M/C boiling, 3M/C boiling, 4 M/C boiling. Ideas of purities of different intermediate massecuite and molasses. False grain and conglomerates formation and their removal.
7. Concept of crystallization of sugar in crystallizer, factors affecting the rate of crystallization, Air cooled and water cooled crystallizers.
8. Theory of centrifugals, different types of drive, gravity factor numerical based upon G.F. Batch type and continuous type centrifugals.

Section-C

9. Sugar Driers: Types of sugar driers, Grass hopper type drier, its working, drying and cooling of sugar, Grading of sugar.

10. Storage of Sugar, Quality of Sugar, Storage of Molasses, Precaution to be taken during storage

Section-D

11. Sugar Beet: Beet Storage: Beet silos or piles, equipment used, type of pile covering, factors affecting piling losses, reclaiming, fluming operation.

12. Primary Operation and Equipment. Diffusion: Definition and explanation, theory of diffusion, factor affecting diffusion.

13. RefiNing Process and Operations: Affination, phosphatation for turbidity and color removal, carbonation for turbidity and color removal, ion-exchange resin processes for color and ash removal.

Recommended Books:

1. Manufacture and refiNing of raw cane sugar by Baikow, V.E., (1982- IInd Edition), Elsevier Publishing Co.

2. Handbook of Cane Sugar Technology by Mathur, R.B.L, (1986- IInd Edition), Oxford and IBH Publishing Co.

3. Principles of Sugar Technology Vol. I by Pieter Honig, (1953-Ist Edition), Elsevier Publishing Co.

4. Principles of Sugar Technology Vol. II by Pieter Honig, (1959-Ist Edition), Elsevier Publishing Co.

5. Handbook of Cane Sugar Engineering by E. Hugot. (1986-IIIrd Edition), Elsevier Science Publishers.

ESL-220 : ENVIRONMENTAL STUDIES (COMPULSORY)

Credits: 4-0-0

Teaching Methodologies
The Core Module Syllabus for Environmental Studies includes class room teaching and field work. The syllabus is divided into 8 Units [Unit-1 to Unit-VII] covering 45 lectures + 5 hours for field work [Unit-VIII]. The first 7 Units will cover 45 lectures which are class room based to enhance knowledge skills and attitude to environment. Unit-VIII comprises of 5 hours field work to be submitted by each candidate to the Teacher in-charge for evaluation latest by 15 December, 2019.

Exam Pattern: **End Semester Examination- 75 marks**
Project Report/Field Study- 25 marks [based on submitted report]
Total Marks- 100

The structure of the question paper being:

Part-A, Short answer pattern with inbuilt choice – **25 marks**
Attempt any five questions out of seven distributed equally from Unit-1 to Unit-VII.
Each question carries 5 marks. Answer to each question should not exceed 2 pages.

Part-B, Essay type with inbuilt choice – **50 marks**
Attempt any five questions out of eight distributed equally from Unit-1 to Unit-VII. Each question carries 10 marks. Answer to each question should not exceed 5 pages.

Project Report / Internal Assessment:

Part-C, Field work – **25 marks [Field work equal to 5 lecture hours]**
The candidate will submit a hand written field work report showing photographs, sketches, observations, perspective of any topic related to Environment or Ecosystem. The exhaustive list for project report/area of study are given just for reference:

1. Visit to a local area to document environmental assets: River / Forest/ Grassland / Hill / Mountain / Water body / Pond / Lake / Solid Waste Disposal / Water Treatment Plant / Wastewater Treatment Facility etc.
2. Visit to a local polluted site – Urban / Rural / Industrial / Agricultural
3. Study of common plants, insects, birds
4. Study of tree in your areas with their botanical names and soil types
5. Study of birds and their nesting habits
6. Study of local pond in terms of wastewater inflow and water quality
7. Study of industrial units in your area. Name of industry, type of industry, Size (Large, Medium or small scale)
8. Study of common disease in the village and basic data from community health centre
9. Adopt any five young plants and photograph its growth
10. Analyze the Total dissolved solids of ground water samples in your area.
11. Study of Particulate Matter ($PM_{2.5}$ or PM_{10}) data from Sameer website. Download from Play store.
12. Perspective on any field on Environmental Studies with secondary data taken from Central Pollution Control Board, State Pollution Control Board, State Science & Technology Council etc.

Unit-I

The multidisciplinary nature of environmental studies

Definition, scope and importance, Need for public awareness

(2 lectures)

Unit-II

Natural Resources: Renewable and non-renewable resources:

Natural resources and associated problems.

(a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.

(b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

(c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

(d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

(e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies.

(f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

- Role of an individual in conservation of natural resources.
- Equitable use of resources for sustainable lifestyles.

(8 Lectures)

Unit-III

Ecosystems

- Concept of an ecosystem
- Structure and function of an ecosystem
- Producers, consumers and decomposers
- Energy flow in the ecosystem
- Ecological succession
- Food chains, food webs and ecological pyramids
- Introduction, types, characteristic features, structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, ocean estuaries)

(6 Lectures)

Unit-IV

Biodiversity and its conservation

- Introduction – Definition: genetic, 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 levels
- India as a mega-diversity nation
- Hot-spots of biodiversity
- Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts
- Endangered and endemic species of India
- Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity

(8 Lectures)

Unit-V

Environmental Pollution

Definition

- Causes, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear pollution
- 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, earthquake, cyclone and landslides

(8 Lectures)

Unit-VI

Social Issues and the Environment

- From unsustainable to sustainable development
- Urban problems and related to energy
- Water conservation, rain water harvesting, watershed management
- Resettlement and rehabilitation of people; its problems and concerns. Case studies.
- Environmental ethics: Issues and possible solutions
- Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
- Wasteland reclamation
- Consumerism and waste products
- Environmental Protection Act, 1986
- Air (Prevention and Control of Pollution) Act, 1981
- Water (Prevention and control of Pollution) Act, 1974
- Wildlife Protection Act
- Forest Conservation Act
- Issues involved in enforcement of environmental legislation
- Public awareness

(7 Lectures)

Unit-VII

Human Population and the Environment

- Population growth, variation among nations
- Population explosion – Family Welfare Programmes
- Environment and human health
- Human Rights
- Value Education
- HIV / AIDS
- Women and Child Welfare
- Role of Information Technology in Environment and Human Health
- Case Studies

(6 Lectures)

Unit-VIII

Field Work

- Visit to a local area to document environmental assets river/forest/grassland/hill/mountain
- Visit to a local polluted site – Urban / Rural / Industrial / Agricultural
- Study of common plants, insects, birds
- Study of simple ecosystems-pond, river, hill slopes, etc

(Field work equal to 5 lecture hours)

References:

1. Bharucha, E. 2005. Textbook of Environmental Studies, Universities Press, Hyderabad.
2. Down to Earth, Centre for Science and Environment, New Delhi.
3. Heywood, V.H. & Waston, R.T. 1995. Global Biodiversity Assessment, Cambridge House, Delhi.
4. Joseph, K. & Nagendran, R. 2004. Essentials of Environmental Studies, Pearson Education (Singapore) Pte. Ltd., Delhi.
5. Kaushik, A. & Kaushik, C.P. 2004. Perspective in Environmental Studies, New Age International (P) Ltd, New Delhi.
6. Rajagopalan, R. 2011. Environmental Studies from Crisis to Cure. Oxford University Press, New Delhi.
7. Sharma, J. P., Sharma. N.K. & Yadav, N.S. 2005. Comprehensive Environmental Studies, Laxmi Publications, New Delhi.
8. Sharma, P. D. 2009. Ecology and Environment, Rastogi Publications, Meerut.
9. State of India's Environment 2018 by Centre for Sciences and Environment, New Delhi
10. Subramanian, V. 2002. A Text Book in Environmental Sciences, Narosa Publishing House, New Delhi.

ECL-210: BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

Credits: 3-1-0

Time: 3 Hours **Max. Marks: 100**
Mid Semester Marks : 20
End Semester Marks : 80

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.
Note : Students can use the Non-Programmable scientific calculator

Section-A

1. **Electric Current and Ohm's Law**
   Ohm's Law, Resistance in Series, Resistance in Parallel, Division of current in Parallel circuits, Equivalent Resistance, Numericals.

2. **Network Theorems:** Kirchhof's laws, TheveNin Theorem, Work, Power and Energy effect of electric current, Joule's law of Electric heating Numericals.

3. **Electromagnetic Induction and A.C. Fundamentals:**
   Faraday's law of Electromagnetic Induction, Generation of Alternating voltage, current, simple wave form, cycle Time period, frequency, Amplitude, phase, phase difference.

Section-B

4. **Transformer :** Working principle of a Transformer construction, Elementary Theory of an ideal Transformer E.M.F. Equation of a Transformer Voltage Transformation Ratio Efficiency of a Transformer

5. **Induction motor:** Classification of A.C. Motors General Principle, construction, Relation between Torque and Slip, control of A.C. motors.

Section-C

6. **D.C. Generators and D.C. Motors:** Generator Principle, Construction and working of Generator, Motor Principle, Comparison of Generator and Motor action, comparison of shunt, series Motors, losses and Efficiency Powerstages, Speed control of D.C. Motors.

7. **Electronic Devices:** Semiconductors, Bipolar Junction Transistor., transistor circuit configuration transistor characteristics, Field Effect Transistor.

Section-D

8. Amplifiers, Classification, Concept of feedback amplifiers.

9. Special Diodes, Zener Diode, Voltage, Regulation.

10. Introduction to DSO (Digital Storage Oscilliscope) and CRO (Cathode Ray Oscilloscope), Electronic versus electrical Instruments.

Recommended Books:

1. Principle of Electrical Engg. by Vincent Del Tora.
2. Basic Electronics by G.K. Mittal, 2003.
3. Electronic Principles by A.P. Malvino, 1999.

B.TECH. (FOOD TECHNOLOGY) SEMESTER-III
(Credit Based Evaluation & Grading System)

FTP-221: BASIC MICROBIOLOGY

Credits: 0-0-2

Note: Students can use the Non-Programmable scientific calculator.

1. Introduction to Microscopic techniques in the identification of Microorganisms

2. Specific Staining techniques.

3. Isolation of pure cultures of bacteria, yeasts, and moulds.

4. Identification on the basis of Morphology and Physiology.

5. Preparation of nutrient broth.

6. Preparation of media with nutrient agar, PDA and special media.

7. Measurement of efficacy of anti Microbial agents.

B.TECH. (FOOD TECHNOLOGY) SEMESTER-III
(Credit Based Evaluation & Grading System)

FTP-224: SUGAR PROCESSING AND REFINING

Credits: 0-0-2

1. Determination of total soluble solids by:
    a) Refractometer.
    b) Brix Spindle
    c) Drying Method.
2. Determination of Pol and calculation of purities juices, syrup, massecuites and other boiling house products.
3. Determination of ash (%) in juices, syrup, massecuites, molasses etc.
    a) Carbonated Ash.
    b) Sulphated Ash.
4. Determination of sucrose and gravity purity of juice, syrup, massecuite and other boiling house products by double polarization using Jackson and Gill's method
5. Determination of sucrose and gravity purity of molasses and boiling house products by Fehling's solution method
6. Determination of reducing sugar in Juices, syrups, massecuites, molasses, etc. by Lane and Eynon method.
7. Determination of phosphate content in juice by Ammonium Molybdate method
8. Determination of SO_2 content in juices and syrup.
9. Analysis of lime for available CaO by Phenol Method.
10. Analysis of lime for available CaO by Sucrose Method.
11. Analysis of Commercial Phosphoric acid.
12. Analysis of Blankit (Sodium Hydrosulphite)
13. Visit to the sugar complex.

Recommended Books:

1. System of Technology Control for Cane Sugar Factories in India, Ist edition, N.C.Varma.
2. Sugar Analysis by Zerban and Brown IIIrd Edition published by John Wiley and Sons.
3. Handbook of Cane Sugar Technology, IInd Edition, R.B.L. Mathur.

B.TECH. (FOOD TECHNOLOGY) SEMESTER-IV
(Credit Based Evaluation & Grading System)

FTL-252: CEREALS AND PULSES TECHNOLOGY

Credits: 3-1-0

Time: 3 Hours **Max. Marks: 100**

Mid Semester Marks : 20
End Semester Marks : 80

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.
Note : Students can use the Non-Programmable scientific calculator

Section-A

Rice: Production, composition, structure and characteristics of varieties, classification and properties, milling, criteria of rice quality and parboiling of paddy, processed foods from rice, rice milling, Machinery and modern rice mill, stabilization of rice bran, by products of rice milling and their uses specifically rice bran oil.

Section-B

Wheat: Production, composition, structure and characteristics of varieties, classification and properties, criteria of g r a i n and flour quality, wheat conditioNing and milling, air classification of flour, Flour and its treatment, rheology and chemistry of dough, physical dough testing instruments. Technology of baking bread, biscuit, cookies, cakes, bakery ingredients and their functions. Durum wheat and pasta products like macaroni, noodles and sphagatti. Processing of wheat flakes.

Section-C

Corn: Production, corn type, composition, structure and characteristics of varieties, dry and wet milling of corn, composition and properties of corn starch, corn based ready- to-eat breakfast cereals, alkaline cooked products, tortillas, nixtamalized corn flours, snacks from corn, tortilla chips, extruded snacks, Corn oil – composition, processing and utilization, corn starch modification and uses, corn sweeteners such as glucose syrup, high fructose corn syrups, dextrose and maltodextrin.

Section-D

Barley: Production, structure, composition, milling, malt production, and malting chemistry and technology.
Pulses: Pulse Production and consumption trend, minor and major constitutents, antinutritional factors. Creteria of pulse quality, production of protein isolates, protein concentrates, functional properties of protein isolates and concentrates, pulse products.

Recommended Books:

1. Technology of Cereals. by N.L. Kent, 1994

2. Wheat Chemistry and Technology- Pomerenz.

3. Corn chemistry and Technology by Tanley A Watson and Paul E. Ramstad.

4. Legumes: Chemistry, Technology and Human Nutrition by Ruth H. Matthews, 1989.

5. Pulse Chemistry and Technology by B. Tiwari and N. Singh (RSC).

B.TECH. (FOOD TECHNOLOGY) SEMESTER-IV
(Credit Based Evaluation & Grading System)

FTL-253: FRUITS AND VEGETABLES TECHNOLOGY

Credits: 3-1-0
Time: 3 Hours **Max. Marks: 100**
Mid Semester Marks : 20
End Semester Marks : 80

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.
Note : Students can use the Non-Programmable scientific calculator

Section-A

Prepackaging of fresh fruits and vegetables. Storage techniques for fresh fruits and vegetables.
Processing of fruit juices.

Section-B

Manufacturing of fruit juices concentrates. Processing of vegetable juice, puree and pastes.
Preparation of jam, jellies and marmalades.

Section-C

Preparation of preserve and candied fruits. Pickling of fruits and vegetables. Preparation of wine. CanNing of fruits and vegetables.

Section-D

Drying and dehydration of fruits and vegetables. Freezing and frozen storage of fruits and vegetables. Waste management in fruits and vegetable processing units.

Recommended Books:

1. Handbook of Analysis of Fruits and Vegetable Products by S. Rangana, Tata McGraw Hill, New Delhi, 986.
2. Commercial Vegetable Processing – Tressler DK and Woodruff JG, AVI Publishing Co., West port, CT 2004.
3. Commercial Fruit Processing – Woodroof J.G. , Luh B.S. AVI Publishing Co, West Port, CT 2004.

B.TECH. (FOOD TECHNOLOGY) SEMESTER-IV
(Credit Based Evaluation & Grading System)

FTL-254: INDUSTRIAL MICROBIOLOGY

Credits : 3-0-0

Time: 3 Hours **Max. Marks: 100**
Mid Semester Marks : 20
End Semester Marks : 80

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.
Note : Students can use the Non-Programmable scientific calculator

Section-A

Economic activities of microorganisms. Propagation of food, food and baker yeasts. Technology of production of alcohol, glycerol and beer. Mechanism of alcohol and glycerol fermentation. Production of wine and other alcoholic beverages (Whiskey, rum etc.). activities of lactic acid bacteria and industrial, production of lactic acid.

Section-B

Activities of acetic acid bacteria and production of vinegar, sorbose and dihydroxyacetone. Production of dextrons, amino acid fermentation, metabolic controls in industrial fermentation,

saccharifying agents - methods of production and uses. Activities of molds, microbial production of organic acids viz. citric, gluconic, fumeric, itaconic, gibbarellic and kojie acids.

Section-C

Microbial production of vitamins B-2 and B-12. Production, Isolation and uses of microbial enzymes, immobilzed enzymes and their applications, production of glucose and fructose and starch by enzymatic methods.Production of mushroom mycelium by submerged culture process. Production of algal protein and recent advances.

Section-D

Microbiological transformation of steroids. Production and isolation of antibacterial antibiotics like pencillin, streptomycin, steptomycin, chloromycetin, tetracyclines, semisynthetic pencillins. Antifungal antibiotics.

Recommended Books:

1. Industrial Microbiology - Prescott and Dunn., 1983

2. Industrial Microbiology – Casida, 2004.

3. Comprehensive Biotechnology – Moo Young, 1985.

B.TECH. (FOOD TECHNOLOGY) SEMESTER-IV
(Credit Based Evaluation & Grading System)

FTL-258: SUGAR INDUSTRY CO- PRODUCTS

Credits: 3-0-0
Time: 3 Hours **Max. Marks: 100**
Mid Semester Marks : 20
End Semester Marks : 80

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.
Note : Students can use the Non-Programmable scientific calculator

Section-A

General Introduction: Co-product of cane sugar and Beet sugar industry.

Bagasse: Physical and Chemical characters fuel value of bagasse, Ways and means of sparing Bagasse, Handling and Storage of Bagasse, Manufacture of pulp and paper from Bagasse, Manufacture of particle board, fibre board and corrugated board, Use of bagasse as a fuel, production of bagasse production gas, Miscellaneous products from Bagasse; (a) Furfural (b) Cellulose (c) Xylitol (d) Poultry Litter (e) Soil ConditioNing (f) Plastics (g) Cattle Feeds (h) Charcoal and Activated Carbon.

Section-B

Molasses; Characteristics of molasses, different types of molasses and their comparison in production and composition, De-sugarization of molasses, Molasses for products of ethyl alcohol, Recovery of CO2 in distilleries, Molasses for production of:(a) Yeast (b) Monosodium Glutamate (c) Lysine (d) Citric acid (e) Tartaric Acid (f) Oxalic Acid (g) Aconitc Acid (h) Acetone Butanol Ethanol ABS. Use of molasses in live stock feeds, Molasses as fuel, fertilizer in briquetting.

Section-C

Filter Mud; Characteristics, different types and their comparison, Use of filter Mud as a) fertilizer b) fuel c) cattle feed. Filter Mud for manufacture of a) Cane wax b) Biogas c) Cement

Section-D

Sugar cane green top: Composition and utilization.

Specialty Sugar Products: Brown or soft sugar, areado soft sugar process, liquid sugar production, microcrystalline sugar.
Sucrose derivatives: Brief introduction.

Recommended Books:

1. Industrial Utilization of Sugarcane and its Co-Products - P.J. Manohar Rao.

2. Manufacture and refiNing of raw cane sugar by Baikow, V.E., (1982- IInd Edition), Elsevier Publishing Co.

B.TECH. (FOOD TECHNOLOGY) SEMESTER-IV
(Credit Based Evaluation & Grading System)

FTL-255: FLUID FLOW AND HEAT TRANSFER

Credits: 3-1-0

Time: 3 Hours **Max. Marks: 100**
Mid Semester Marks : 20
End Semester Marks : 80

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.
Note : Students can use the Non-Programmable scientific calculator

Section-A

Nature and classification of fluids. Concept of viscosity and its measurement - capillary tube viscometer, rotational viscometer. Mechanical energy balance, Bernoulli's equation

and its application. Friction in pipes and pipe line fittings.

Section-B

Pumps and their classification - positive displacement pumps and centrifugal pumps. Flow measurement devices - Pitot tube, Orifice tube, Venturimeter. Pressure and its measurement - Simple and Differential manometers.

Section-C

Modes of heat transfer-conduction, convection and radiation. Conduction: Fourier's law, applications of steady-state heat transfer i.e. conductive heat transfer in a rectangular slab, tubular pipe, composite rectangular wall (in series), composite cylindrical tube (in series) and sphere. Convection: Free convection and forced convection. Estimation of convective heat transfer coefficient and overall heat transfer coefficient.

Section-D

Critical thickness of insulation. Heat exchangers: Steam injection, Steam infusion, Plate heat exchanger, Scraped surface and Tubular heat exchanger. Design of a tubular heat exchanger by LMTD and NTU-Effectiveness method. Radiation: Stefan-Boltzmann law, Black body, Emissivity, Gray body. Application of radiation in food drying.

Recommended Books:

1. Introduction to Food Engineering (3rd Edition) by R Paul Singh and Dennis R Heldmann; Academic Press, London, UK, 1993

2. Unit Operations of Chemical Engineering (5th Edition) by Warren L McCabe, Julian C Smith, Peter Harriott; McGraw-Hill, Inc., New Delhi,1998

3. Fundamentals of Food Engineering by Radha Charan Verma and Sanjay Kr Jain; Himanshu Publications, Udaipur, 2002

4. Heat Transfer (7th Edition) by J P Holman; McGraw-Hill, Inc., New Delhi, 2008.
5. Transport Processes and Unit Operations (3rd Edition) by Christie J Geankoplis, Prentice-Hall of India Pvt Ltd, New Delhi, 1999.

B.TECH. (FOOD TECHNOLOGY) SEMESTER-IV
(Credit Based Evaluation & Grading System)

FTL-256: MECHANICAL OPERATIONS

Credits: 3-1-0

Time: 3 Hours **Max. Marks: 100**

Mid Semester Marks : 20
End Semester Marks : 80

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.
Note : Students can use the Non-Programmable scientific calculator

Section-A

1. **Size Reduction**

   General principles, considerations goverNing equipment selection, size reduction equipment, modes of operation of size reduction plant, calculation of energy requirements for comminution of solids, disintegration of fibrous materials-slicing, dicing, shredding and pulping. ScreeNing terminology, types of screens, effectiveness of screens, screen analysis for particle size determination.

2. **Material Handling**

   Theory, types of material handling equipments like belt conveyor, screw conveyor, bucket elevator and pneumatic conveyor.

Section-B

3. **Filtration**

   Theory of filtration, filtration equations for constant pressure and constant rate filtration, filtration equipments, filter media and filter aids.

Section-C

4. Sedimentation

Theory, free and hindered settling, sedimentation equipments

5. Centrifugal Separation

Theory, basic equation, rate of separation, liquid separation, gas-solid separation, centrifugation equipments.

Section-D

6. Mixing

Theory, measurement of mixing, rates of mixing, types of mixers – mixers for liquids of low or moderate viscosity, mixers for high viscosity pastes and plastic solids, mixers for dry solids.

Recommended Books:

1. Transport Processes and Unit Operations (3rd Edition) by Christie J Geankoplis, Prentice- Hall of India Pvt Ltd, New Delhi, 1999.

2. Food Engineering Operations (3rd Edition) by J G Brennan, J R Butters, N D Cowell, A E V Lilley; Elsevier Science Publishing Co. Inc., New York, USA, 1990

3 . Unit Operations of Chemical Engineering (5th Edition) by Warren L McCabe, Julian C Smith, Peter Harriott; McGraw-Hill, Inc., New Delhi, 1998

4 . Unit Operations in Food Processing (2nd Edition) by R L Earle; Pergamon Press, Oxford, UK, 1992

5 . Unit Operations of Agricultural Processing by K M Sahay and K K Singh; Vikas Publishing

B.TECH. (FOOD TECHNOLOGY) SEMESTER-IV
(Credit Based Evaluation & Grading System)

FTP-271: CEREALS AND LEGUMES TECHNOLOGY

Credits: 0-0-2

Note: Students can use Non-Programmable scientific calculator.

1. **Wheat Technology:**

   Evaluation of properties of Wheat and milled products, Physical, Chemical and Rheological.

   Experiment baking bread, biscuit, cakes, and pastries.

   Evaluation of baked bread.

   Experimental milling of wheat.

2. **Rice Technology –evaluation of properties of rice, physical and chemical-**

   Cooking quality of rice.

   Experiment on parboiling, evaluation of quality.

   Milling of rice, assessment of degree of polishing,

   Evaluation of extruded products.

   Milling of pulses.

3. **Legumes Technology-**

   Evaluation of properties of legumes (Physical, Chemical and cooking)

   Production of isolates and Concentrates

   Production of different soybean products. Evaluation and Production of extruded products

4. **Industrial Visit.**

B.TECH. (FOOD TECHNOLOGY) SEMESTER-IV
(Credit Based Evaluation & Grading System)

FTP-272: FRUITS AND VEGETABLES TECHNOLOGY

Credits: 0-0-2

Note: Students can use the Non-Programmable scientific calculator.

1. Preparation of fruit juices, squash, R-T-S, Nectar.
2. Preparation of jam, jelly, marmalade preserve, candied.
3. Preparation of fruit juice concentrate and powder.
4. Preparation of tomato products.
5. Preparation of pickles, chutneys, sauces.
6. Dehydration of fruits and vegetables.
7. Freezing of fruits and vegetables.
8. Quality control of processed products.
9. Can seaming operation and canning of fruits and vegetables.

B.TECH. (FOOD TECHNOLOGY) SEMESTER-IV
(Credit Based Evaluation & Grading System)

FTP-273: INDUSTRIAL MICROBIOLOGY

Credits: 0-0-2

Note: Students can use the Non-Programmable scientific calculator.

Production, recovery and control tests for the following fermentation products.

1. Alcohol
2. Baker's yeast
3. Citric acid
4. Glutamic acid
5. Amylases
6. Pectinase
7. Wine
8. Cider
9. Miso
10. Tempeh
11. Yoghurt
12. Riboflavin

B.TECH. (FOOD TECHNOLOGY) SEMESTER-IV
(Credit Based Evaluation & Grading System)

FTP- 276: SUGAR INDUSTRY CO PRODUCTS

Credits: 0-0-2

1. Analysis of Molasses for:
   a) Bx (%), Pol (%) and Purity b) Ash (%)
   c) Reducing sugar (%) d) Total sugars

2. Analysis of Sugarcane for:
   a) Pol (%)
   b) Fibre(%)

3. Analysis of Bagasse for:
   a) Pol (%)
   b) Moisture (%)

4. Analysis of Press Mud for:
   a) Pol (%)
   b) Moisture(%)

5. Sieving and Grading of Sugar.

6. Preparation of seed slurry by:
   a) Precipitation method
   b) Grinding method.

7. Colour measurement using spectrophotometer by ICUMSA method in

   a) White sugar b) Raw sugar

8. Analysis of Gur for:
   a) Bx (%), Pol (%) and Purity b) Ash(%)
   c) Reducing sugar (%) d) Total sugars

9. Determination of turbidity of Juice using Nephlometer

10. Analysis of Electrolytic Chlorine

11. Analysis of Ammonium bifluoride

12. Analysis of Commercial formalin

13. Visit to a sugar/distillery/Brewery

Recommended Books:

1. System of Technology Control for Cane Sugar Factories in India, Ist edition, N.C.Varma.
2. Sugar Analysis by Zerban and Brown IIIrd edition published by John Wiley and Sons.
3. Handbook of Cane Sugar Technology, IInd edition, R.B.L. Mathur.

B.TECH. (FOOD TECHNOLOGY) SEMESTER-IV
(Credit Based Evaluation & Grading System)

FTP-274: MECHANICAL OPERATIONS

Credits: 0-0-2

Note: Students can use Non-Programmable scientific calculator.

1. Study of working principle and operation of various types of grinders.
2. Study of working principle and operation of various types of crushers.
3. Sieve analysis to determine particle size of flour sample.
4. Design calculations of belt conveyor.
5. Design calculations of screw conveyor
6. Design calculations of bucket elevator.
7. Study of filtration operation.
8. Study of mixing operation.
9. Visit to a food industry.

B.TECH. (FOOD TECHNOLOGY) SEMESTER-V
(Credit Based Continuous Evaluation Grading System)

FTL-301: DAIRY TECHNOLOGY

Credits: 3-1-0

Note: Students can use the Non-Programmable scientific calculator.

UNIT-I

1. Chemical composition, nutritive value and physico-chemical characteristics of milk.
2. Microbiology of Milk.
3. Processing of liquid milk- methods of milk collection, filtration, pasteurization, homogenization, packaging .
4. Special milks.
5. Synthetic milk and its detection.
6. Various analytical techniques of determination of milk quality.

UNIT-II

7. Chemistry and technology of cream, butter, margarine and ghee manufacture
8. Production of ice cream and other frozen desserts.
9. Chemistry and technology of: a) Evaporated milk b) Condensed milk
10. Chemistry and Technology of Milk Powders (full fat, Skim-milk and instantized milk powders).

UNIT-III

11. Technology of cheese and other fermented milk products.
12. Indigenous milk products and their technology.
13. Fortification of milk products with different nutrients.
14. Byproducts of dairy industry.
15. Milk plant hygiene, sanitation and waste utilization.

Recommended Books:

1. Technology of Dairy Products by Early, R.
2. Outlines of Dairy Technology by De. S.
3. Chemistry and Testing of Dairy Products by Atherten.

B.TECH. (FOOD TECHNOLOGY) SEMESTER-V
(Credit Based Continuous Evaluation Grading System)

FTL-302: FISH, MEAT AND POULTRY TECHNOLOGY

Credits: 3-1-0

Note: Students can use the Non-Programmable scientific calculator.

UNIT-I

Development of meat and poultry industries in India. Ante-mortem examination of animals and poultry birds. Slaughter and dressing, post-mortem examination. Post-mortem changes in meat and factors affecting them. Nutritive value of meat. Whole sale and retail cuts. Meat tenderization methods. Communited meat products.

UNIT-II

Canning of meat and meat products, Restructured meat products, sausages, curing and smoking of meat. Disposal and utilization of meat industry by- products. Modified atmospheric packaging of meats. MFPO and sanitation of abattoir.

UNIT-III

Structure, composition and nutritive value of poultry eggs. Poultry dressing, Functional properties of eggs, internal quality of eggs and its preservation. Eggs spoilage, Spray dried and frozen egg products. Fish structure and composition. Cold storage, freezing preservation and canning of fish. Picking of fish, fish protein concentrates, fish meal and by products of fish processing industry.

Recommended Books:

1. Meat, Poultry and Sea Food Technology - R.L. Henricksons.
2. Meat Hand Book -Albert Lovie.
3. Poultry Products Technology - G.J. Mountney.
4. Fish as Food (Vol. I, II, III, IV) - George Borgstorm.
5. Fish Technology - R.J. Roberts.

B.TECH. (FOOD TECHNOLOGY) SEMESTER-V
(Credit Based Continuous Evaluation Grading System)

FTL-303: FATS AND OIL TECHNOLOGY

Credits: 3-0-0

Note: Students can use the Non-Programmable scientific calculator.

UNIT-I

Status of oils and fats and Indian Economy.

General chemistry, Analytical methods for characterization.

Quality standards of edible oils and fats.

UNIT-II

Antioxidants and rancidity, oil and fats in diet, nutrition and disease.

Detection of adulteration. Extraction and clarification of vegetable oil.

Modifications of the properties of oils and fats including chemical processes.

UNIT-III

Confectionery plastic fats, preparation of various products including different shortenings, margarine, salad dressing and mayonnaise, imitation of dairy products, low calorie spreads, Animal fat, oil derivatives.

Technology of oilseed protein isolate.

Recommended Books:

1. Fats and Oil - Bailey.

2. The Chemistry and Technology of Edible Oils and Fats**,** P.N. Williams and J. Devine.

B.TECH. (FOOD TECHNOLOGY) SEMESTER-V
(Credit Based Continuous Evaluation Grading System)

FTL-306: MASS TRANSFER

Credits: 3-0-0

Note: Students can use the Non-Programmable scientific calculator.

UNIT-I

Theory of diffusional processes - molecular diffusion in fluids, measurement of diffusivity. Theory of interphase mass transfer, mass transfer coefficients and mass transfer theories. Analogies between heat, mass and momentum transfer.

UNIT-II

Crystallization and absorption: Theory of crystallisation, material and energy balance calculations, introduction to crystallizer design. Introduction to the principles of absorption.
Distillation: Vapor-Liquid equilibria, relative volatility batch and equilibrium distillation, steam distillation, molecular distillation, azeotropic and extractive distillation, enthalpy concentration diagram. Theory of rectification column design.

UNIT-III

Extraction: Fundamental principles of liquid - liquid extraction, selectivity, and choice of solvent. Material balances in stage operations and principles of the graphical methods in determination of number of equilibrium stage.
Fundamental principles of leaching operation and material balance calculations.

Recommended Books:

1. Unit Operation in Chemical Engineering – Mcabe and Smith.
2. Mass Transfer – Traybel.
3. Chemical Engineering – Coulson and Richardson

B.TECH. (FOOD TECHNOLOGY) SEMESTER-V
(Credit Based Continuous Evaluation Grading System)

FTL-307: COMPUTER APPLICATIONS IN FOOD INDUSTRY

Credits: 3-1-0

UNIT -I

Computerization, Importance of Computerization in food industry and IT applications in food industries.

Computer operating environments and information system for various types of food industries. Introduction to a Barcharts and Piecharts and the procedure to develop a barchats and piecharts on given Data.

Introduction to Software and Programming Languages, Properties, Differences of an Algorithm and Flowcharts, Advantages and disadvantages of Flowcharts and Algorithms.

Introduction, Fundamentals and advantages of "C"
Steps in learning "C" (Character set, Identifiers, Keywords)
Steps in learning "C" (Data types, Constants, Variables, Escape sequences) IT Applications in Food Industry

Steps in learning "C" (Operators, Statements)
Steps in learning "C" (Header Files, Input and Output functions:
Formatted I/O functions Unformatted I/O functions)

UNIT-II

Basic Structure of a simple "C" program
Decision Making/Control Statements (If statement, if else statement, ladder if statement, switch statement)
Branching, Concept of Looping and Looping statements (for loop, do while loop)
Concept of Arrays and Types of Arrays (Single, Double and Multi dimensional Arrays)

UNIT-III

Concept of Functions (Defining a function and Function Prototypes,
Types of functions: Library functions and User defined functions)
Concept of various types of User Defined Functions (i.e., About 4 types) Concept of a String Library Functions Concept of Pointers, Structures and Unions Introduction to a Data Structures

B.TECH. (FOOD TECHNOLOGY) SEMESTER-V
(Credit Based Continuous Evaluation Grading System)

FTP-321: DAIRY TECHNOLOGY

Credits: 0-0-2

Note: Students can use the Non-Programmable scientific calculator.

1. Quantitative estimation of milk constituents such as moisture, % TS, ash, and fat.
2. Determination of titrable acidity of milk.
3. Determination of specific gravity of milk and observe effect of water addition on it.
4. Performance of platform tests on given sample of milk.
5. Detection of adulterants and preservatives in milk.
6. Determination of bacteriological quality of milk by MBRT and Resazurin test.
7. Preparation of sterilized flavored milk.
8. Preparation of
   a) Butter
   b) Ghee
   c) Ice Cream
   d) Paneer and Chhana
   e) Milk Powder
   f) Khoa
9. Visit to milk processing plant.

B.TECH. (FOOD TECHNOLOGY) SEMESTER-V
(Credit Based Continuous Evaluation Grading System)

FTP-322: FISH, MEAT AND POULTRY TECHNOLOGY

Credits: 0-0-2

Note: Students can use the Non-Programmable scientific calculator.

1. Determination of egg constituents such as ash/ Total solid/ moisture.
2. Determination of Specific gravity of eggs.
3. Determination of internal quality of eggs.
4. Determination of Haugh units of eggs.
5. Preparation of egg pickle.
6. To determine effect of different time and temperature combination condition on formation of iron sulfide in eggs.
7. To study slaughtering and dressing of poultry bird.
8. To make retail cuts of dressed chicken and calculating percentage yields.
9. To determine meat to bone ratio of chicken.
10. Preparation of comminuted meat products.
11. Preparation of meat block.
12. Dressing of fish and calculation of dressing percentage.
13. To determine meat to bone ratio of fish meat.
14. Preparation of comminuted fish products.

B.TECH. (FOOD TECHNOLOGY) SEMESTER-V
(Credit Based Continuous Evaluation Grading System)

FTP-323: FATS AND OIL TECHNOLOGY

Credits: 0-0-2

Note: Students can use the Non-Programmable scientific calculator.

1. Experimental expeller processing of oilseeds.
2. Solvent extraction process.
3. Determination of Iodine value, saponification value, R.M. value, Kirschner, Polenski value, melting point and peroxide value of fats and oils sample.
4. Adulterants in fats and oils.
5. Imitated dairy products, margarine etc.
6. Production of protein concentrates and isolates.
7. Determination of anti-oxidant-used in oil.

B.TECH. (FOOD TECHNOLOGY) SEMESTER-V
(Credit Based Continuous Evaluation Grading System)

FTP-326: COMPUTER APPLICATIONS IN FOOD INDUSTRY

Credits: 0-0- 2

1. Application of MS Excel to solve the problems of food technology Introduction to a C complier and How to handle the C compiler (Controllers used in C Compiler)
2. Statistical quality controls of food Developing and executing simple C programs (By using various operators used in "C").
3. *Sensory Evaluation of food Developing* and executing simple "C" programs (By using some mathematical and logical operation)
4. Chemical kinetics in Food processing Developing and executing simple "C" programs (By using Control statements: if, if-else, multiple if-else)
5. Use of Word Processing software (MS- Power Point) for creating reports and presentation Developing and executing simple "C" programs (By using Control statements: nested if "s, conditional operator, and switch statements)
6. Familiarization with the application of computer in food industries Developing and executing simple "C" programs (By using loops: while, do- while loops)
7. Milk plant, dairy units, fruit and vegetable processing unit familization with software related to food industries. Developing and executing simple "C" programs (By using loops: for loop)
8. Ergonamics application in the Food industries. Developing and executing simple "C" programs (By using arrays: single (or) one dimensional arrays)
9. Developing and executing simple "C" programs (By using arrays: two dimensional arrays)
10. Developing and executing simple "C" programs (By using four types of Functions)
11. Developing and executing simple "C" programs (By using a string functions : strlen ( ), strrev ( ), strcpy ( )
12. Developing and executing simple "C" programs (By using a string functions: strcat( ), strlwr( ), strupr( ))
13. Developing and executing simple "C" programs (By using structures, unions)

Recommended Books:

1. Let us "C" – Yeswanth Kanethkar
2. Computer Programming in „C" – E. Balaguruswamy
3. Data Structures – Mark Allen Waise
3. M. S Excel 2000 - Microsoft Corp.
4. M. S. Office – Microsoft Corp
5. Computer Concepts for Agri Business – M.V. Verton, AVI Pub. Corp, West Port, USA.

B.TECH. (FOOD TECHNOLOGY) SEMESTER-VI
(Credit Based Continuous Evaluation Grading System)

FTL-351: FOOD REGULATIONS AND QUALITY CONTROL

Credits: 3-1-0

Note: Students can use the Non-Programmable scientific calculator.

UNIT I

Introduction, Objective and importance of general principles of quality control, Quality attributes - color, gloss, viscosity and consistency, size and shape and texture.

Flavor and Taste. Introduction to sensory evaluation of foods. Different sensory evaluation techniques.

UNIT II

Good Manufacturing Practices, Good Laboratory Practices. Micro analytical and microbiological methods of quality evaluation. Govt. and Trade standards for quality. Pest Control in Food Industry, Concept of Quality Circles, Importance and Objectives, Codex Alimentarious.

UNIT III

Food Safety and Standards Authority of India (FSSAI), 2006, FSSAI Legislation, Food Safety Standards Standards, ISO: 9000, ISO: 22000; Total Quality Management; Bureau of Indian Standards; The Consumers' Protection A ct, 1986. Recording and Reporting of quality. Introduction to Statistical Quality Control.

Recommended Books:

1. Advances in Food Research - By Academic Press.
2. Quality Control for Food Industry - By Krammar and Twigg.
3. Quality Control in Food Industry - By S.N. Herschdoarfar.

B.TECH. (FOOD TECHNOLOGY) SEMESTER-VI
(Credit Based Continuous Evaluation Grading System)

FTL-352: APPLICATIONS OF ENZYMES IN FOOD INDUSTRY

Credits: 3-0-0

Note: Students can use the Non-Programmable scientific calculator.

UNIT-I

1. General properties and classification of enzymes. Co-enzymes, cofactors, enzymes inhibitors. Enzyme kinetics, factors affecting enzyme action
2. Enzyme kinetics, actors affecting enzyme action.
3. Immobilized enzymes.
4. Sources of enzymes and their production.

UNIT-II

5. Role of enzymes in meat tenderization
6. Significance of enzymes in starch industry- high fructose corn syrups, glucose syrups, monohydrate dextrose.
7. Application of amylases, proteases, lipoxidase, lipases and pentosanes in baking industry.

UNIT-III

8. Applications of enzymes in milk and milk products.
9. Enzymes in fruits and vegetables processing-clarification and debittering.
10. Enzymes in beer and wine making

Recommended Books:

Food Enzymes by Reed.

B.TECH. (FOOD TECHNOLOGY) SEMESTER-VI
(Credit Based Continuous Evaluation Grading System)

FTL-353: BIOCHEMICAL ENGINEERING

Credit: 2-0-0

Note: Students can use the Non-Programmable scientific calculator.

UNIT-I

1. **Introduction:** Introduction to biochemical engineering, chemical engineering, microbiology, biotechnology and biochemistry.

2. **Cell growth:** Introduction, quantifying cell concentration, growth patterns and kinetics in batch culture, effect of environmental conditions on growth kinetics, heat generation by microbial growth.

UNIT-II

3. **Enzymes:** Production of crude enzyme, isolation and purification, immobilized enzymes and bio-reactor. Immobilization techniques, kinetics, industrial application and product recovery.

4. **Enzyme kinetics:** Introduction, mechanistic models for simple enzyme kinetics, Michaelis-Menten type kinetics, effects of pH and temperature.

UNIT-III

5. **Fermenter design, control and scale up:** Aeration and agitation in fermenter, oxygen supply and demand in microbial processes - single and multiple bubble aeration, oxygen transfer in fermentation, types of spargers, etc.
6. **Continuous fermentation.**

Recommended Books:

1. Bioprocess Engineering: Basic Concepts by M.L. Shuler and F. Kargi, PHI Learning Private Limited, New Delhi.

2. Biochemical Engineering by D.G. Rao, McGraw Hill Publishing Co. Ltd.

3. Fundamentals of Biochemical Engineering by A.V.N. Swamy, BS Publications.

4. Fermentation and Biochemical Engineering Handbook: Principles, Process Design and Equipment by H.C. Vogel and C.L. Todaro, Standard Publishers Distributors, Delhi

B.TECH. (FOOD TECHNOLOGY) SEMESTER-VI
(Credit Based Continuous Evaluation Grading System)

FTL-354: PACKAGING TECHNOLOGY

Credits: 3-1-0

Note: Students can use the Non-Programmable scientific calculator.

UNIT-I

1. Definition, Functions of Food package
2. Hazards acting on package during transportation.
3. Various packaging materials - rigid, semi rigid and flexible and their properties.
4. Principles of manufacture, types and uses of - wood, paper, paper-board, corrugated fiber board
5. Use of Plastic, metal and glass in food packaging

UNIT-II

6. Laminates and coextruded films.
7. Special packaging methods: Retortable packaging, Aseptic, vacuum, shrink packaging.
8. Free oxygen scavenging packaging.
9. Modified and controlled atmosphere packaging.
10. Shelf life prediction.

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UNIT-III

11. Edible films and coatings
12. Packaging requirements of different products:
    Dairy products, Flesh foods, Cereal based foods, Fruits and vegetables, Beverages, Snack foods, Microwavable foods.
13. Safety and legislative aspects of packaging.

Recommended Books:

1. Fundamentals of Food Packaging by F.A. Paine.
2. Packaging of Food Beverages by F.T. Day.
3. Food Packaging by Saccharow and Grifith.
4. Flexible Packaging of Foods by A.L. Brandy.
5. Principles of Food Packaging by R. Heiss.

B.TECH. (FOOD TECHNOLOGY) SEMESTER-VI
(Credit Based Continuous Evaluation Grading System)

FTL –357: HUMAN RESOURCES MANAGEMENT IN FOOD INDUSTRY

Credits: 3–0–0

UNIT-I

Introduction to Human Resource Management and its definition, Functions of Human Resource Management and its relation to other Managerial functions, Importance of human resource management in Industry. Need for Human Resource Planning, Process of Human Resource Planning, Methods of Recruitment and Interviews. Meaning and Importance of Placement and Induction, Job satisfaction and its Importance.

UNIT-II

Training and Development: Difference between Training and Development, Principles of Training, Employee Development, Promotion Merit V/s. Seniority Performance appraisal. Job satisfaction and its importance. Motivation, Factors affecting motivation, Introduction to Motivation theory, Quality of Working life. Grievances and Grievance Handling Procedure, Discipline and Disciplinary action. Human Relations and Industrial Relations, Differences between Human Relations and Industrial Relations, Factors required for Good Human Relations policy in Industry.

UNIT-III

Employee-Employer relationship, Causes and effects of Industrial disputes; Prevention and statement Machinery of Industrial Disputes in India; Importance of Collective Bargaining, Role of Trade Unions in maintaining Cordial Industrial Relations. Maintenance: Meaning and importance of Employees Safety Accidents-Causes, Preventions, Safety provisions under the Factories Act, 1948. Welfare of Employees and its importance, Provisions under the Factories Act. Social Security, its meaning, importance, Steps taken by Government of India; Future challenges for Human Resource Management.

Recommended Books:

1. Personnel Management : C B Mamoria
2. Principles of Personnel Management : Dawin B Filppo
3. Labour Problems and Social Welfare : R C Saxena
4. Principle and Practice of Marketing in India : CB Mamoria and RC Joshi

B.TECH. (FOOD TECHNOLOGY) SEMESTER-VI
(Credit Based Continuous Evaluation Grading System)

FTL-358: SUGAR INDUSTRY (Technical Control and Design)

Credits: 3-1-0

UNIT-I

MILLING CONTROL: Technical definitions, fundamental formula for cane, added water, mixed juice and bagasse, calculation of brix percent bagasse, fibre percent bagasse, undiluted juice lost in bagasse percent fibre, added water in mixed juice percent added water in cane. Methods of control-differential and inferential methods, primary extraction, secondary extraction using simple and compound imbibition scheme. Ideal extraction, mill extraction, brix curves, brix free cane water, lost juice percent fibre, reduced mill extraction, E.R.Q.V., Inferential methods for calculation, undiluted juice percent cane, undiluted juice in mixed juice percent cane, added water percent cane and added water per unit cane, indirect method of calculating cane weight. Methods of comparison of milling efficiency of factories.

UNIT-II

BOILING HOUSE CONTROL: S.J.M.formula and its postulates, winter Carp's formulas, relation between S.J.M. and winter's formulas. Differences between commercial sugar, standard granulated and equivalent standard Granulated (E.S.G.), calculation of E.S.G., clarification factor, actual molasses percent theoretical molasses and non-sugar in molasses percent non-sugar in mixed juice. boiling house recovery, basic boiling house recovery, boiling house performance and boiling house recovery (E.S.G.) Comparison of boiling house recovery of different factories, virtual purity of waste molasses, reduced boiling house, recovery. Norms of efficiency

UNIT-III

CAPACITY Selection of site, types of plant i.e. gravity & non-gravity. Cane Carrier, Cane knives. Mill capacity, Power requirement for milling tandem. mill screen area, juice pumps, imbibition water pump, mixed juice / water weighing scale, juice receiving tanks, M.J. Pump. Juice heaters, Sulphur furnace -combustion temp. % of SO_2 , tray area, milk of lime preparation tanks & pumps. continuous juice sulphiter. clarifiers. rotary vacuum filters. Evaporators, Condensers. Capacity of injection pump. Spray pond -depth, area, spray pumps, spray nozzles, forced draught cooling towers. Capacity of syrup sulphiter, syrup pumps. Capacity of pans, crystallizers, cooling time for different massecuites, vertical crystallizers, brief idea about its design. Centifugal -batch type & continuous centrifugal machines, nos. of machines required for a sugar factory, sugar conveyers, elevators, graders. Storage of sugar & molasses, N.C.V. & G.C.V. of bagasse, calculation of steam balance, calculation of heating surface of boilers.

Recommended Books:

1. Cane Sugar Handbook: Chen & Meade.
2. Standard Fabrication Practice for Cane Sugar Mills Deldan.
3. Handbook of Cane Sugar Engineering. E. Hugot.
4. Machinery & Equipment of Cane Sugar Factory: L.A. Tromp.
5. Handbook of Cane Sugar Tech.: R.B.L. Mathur.
6. System of Technology Control for Cane Sugar Factories in India, Ist edition, N.C.Varma.

B.TECH. (FOOD TECHNOLOGY) SEMESTER-VI
(Credit Based Continuous Evaluation Grading System)

FTP-371: FOOD REGULATIONS AND QUALITY CONTROL

Credits: 0-0-2

Note: Students can use the Non-Programmable scientific calculator.

1. Estimation of moisture content of food sample.
2. Estimation of ash content of food sample.
3. Estimation of extraneous matter present in food sample.
4. Recognition of threshold concentration of primary taste.
5. Recognition of the flavor of food sample.
6. Determination of water activity of food sample.
7. Determination of color of food sample using Hunter Colorimeter.
8. Determination of viscosity of given food sample.
9. Preparation and sensory evaluation of food sample (cookies).
10. Detection of adulteration of desi ghee with vanaspati.
11. Detection of adulterants in milk.
12. Detection of preservatives such as boric acid, borate, carbonates, bicarbonates in milk.
13. Quality control tests in milk.
14. Quality examination of canned food sample

B.TECH. (FOOD TECHNOLOGY) SEMESTER-VI
(Credit Based Continuous Evaluation Grading System)

FTP–372: BIOCHEMICAL ENGINEERING

Credits: 0-0-2

Note: Students can use the Non-Programmable scientific calculator.

1. Preparation of culture media.
2. Demonstration of bacterial growth in batch cultures.
3. Heat inactivation of enzyme, calculation of rate constants, thermal death rate, etc.
4. M easurement of mass transfer coefficient (K_La) by dynamic method, effect of air flow rate and r.p.m.
5. Determination of total dissolved solids in water.
6. Measurement of dissolved oxygen.
7. Measurement of B.O.D.
8. Measurement of C.O.D.
9. Introduction to fermentation operation, instrumentation etc.
10. Layout of fermentation technology.

B.TECH. (FOOD TECHNOLOGY) SEMESTER-VI
(Credit Based Continuous Evaluation Grading System)

FTP-373: PACKAGING TECHNOLOGY

Credits: 0-0-2

Note: Students can use the Non-Programmable scientific calculator.

1. Identification of different types of packaging material.
2. Physical properties of packaging films.
3. Determination of water absorption of paperboard and CFB
4. Uniformity and amount of wax determination.
5. Chemical resistance of packaging material
6. WVTR of different packaging material.
7. Grease resistance of packaging material.
8. Pre-Packaging of Fruits and Vegetables.
9. Determination of tin coating weight and porosity.
10. Determination of continuity of lacquer coating.
11. Determination of tensile strength and heat seal strength of packaging material.
12. To conduct drop test.
13. Estimation of shelf life of packaged foods.
14. Determination of thermal shock resistance of glass containers.

B.TECH. (FOOD TECHNOLOGY) SEMESTER-VI
(Credit Based Continuous Evaluation Grading System)

FTP: 374 SUGAR INDUSTRY DESIGN LAB.

CREDITS: 0-0-2

1. **Juice Heaters:** To find out the heating surface area, number of tubes, dia, thickness of heaters, shell thickness with respect to hydraulic test pressures.

2. **Evaporator:** With a given heating surface area, to find out the number of tubes, downtake dia, tube plate design, dimension, vapour body thickness under external pressure (Vacuum conditions and calendria design).

3. **Pans:** With given capacities to find the heating surface, down take dimension, shell dimensions with standard tubes, tube plate thickness with heat exchange principle.

4. **Storages Vessels:** Molasses tank for different crushing capacities, so find the thickness of various courses of steel tank, dia and height of steel tank.

5. **Rollers:** Taking into consideration then hydraulic load and bearing joural pressures.

6. **Crystallizers:** To find the dimension parametor of crystallizers taking considerations of the volume of massecuites discharged into crystallizers, cooling temp. at different time intervals.

7. **Condenser:** Design the multi jet condenser, calculate the height of the condenser, cross-section of the condenser, condenser volume size of vapour pipe, diameter of cooling water piper, wt. of cooling water required.

8. **Juice sulphiter :** Design, Dia and height, juice pipe entry, SO2 gas pipeline dia, Milk of line pipe line dia. Required.

9. **Plant layout:** layout of the factory, lay out of the machinery, precautions to be considered.

10. **Visit to sugar complex**

Books Recommended

1. Hand book of Sugar Engineering by E.Hugot
2. Engineering Drawing by P.S.Gill

FTL-401: FOOD PROCESS ENGINEERING

Time : 3 Hours

Credits : 3-1-0
Max.Marks : 100
Mid Semester Marks :20
End Semester Marks : 80

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.
Note : Students can use the Non-Programmable scientific calculator

SECTION A

1. Refrigeration

Selection of refrigerant, components of refrigeration systems - different types of evaporators, compressors, condensers, expansion valves; pressure-enthalpy chart for a vapour-compression refrigeration cycle under saturated conditions, pressure-enthalpy chart for a vapour-compression refrigeration cycle with deviations; and mathematical expressions useful in the analysis of vapour compression refrigeration.

SECTION B

2. Freezing

Different types of food freezing systems - indirect contact systems: plate freezer, air-blast freezer and freezers for liquid foods; and direct contact systems: air blast freezing system and immersion freezing system; freezing time calculations using Plank's equation.

SECTION C

3. Evaporation

Boiling point elevation, types of evaporators – batch-type pan evaporator, natural circulation evaporator, rising-film evaporator, falling-film evaporator, rising/falling-film evaporator, forced-circulation-type evaporator, agitated thin-film evaporator; design of single effect and multi effect evaporators, steam economy, vapour recompression systems – thermal recompression and mechanical recompression.

4. Extrusion

Functions of extrusion, advantages of extrusion, development of extruders, extrusion terminology – feedstock, preconditioner, screw, shear, interrupted- or cut-flight screw, barrel, cooling/heating jacket, vent, barrel section, barrel liner, length-to-diameter ratio, compression ratio, die plate, pellet, collet, die land, cutter; types of extruders, classification of single screw extruder: based on extent of shear – cold forming extruders, high-pressure forming extruders, low-shear cooking extruders, collet extruders, high shear cooking extruders; based on heat generation – adiabatic extruders, isothermal extruders, polytropic extruders; based on design – solid single-screw extruders, interrupted-flight extruder-expander, single segmented-screw extruders; twin screw extruders and their classification.

SECTION D

5. Drying

Theory of drying, bound moisture, free moisture, water activity, equilibrium moisture content, hygroscopic material, non-hygroscopic material, case hardening, drying rate curves - constant rate drying period, critical moisture content and falling rate drying period. Representation of moisture content on wet basis and dry basis and their relationship. Engineering aspects of different types of dries including bin drier, cabinet or tray drier, belt or conveyor drier, fluidized bed drier, kiln drier, pneumatic drier, spray drier, trough drier, tunnel drier and freeze drier.

Recommended Books:

1. Introduction to Food Engineering (3rd Edition) by R. Paul Singh and Dennis R. Heldman, Academic Press, Inc.
2. Unit Operations of Chemical Engineering (5th Edition) by Warren L. McCabe, Julian C. Smith, Peter Harriott, McGraw-Hill, Inc., New Delhi.
3. Transport Processes and Unit Operations (3rd Edition) by Christie J. Geankoplis, Prentice-Hall of India Pvt. Ltd., New Delhi.
4. The Technology of Extrusion Cooking by N.D. Frame, Blackie Academic and Professional, Madras.

FTL- 402: CONFECTIONERY TECHNOLOGY

Time : 3 Hours

Credits : 3-1-0
Max.Marks : 100
Mid Semester Marks : 20
End Semester Marks : 80

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.
Note : Students can use the Non-Programmable scientific calculator

SECTION -A

Crystalline and non crystalline sugar confectionary: fondant, hard boiled candy, caramel, toffee, fudge, nut brittles, krokant, praline, truffles, pulled sugar, marshmallows. Basic ingredients: sucrose, glucose syrup, invert syrup, sugar alcohols

SECTION -B

Gums and jellies, pastilles, turkish delight, marzipan. Sugar panning. Defects in confectionary: sugar bloom. Chewing gum and bubble gum: manufacturing and ingredients. Packaging requirements of sugar confectionary.

SECTION -C

Chocolate confectionary: Processing of cocoa beans: harvesting, fermentation, roasting, grinding. Chocolate refining, conching,

SECTION -D

Tempering, molding, enrobing, panning. Ingredients used in chocolate. Cocoa butter equivalents and substitutes. Fat bloom. Packaging requirements of chocolate confectionary.

Recommended Books:

1. The Science of Sugar Confectionary by W.P. Edwards, RSC Publishers.
2. The Science of Chocolate by Stephent Becett, RSC Publisher.
3. Chocolate, Cocoa and Confectionary Science and Technology by Bernard W. Minifie.

FTL-403: SPICES AND FLAVOUR TECHNOLOGY

Time : 3 Hours

Credits : 3-0-0
Max.Marks : 100
Mid Semester Marks : 20
End Semester Marks : 80

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.
Note : Students can use the Non-Programmable scientific calculator

SECTION -A

Production of spices in India. Chemical composition of spices. Properties of spices and spice products.

SECTION -B

Spice Processing : Production of whole, ground, essential oil, oleoresins and encapsulated spices from raw spices. Quality standards for processed spices and their products.

SECTION -C

Flavour Technology - Physiology of flavor. Classification of flavouring compounds. Production of compound flavouring. Standards for compound flavourings. Instrumental and sensory analysis of flavourings.

SECTION -D

Flavour Application: Factor affecting stability of flavourings in foods. Incorporation of spices and compound flavourings in food products.

Recommended Books:

1. Handbook of Herbs and Spices, Vol 3, K.V.Peter, Wood Head Publishing, Combridge, UK 2004.
2. Spice Statistics- Spice Board, Govt. of India, Ministry of Commerce, Cochin, India
3. Spice and Seasonings., A Food Technology Handbook - DR Tainter and A.T.Grenis, VCH, Publishing Co. 2003.

FTL-404: FOOD PROCESSING PLANT LAYOUT AND DESIGN

Time : 3 Hours

Credits : 3-0-0
Max.Marks : 100
Mid Semester Marks : 20
End Semester Marks : 80

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.
Note : Students can use the Non-Programmable scientific calculator

SECTION A

Plant Location
Concept and factors governing plant location. Locational economics – comparison of rural vs urban plant sites.

Plant Layout
Plant layout – objectives and principles; types of layouts – process layout, product layout, combination layout, fixed position layout; flow patterns; workstation design; methods of plant and factory layouts; plant layout procedure.

SECTION B

Factory Building
Building design considerations – flexibility, expandability, service and employee facilities, lighting, heating, ventilation, air-conditioning, etc.

Network Analysis of Processes
Basic terms, objectives and advantages of network analysis, various network techniques – PERT and CPM.

SECTION C

Cost Analysis
Introduction to cost and accounting; elements of cost – material, labour and expense; nature of cost – fixed, variable, semi-variable, controllable, uncontrollable. Depreciation – definition and concept, causes of depreciation, methods of calculating depreciation – straight line method, reducing balance method, production based method, rapid provision method, annuity method, sinking fund method.

SECTION D

Plant Maintenance

Objectives and importance of maintenance, types of maintenance – corrective or breakdown maintenance, scheduled maintenance, preventive maintenance and predictive maintenance.

Recommended Books:

1. Plant Layout and Design by James M. Moore, The Macmillan Company, New York.
2. Industrial Engineering and Management by O.P. Khanna, Dhanpat Rai Publications (P) Ltd., New Delhi.

B.TECH. (FOOD TECHNOLOGY) SEMESTER-VII
(Credit Based Continuous Evaluation Grading System)

FTP-421: FOOD PROCESS ENGINEERING

Credits: 0-0-2

Note: Students can use Non-Programmable scientific calculator.

1. Study of dehydration characteristics of food material using cabinet drier.
2. Study of dehydration characteristics of food material using fluidized bed drier.
3. Study the working principle and operation of freeze drier.
4. Study the working principle and operation of spray drier.
5. Study of psychometrics – use and applications.
6. Study the working principle and operation of an evaporator.
7. Study of design parameters and refrigeration load capacity of a cold storage plant.
8. Determination of freezing time of selected food materials.
9. Study the working principle and operation of an extruder.
10. Visit to a food industry.

B.TECH. (FOOD TECHNOLOGY) SEMESTER-VII
(Credit Based Continuous Evaluation Grading System)

FTP–422: CONFECTIONERY TECHNOLOGY

Credits: 0-0-2

Note: Students can use the Non-Programmable scientific calculator.

To study the preparation of confectionary products

1. Fondant
2. Hard boiled candy
3. Caramel
4. Toffee
5. Butterscotch
6. Pulled sugar
7. Jellies, gums
8. Visit to Confectionery Industry

B.TECH. (FOOD TECHNOLOGY) SEMESTER-VII
(Credit Based Continuous Evaluation Grading System)

FTP-423: SPICES AND FLAVOUR TECHNOLOGY

Credits: 0-0-2

Note: Students can use the Non-Programmable scientific calculator.

1. Spice analysis.
2. Identification of whole spices.
3. Determination of Essential oil in spices.
4. Detection of Adulteration in Spices
5. Sensory analysis of flavored foods.
6. Correlation of subjective and objective methods
7. Formulation of compound flavorings.
8. Application of spices and compound flavorings in processed food products.
9. Visit to Spice Processing Unit.

B.TECH. (FOOD TECHNOLOGY) SEMESTER-VII
(Credit Based Continuous Evaluation Grading System)

FTP-424: SEMINAR AND GROUP DISCUSSION

Credits: 0-0-2

B.TECH. (FOOD TECHNOLOGY) SEMESTER-VIII
(Credit Based Continuous Evaluation Grading System)

FTP-451: INDUSTRIAL TRAINING

Credits: 0-0-16

Students will be required to undertake Practical Training in Industrial establishment in the 8th semester of B. Tech. (Food Tech.) and will have to submit a Industrial Training Report along with original certificate at the completion of the training. Every student will be required to submit a training report in typed standard prescribed format containing a copy of original certificate. The objective of the industrial training is to test the ability of the student to grasp the industrial environment in the field of food processing. Every student will make PowerPoint presentation of industrial training and will be orally examined in the context of the training report.

FTP-452 : RESEARCH PROJECT

Credits : 0-0-4

Every student will be required to submit a project report or equipment design report in typed standard form on a topic set by one or more teachers. The objective of the Project Work is to test the ability of the student to tackle an investigational problem in his field of specialization. Every student will be orally examined in the subject incorporated in his Project Report.