Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Food Technology

(Applicable from the academic session 2018-2019)

Semester-IV

Name of the Course: Unit operation II (Transfer Operation)	
Course Code: ES-FT 401	**Semester: IV**
Duration: 6 months	**Maximum Marks: 100**

Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./ week	Mid Semester Exam.: 15 Marks
Tutorial: Nil	Assignment & Quiz: 10 Marks
Practical: Nil	Attendance: 5 Marks
Credit Points: 3	End Semester Exam: 70 Marks

Objective:	
1	Understand several unit operations are carried out in Food Processing Industries by applying the knowledge.
2	Recall several fundamental equations of fluid flow and heat transfer in understanding the subject.
3	Analyze processing operation by applying the knowledge
4	Make use of this knowledge for understanding of operations in industrial distillation in alcohol industries.
5	Analyze different Industrial scale absorption and stripping operations
6	Understand basic theory of mass transfer operation and different diffusion related theories
Pre-Requisite:	
1	At least12 units of undergraduate study in a particular profession

Details of Syllabus:

Unit	**Content**	**Hrs/ Unit**	**Marks / Unit**
1	**Momentum Transfer and Flow of Fluid**: Raleigh's method and Buckingham's π theorem, dimensional analysis, dimensionless numbers Pressure drop-flow rate, relationship for flow through pipe, rectangular conduit and circular in laminar flow; Turbulent flow and fanning's friction factor; Compressible flow: flow through nozzle and porous media, Apparent viscosity, generalized viscosity coefficient, fundamentals of fluidization, ideal& real fluids, Newton's law of viscosity, Newtonian & Non Newtonian Fluids,	9	
2	II Transport theorem, conservation laws, equation of continuity, Euler's equation of motion, Bernoulli's equation, viscous flow., types of similarities, Friction in flow through packed beds; Measurement of flow	8	

	rate : Venturimeter, pitot tube, orificemeter; Rotameter, Pipe Fittings and valves, Pumps – classification, centrifugal and positive displacement type – peristaltic		
3	**Heat Transfer:** Classification of heat flow processes, conduction, Thermal conductivity. Heat flow in fluids by conduction and convection. Counter current and parallel flow. Enthalpy balance in heat exchange equipment. Individual heat transfer coefficients, overall coefficient, Heating and cooling of fluids, Heat transfer equipment. NTU-Effectiveness relationship; Unsteady state heat transfer in plate, cylinder and spherical bodies; Radiation.	10	
4	**Mass Transfer::** Molecular diffusion and Fick's Law; Steady state mass transfer in equimolar counter diffusion and diffusion through stagnant mediumIntroduction to mass transfer: Molecular diffusion in fluids, diffusivity, mass transfer coefficients, interphase mass transfer, gas absorption,	9	
5	Counter-current multistage operation, packed tower. Analogy between momentum, heat and mass transfer. Distillation- vapor-liquid equilibrium, relative volatility, batch and equilibrium distillation, steam distillation, molecular distillation, azeotropic and extractive distillation,; theory of rectification; design of distillation column	9	

Text and Reference Books:

Revision: 5L

Books :

1.Unit Operations of Chemical Engineering: McCabe, Smith &Harriot, TMH, 5th edition
2. Transport Processes & Unit operations: Geankopolis, PHI, 3rd edition
3. Chemical Engineering, Vol-I & II: Coulson & Richardson, Butterworth Heinemann
4. Heat Transfer: D.Q. Kern, MGH
5. Badger, W.L., Banchero, J.T., Introduction to Chemical Engineering, MGH
6. Foust, A.S., Wenzel, L.A., et.al. Principles of Unit Operations, 2nd edition, JWS
7. Perry, Chilton & Green, Chemical Engineers' Handbook, MGH

8 Mass transfer operations by Robert. E. Treybal Third Edition MGH

Course Outcome:

1. After completion of the course the students will be able to understand about nature of fluid flow in a pipe line.

2. They can design continuous sterilization unit considering the different holding time for different parts of fluid.

3. They can understand the operational principle of different type of heat exchangers.

4. They can correlate shear rate of a fluid and pressure drop in a pipe line

5. They can understand different diffusion control mass transfer operations.

6. They can understand the vapour liquid mass transfer phenomenon in a distillation column

7. The can also realize about importance of reflux ratio and the concept of optimum reflux ratio for minimizing the cost of operation of a distillation column.

8. They can also understand about simultaneous mas and heat transfer phenomenon and different types of analogies between mass and heat transfer

Special Remarks (If any): For understanding of basic principles in Food processing Operations

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Food Technology

(Applicable from the academic session 2018-2019)

Name of the Course: Biochemistry & Nutrition	
Course Code: PC-FT 401	**Semester: IV**
Duration: 6 months	**Maximum Marks: 100**

Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./ week	Mid Semester Exam.: 15 Marks
Tutorial: 1 hrs./ week	Assignment & Quiz: 10 Marks
Practical: Nil	Attendance: 5 Marks
Credit Points: 4	End Semester Exam: 70 Marks

Objective:	
1	To develop the knowledge of students about biomolecules, relevant biochemical reactions and nutrition.
2	To enable the students to develop an insight on metabolism of different biomolecules and enzymatic pathways leading to end products
3	To make students understand about basic concepts of nutrition, different nutritional demands and dietary requirements
Pre-Requisite:	
1	Basic organic chemistry
2	Bio-molecules

Details of Syllabus:

Unit	**Content**	**Hrs/ Unit**	**Marks / Unit**
1	Introduction to Biochemistry in relation to food, Concept of metabolism with respect to food groups, Proteins and protein structures; Essential amino acids, Metabolism of proteins (digestion and absorption); Nitrogen balance and nitrogen pool; Evaluation of quality of proteins, Protein hydrolysate and their role in nutrition, bioactive peptides	8	
2	Enzymes; Definition, function in human nutrition , classification, nomenclature & structure; Co-enzymes and its function; Mechanism of enzyme action, enzyme kinetics & environmental effects; Enzyme inhibition, Common food enzymes, Enzymes for food industries and their role	6	
3	Carbohydrates; Definition & classification; Metabolic pathways for breakdown of carbohydrates: glycolytic pathway, citric acid	10	

	cycle, ATP balance, electron transport chain, gluconeogenesis, glycogenolysis, pentose phosphate pathway ; Cori cycle		
4	Lipids; Essential fatty acids; Digestion & absorption of lipids	6	
5	Vitamins & minerals: their common food sources and physiological functions.	4	
6	Nutrition: Balanced diet, Nutrition and calorie requirements, Dietary requirements and deficiency diseases of different nutrients, complex carbohydrates and metabolism, special nutrition needs during pregnancy, lactation, infancy, for children, adolescents and aged; nutrition and public health; glycemic index and load, introduction to therapeutic nutrition, sports foods and nutrition **food hypersensitivity: food allergy, food intolerancy, biogenic amines**	8	

Text and Reference Books:

TEXT

1. Principles of Biochemistry by Lehninger, Nelson & Cox, CBS Publication
2. Biochemistry and Nutrition by Debajyoti.Das,

REFERENCE

3. Food Chemistry by O. R. Fennema, Third Edition, Marcel Dekker, Inc., New York
4. Food chemistry by Belitz H.D., Grosch W. and Schieberle, Third Edn., Berlin: Springer Verlag
5. Food Chemistry by L. H. Meyer, CBS Publishers and Distributors

Course Outcome:

After completion of the course the students will be able to

1. They can relate (BT1) properties of macro as well as micronutrients of food
2. They can relate (BT2) these properties to interpret (BT2) properties of food
3. The student will be able to compare (BT4) different catabolic & anabolic pathways with human nutrition
4. This will help students for future study or research analysis& conclusion (BT4)
5. With the previous knowledge they are able to explain (BT5) the food formulation with respect to nutrition.

Special Remarks (If any):

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Food Technology

(Applicable from the academic session 2018-2019)

Name of the Course: Principles of Food Preservation	
Course Code: PC-FT 402	**Semester: IV**
Duration: 6 months	**Maximum Marks: 100**

Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./ week	Mid Semester Exam.: 15 Marks
Tutorial: 1 hrs./ week	Assignment & Quiz: 10 Marks
Practical: Nil	Attendance: 5 Marks
Credit Points: 4	End Semester Exam: 70 Marks

Objective:	
1	To introduce students about the importance of preserving food to prevent wastage and losses
2	To introduce students about the methods of preservation to increase shelf life of food commodities and retain its overall quality
3	To introduce students about the methods of preserving food for value addition
Pre-Requisite:	
1	Knowledge of biology, chemistry
2	Knowledge of basic mathematics
3	Knowledge of food chemistry, food microbiology

Details of Syllabus:

Unit	**Content**	**Hrs/ Unit**	**Marks/ Unit**
1	**Introduction to food preservation:** General principles of preservation; classification of methods used for preservation; need and importance of preservation at domestic and large scale; causes of food spoilage.	4	
2	Basic concepts of thermal destruction of microorganisms – lethality, D, Z and F values; assessment of adequacy of thermal processing of food processing operations; canning (definition, equipments, advantage, disadvantage, influence of canning on the quality of food, spoilage of canned foods); retorting process; commercial sterility; pasteurization (definition, time-temperature combination and equipments, application, advantage, disadvantage); blanching (definition, time-temperature combination and equipments, adequacy in blanching, application, advantage, disadvantage); sterilization of foods	10	
3	Principles of food freezing, basic working principle and application of different types of freezers, IQF; frozen storage of foods; freeze concentration, refrigerated storage; cold storage; cold chain; effect of low temperature storage on organoleptic and nutritional characteristics of	6	

	food.		
4	Drying and dehydrations: Sun drying, Freeze drying, drying phenomenon, factors affecting rate of drying, working principle of batch & continuous driers and their suitability for different foods; intermediate moisture foods, effect of drying on organoleptic and nutritional characteristics of food; osmotic dehydration.	8	
5	Preservation by microbial fermentation (principle, types, applications); Chemical preservatives; Biopreservation; lactic acid bacteria, antibiotics; lantibiotics; Hurdle technology, Principles of preservation by use of sugar and salt, curing, pickling; smoking, Overview of minimal processing	6	
6	Novel Non-thermal methods: HPP, ultrasonication, ohmic heating, microwave, pulsed electric field, pulsed light, cold plasma, ozone. Preservation by ionizing radiations (Sources of radiations, units and doses, irradiation mechanism, effect on microorganisms and different nutrients; dose requirements for radiation preservation of foods, safe limits);	6	

Revision: 5L

Text and Reference Books:

1. Technology of Food Preservation by Desrosier
2. Handbook of. Food Preservation. Second Edition edited by. M. Shafiur Rahman. CRC Press
3. Food Science by Potter
4. Fruits and vegetable processing by Cruss
5. Preservation of Fruits & Vegetables by IRRI

Course Outcome:

1. Relate the basic knowledge of food science to understand the need and importance of food preservation
2. Recognise and understand the causes of spoilage and how they affect the shelf life of food.
3. Describe the principles, working mechanism, advantages and disadvantages of different methods and techniques of food preservation
4. Apply the knowledge of mathematics and graphical derivation in process time calculations to estimate lethality of sterilisation processes and spoilage probability of food products.
5. Demonstrate the appropriate application of different preservation processes in specific foods ensuring maximum retention of nutritional and orgnoleptical quality of food products
6. Evaluate preservation principles in product design and value addition of food products

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Food Technology

(Applicable from the academic session 2018-2019)

Name of the Course: Numerical Methods & Statistical Technique	
Course Code: BS-FT 401	**Semester: IV**
Duration: 6 months	**Maximum Marks: 100**

Teaching Scheme	**Examination Scheme**
Theory: 2 hrs./ week	Mid Semester Exam.: 15 Marks
Tutorial: Nil	Assignment & Quiz: 10 Marks
Practical: Nil	Attendance: 5 Marks
Credit Points: 2	End Semester Exam: 70 Marks

Objective:	
1	The goal is to provide a basic understanding of the derivation, analysis, and use of these numerical and statistical methods, to solve the various problems and methods.
2	Purpose is to provide students with the skills, knowledge and attitudes required to provide solutions to mathematical problems which cannot always be solved by conventional analytical techniques,
3	Realize the importance of selecting the right numerical technique for a particular application, and carefully analyse and interpret the results obtained
Pre-Requisite:	
1	Basic engineering mathematics
2	

Details of Syllabus:

Unit	**Content**	**Hrs/ Unit**	**Marks / Unit**
1	**Approximation in numerical computation**: Truncation and rounding errors, Fixed and floating-point arithmetic, Propagation of errors.	4	
2	**Interpolation:** Newton forward/backward interpolation, Lagrange's and Newton's divided difference Interpolation.	5	
3	**Numerical integration**: Trapezoidal rule, Simpson's 1/3 rule, Expression for corresponding error terms.	3	
4	**Design of experiments**: Guidelines for designing experiments and importance of designed experiments in food research, Types of DOE: Full Factorial, fractional factorial, central composite design, rotatable central composite experimental design, box behenken design. Limitations of each.	9	
5	**Analysis of variance** of experiments with one or more fixed and random factors, Multiple comparisons. Analysis of residuals, Non-parametric ANOVA, Kruskal–Wallis test.	6	
6	Developing empirical equations using experimental data. Basics of RSM(Response surface methodology	4	
7	Application of Fuzzy logic to sensory evaluation and ranking of foods.	5	
8	**Applied Statistics:**	4	

	Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves.		
9.	**Test of significance**: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.	4	
10.	**Testing of fitness**:Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes	5	

Text and Reference Books:

Text Books:

1. C.Xavier: C Language and Numerical Methods.
2. Dutta & Jana: Introductory Numerical Analysis.
3. J.B.Scarborough: Numerical Mathematical Analysis.
4. Jain, Iyengar , & Jain: Numerical Methods (Problems and Solution).
5. **Experimental Designs, 2nd Edition,**William G. Cochran, Gertrude M. Cox,ISBN: 0-471-54567-5 May 1992

6.Montgomery, D.C. (2009). Design and Analysis of Experiments.

References:

1. Balagurusamy: Numerical Methods, Scitech.
2. Baburam: Numerical Methods, Pearson Education.
3. N. Dutta: Computer Programming & Numerical Analysis, Universities Press.
4. Soumen Guha & Rajesh Srivastava: Numerical Methods, OUP.
5. Srimanta Pal: Numerical Methods, OUP.

Course Outcome:

After completion of the course the students will be able to

CO1: Construct the interpolating polynomial for both equispaced and unequispaced arguments.

CO2: Apply numerical techniques to solve food engineering problems.

CO3: Construct graphical displays of science/engineering data and interpret the role of such displays in data analysis.

CO4: Apply basic statistical inference techniques, including confidence intervals, hypothesis testing and analysis of variance, to science/engineering problems.

CO5:Employ appropriate regression models to determine statistical relationships.

CO6: Construct optimal or good designs for a range of practical experiments

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Food Technology

(Applicable from the academic session 2018-2019)

Name of the Course: Professional ethics and IPR	
Course Code: HU-FT 401	**Semester: IV**
Duration: 6 months	**Maximum Marks: 100**

Teaching Scheme	**Examination Scheme**
Theory: 2 hrs./ week	Mid Semester Exam.: 15 Marks
Tutorial: Nil	Assignment & Quiz: 10 Marks
Practical: Nil	Attendance: 5 Marks
Credit Points: 2	End Semester Exam: 70 Marks

Objective:	
1	To create awareness amongst students on engineering ethics and Human values
2	To instill Moral and social values, loyalty and to appreciate the rights of others
3	To introduce the fundamental aspects of Intellectual Property Rights so as to make the students competent to play a major role in development and management of innovative projects in Industries
Pre-Requisite:	
1	Atleast 12 units of undergraduate study in a particular profession

Special Remarks (If any):

Details of Syllabus:

Unit	Content	Hrs/ Unit	Marks / Unit
1	**Morals, values and ethics-integrity-work ethic,** moral dilemmas, Kohlberg's theory-gilligan's theory-consensus and controversy, models of professional roles –theories about right action, Moral leadership-code of conduct, introduction to techniques of professional excellence and stress management. corporate social responsibility, respect for authority, confidentiality-conflicts of interest, occupational crime-professional rights, employee rights	3	
2	**Ethical issues in engineering** practice, social and ethical responsibilities of technologists, Conflicts between business demands and professional ideas , fair trade practices, case studies	2	
3	**Environmental ethics**, environmental regulations, Safety and risk-Assessment, risk benefit analysis and mitigation of risk,	3	
4	**Introduction to IPR**: Meaning of property, Origin, Nature, Meaning of Intellectual Property Rights,. Kinds of Intellectual property rights—Copy Right, Patent, Trade Mark, Trade Secret and trade dress, Design, Layout Design, Geographical Indication, Plant Varieties and Traditional	3	

	Knowledge		
5	**Patents and copyrights**—Origin, Meaning of Patent, Types, Inventions which are not patentable, Registration Procedure, Rights and Duties of Patentee, Assignment and licence , Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties. **Copyright-** Origin, Definition &Types of Copy Right, Registration procedure, Assignment & licence, Terms of Copy Right, Infringement, Remedies, Copy rights with special reference to food excipients, additives and processed products	8	
6	**Trademarks**—Origin, Meaning & Nature of Trade Marks, Types, Registration of Trade Marks, Infringement & Remedies, Offences relating to Trade Marks, Passing Off, Penalties.	3	
7	**Design**-Meaning, Definition, Object, Registration of Design, Cancellation of Registration, International convention of design- types and functions.	3	
8	**International registration systems**, Provision of IPR under TRIPS and WTO, unfair competitions, Legal implications and public concerns in genetic modification in foods, International and National policies of food security	3	

Text and Reference Books:

1. Ajit Parulekar and Sarita D Souza,Indian Patents Law-Legal and Business Implications, Macmillan India Ltd,2006

2. B. L.Wadehra, Law Relating to Patents, Trade Marks, Copyrights, Designs and Geographical Indications, Universal Law Publishing Pvt. Ltd., India 2000

3. P.Narayanan Law of Copyright and Industrial Designs, Eastern Law House, Delhi, 2010

4. Intellectual Property Rights in Agricultural Biotechnology;Edited by Erbish, Maredia, CABI

5. T.M.Murray and M.J.Mehlam, Encyclopedia of Ethical,Legal and Policy issues in Biotechnology,John Wiley and Sons 2000

6. S.K.Chakraborty:Values and Ethics in Organization,OUP

7. N.Tripathi,Human values,New age International Economic Reforms and Food Security.The Impact of trade and technology in South Asia by Suresh Chandra Babu,Haworth Press

Course Outcome:

After completion of the course the students will be able to

CO1: Debate interaction of moral and ethics in profession.

CO2: Relate informed critical reflection on the nature of professionalism and ethical challenges inherent in professionalism

CO3: Explain ethical concepts, challenges and dilemmas confronting members in various aspects of food industry

CO4: Explain the significance of various types of IPR with special reference to food industry

CO5: **Apply** the strategy of acquiring patent and copyright for own innovative works.

CO6: Identify plagiarized contents in written representations and innovations which can be questioned legally in works

Special Remarks (If any):

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Food Technology

(Applicable from the academic session 2018-2019)

Name of the Course: Environmental Sciences	
Course Code: MC-401	**Semester: IV**
Duration: 6 months	**Maximum Marks: 100**

Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./ week	Mid Semester Exam.: 15 Marks
Tutorial: Nil	Assignment & Quiz: 10 Marks
Practical: Nil	Attendance: 5 Marks
Credit Points: 0	End Semester Exam: 70 Marks
Atleast 45hrs/Sem	

Objective:	
1	To understand about different types of pollution of Environment
2	To get idea of Different type of biological Cycles in Nature
3	To understand about different types of pollution and their remedy
4	To understand Air pollution and greenhouse effect
5	To get idea about water pollution and their sources and remedial measure
6	To analyze water for pollution level organic and Inorganic load
7	To understand land pollution and its control
8	To Understand Different type of noise pollution its sources and remedial measure
9	To understand about different types of pollution of Environment
10	To get idea of Different type of biological Cycles in Nature
Pre-Requisite:	
1	At least15 units of undergraduate study in a particular profession
2	Basic knowledge of Chemistry, Biology and Mathematics

Details of Syllabus:

Unit	**Content**	**Hrs/ Unit**	**Marks / Unit**
1	Introduction: Basic ideas of environment, basic concepts, man, society & environment, their interrelationship. Environmental Laws of India Mathematics of population growth and associated problems, Importance of population study in environmental engineering, definition of resource, types of resource, renewable, non-renewable, potentially renewable, effect of excessive use vis-a-vis population growth, sustainable development.	**3**	
2	Materials balance: Steady state conservation system, steady state system with non conservative pollutants,step function. Environmental degradation: Natural environmental Hazards like Flood, earthquake, Landslide-causes,effects and control/management; Anthropogenic degradation like Acid rain-cause, effects and control.Nature and scope of environmental science and engineering.	**3**	
3	Ecology: Elements of ecology: System, open system, closed system, definition	**5**	

	of ecology, species, population,community, definition of ecosystem-components types and function. Structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desertecosystem, Aquatic ecosystems, Mangrove ecosystem (special reference to Sundarban); Food chain: definition and one example of each food chain, Food web. Biogeochemical Cycle- definition, significance, flow chart of different cycles with onlyelementaryreaction [Oxygen, carbon, Nitrogen, Phosphate, Sulphur]. Biodiversity- types, importance, Endemic species, Biodiversity Hot-spot,Threats to biodiversity, Conservation of biodiversity.		
4	Air pollution and control: Atmospheric Composition: Troposphere, Stratosphere, Mesosphere, Thermosphere, Tropopause andMesopause. Energy balance: Conductive and Convective heat transfer, radiation heat transfer, simple global temperature model [Earth as a black body, earth as albedo], Problems. Green house effects: Definition, impact of greenhouse gases on the global climate andconsequently on seawater level, agriculture and marine food.Global warming and its consequence, Control of Global warming.Earth's heat budget. Lapse rate: Ambient lapse rate Adiabatic lapse rate, atmospheric stability, temperature inversion (radiationinversion).	**8**	
5	Atmospheric dispersion: Maximum mixing depth, ventilation coefficient, effective stack height, smokestack plumes and Gaussian plume model. Definition of pollutants and contaminants, Primary and secondary pollutants: emission standard, criteriapollutant.Sources and effect of different air pollutants- Suspended particulate matter, oxides of carbon, oxides ofnitrogen, oxides of sulphur, particulate, PAN. Smog, Photochemical smog and London smog.Depletion Ozone layer: CFC, destruction of ozone layer by CFC, impact of other green house gases, effectof ozone modification. Standards and control measures: Industrial, commercial and residential air quality standard, controlmeasure (ESP. cyclone separator, bag house, catalytic converter, scrubber (ventury), Statement with briefreference).	**8**	
6	Water Pollution and Control: Hydrosphere, Hydrological cycle and Natural water.Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, thermalapplication, heavy metals, pesticides, volatile organic compounds. River/Lake/ground water pollution: River: DO, 5 day BOD test, Seeded BOD test, BOD reaction rateconstants, Effect of oxygen demanding wastes on river[deoxygenation, reaeration], COD, Oil, Greases, pH. Lake: Eutrophication [Definition, source and effect]. Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only) Standard and control: Waste water standard [BOD, COD, Oil, Grease],Water	**8**	

	Treatment system [coagulation and flocculation, sedimentation and filtration, disinfection, hardnessand alkalinity, softening]Waste water treatment system, primary and secondary treatments [Trickling filters, rotating biologicalcontractor, Activated sludge, sludge treatment, oxidation ponds] tertiarytreatment definition.		
7	Water pollution due to the toxic elements and their biochemical effects: Lead, Mercury, Cadmium, andArsenic Land Pollution: Lithosphere; Internal structure of earth, rock and soil. Solid Waste: Municipal, industrial, commercial, agricultural, domestic, pathological and hazardous solidwastes; Recovery and disposal method- Open dumping, Land filling, incineration, composting, recycling.Solid waste management and control (hazardous and biomedical waste).	**4**	
8	Noise Pollution: Definition of noise, effect of noise pollution, noise classification [Transport noise, occupational noise,neighbourhood noise] Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noiselevel, L_{10}(18hr Index), Ld_n. Noise pollution control. Environmental Management:Environmental impact assessment, Environmental audit, Environmental laws and protection act of India,Different international environmental treaty/ agreement/ protocol.	**6**	

Text and Reference Books:

Revision: 5L

References/Books

1. Masters, G. M., "Introduction to Environmental Engineering and Science", Prentice-Hall of IndiaPvt. Ltd., 1991.
2. De, A. K., "Environmental Chemistry", New Age International.

Course Outcome:

1. After completion of the course the students will be able to understand about nature of different pollution and their sources
2. They can also learn about Environmental law of the country
3. They can also learn about the nature of industrial waste coming out of different Food Industry
4. They can also have an idea about removal of different water pollutant
5. They can also understand about different type of air pollutant and their method of removal.
6. They can also have some basic idea of solid waste Management and treatment process.

Special Remarks (If any): For understanding of basic principles in Food processing Operations

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Food Technology

(Applicable from the academic session 2018-2019)

Name of the Course: Unit Operation Lab	
Course Code: ES-FT 491	**Semester: IV**
Duration: 6 months	**Maximum Marks: 100**

Teaching Scheme	**Examination Scheme**
Theory: Nil	Maximum marks: 100 Marks
Tutorial: Nil	Continuous Internal Assessment: 40 Marks
Practical: 3 hrs./ week	External Assessment: 60 Marks
Credit Points: 1.5	Distribution of marks: Experiments - 40 Marks Viva -20 Marks

Course Objective: After the end of the course students are expected to:

1.	Recall several fundamental equations of fluid flow and heat transfer in understanding the subject.
2.	Understand several unit operations are carried out in Food Processing Industries by applying knowledge of the lab.
3.	Assess some process line intricacy by applying knowledge of this lab
4.	Enhance their ability to work in a team.
5.	Enhance their oral and written communication skills through published paper review, analysis and presentation.
6	**Make use of** this knowledge for understanding of operations in industrial distillation in alcohol industries.
7	**Analyse** different Industrial scale absorption and stripping operations
8	**They can understand diffusional phenomenon and mass and heat transfer analogies**

Course Outcomes: After the end of the course students shall be able to:

1	Learn the different aspect of fluid flow in a pipe line and through packed bed
2	The engineering aspect of heat transfer phenomenon.
3	Food processing operations and different mechanical operations in Food processing industries.
4	Apply the knowledge of mathematics, science, engineering fundamentals and engineering specialization to the solution of complex Engineering problem
5	**After leaning the subject they can analyze operation in distillation plant**
6	**They can understand interphase mass transfer operation in absorption column**

Pre-Requisite: Before the beginning of the course all students must have an awareness and understanding of:

1.	Nature of fluid and flow characteristics
2.	Basic principles of heat transfer.
3.	Basic idea about mechanical operation and mass transfer operation.
4.	Application of diffusional mass transfer operation in different separation process.
5.	Basic idea about heat transfer with phase change
Practical:	
1.	**Intellectual skills-**Knowledge & Understanding, Critical Thinking, Problem Solving Skills
2.	**Motor skills-**Hand – eye co-ordination, Attention to detail, Manipulative skills.

Laboratory Experiments:	
1	Experiments on Reynolds's Apparatus –Determination of flow regime and construction of friction factor againstNRE
2	Experiments on flow measuring device — in closed conduit using (a) Venturimeter, (b) Orifice meter, (c)Rotameter.
3	Determination of Pressure drop for flow through packed bed & verification of Ergun Equation, Kozeny-Karman equation, Blake-Plummer Equation.
4	To study the working characteristics of a Jaw Crusher, calculate the energy consumption as afunction of size reduction and compare it with the actual energy requirements.
5	To study the working characteristics of a Ball Mill, calculate the energy consumption as a function of size reduction and determine the critical speed.
6	To Determine the Overall heat transfer coefficient of a concentric pipe heat exchanger based on the insidediameter of the tube.
7	To study the characteristics of film-wise/drop-wise condensation.
8	Separation: Filtration, centrifugation
9	Mass transfer coefficient / kLa determination
10	Determination of Distillation efficiency in a sieve plate distillation column.
11	Differential distillation and verification of Rayleigh's Equation
12	Differential distillation and verification of Rayleigh's Equation
13	Liquid liquid mixing

Text and Reference Books

Books :

1.Unit Operations of Chemical Engineering: McCabe, Smith &Harriot, TMH, 5th edition
2. Transport Processes & Unit operations: Geankopolis, PHI, 3rd edition
3. Chemical Engineering, Vol-I & II: Coulson & Richardson, Butterworth Heinemann
4. Heat Transfer: D.Q. Kern, MGH
5. Badger, W.L., Banchero, J.T., Introduction to Chemical Engineering, MGH
6. Foust, A.S., Wenzel, L.A., et.al. Principles of Unit Operations, 2nd edition, JWS
7. Perry, Chilton & Green, Chemical Engineers' Handbook, MGH

Special Remarks (If any): Nil

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Food Technology

(Applicable from the academic session 2018-2019)

Name of the Course: Biochemistry Lab	
Course Code: ES-FT 492	**Semester: IV**
Duration: 6 months	**Maximum Marks: 100**

Teaching Scheme	**Examination Scheme**
Theory: Nil	Maximum marks: 100 Marks
Tutorial: Nil	Continuous Internal Assessment: 40 Marks
Practical: 3 hrs./ week	External Assessment: 60 Marks
Credit Points: 1.5	Distribution of marks: Experiments - 40 Marks Viva -20 Marks

Objective:	
1	Understand the biochemical composition of food
2	Comprehend the different methods of separation and isolation methods of biochemical components of food
3	Comprehend the principle and kinetics of different enzymatic assays
4	Understand and use effectively BOD5 and COD methods to evaluate water pollution
5	Analyze effectively the data to reach reasonable and valid conclusion
6	Design appropriate methods for biochemical assays in real situation
Pre-Requisite:	
1	Handling of glasswares, chemicals and equipments
2	Basic knowledge of solution preparation, chemical reactions
3	Spectrophotometric , titrimetric, gravimetric, volumetric principles

Practical:	
	1) Intellectual skills-
	2) Motor skills- Spectrophotometer,centrigfuge, pH meter, Hot Air Oven/ Moisture Analyzer, Incubator, Vortex machine, Titration,electrophoresis, Glasswares, chemicals & consumables

Laboratory Experiments:	
1	Separation of amino acids/sugars by Ascending Paper Chromatography.
2	Separation of sugars/ lipids by Thin Layer Chromatography.
3	Separation and isolation of proteins/amino acids by Paper Electrophoresis.
4	Determination of BOD5 and COD of a sample of waste water.
5	Preparation of cell-free extract: Bacterial cell by sonication, Chicken liver by homogenization.
6	Assay of enzyme activity − (a) Phosphatase assay [Chicken liver] (b) Protease assay
7	Study of an enzymatic reaction.

Text and Reference Books:

1. Nielsen, S. S. (Ed.). (2010). Food analysis (pp. 139-141). New York: Springer.
2. Jeantet, R., Croguennec, T., Schuck, P., & Brule, G. (Eds.). (2016). Handbook of Food Science and Technology 3: Food Biochemistry and Technology (Vol. 3). John Wiley & Sons.
3. Official methods of analysis of AOAC

Special Remarks (If any): Nil

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Food Technology

(Applicable from the academic session 2018-2019)

Name of the Course: Numerical Method Lab	
Course Code: BS-FT 491	**Semester: IV**
Duration: 6 months	**Maximum Marks: 100**

Teaching Scheme	**Examination Scheme**
Theory: Nil	Maximum marks: 100 Marks
Tutorial: Nil	Continuous Internal Assessment: 40 Marks
Practical: 2 hrs./ week	External Assessment: 60 Marks
Credit Points: 1	Distribution of marks: Experiments - 40 Marks Viva -20 Marks

Objective:	
1	**Demonstrate** the use of a range of standard numerical methods to solve complex engineering problems
2	**Apply** computational techniques as tools in solving engineering problems
3	**Demonstrate** a movement towards ongoing independent development of applying numerical methods to real engineering situations
4	**Interpret** Graphical presentations of data

Pre-Requisite:	
1	Basic computation and mathematics
2	Data collection and representation

Practical:	
	1) Intellectual skills- Critical thinking and reasoning**,** Analysing, interpreting ,summarizing
	2) Motor skills- use of computer and programming

Laboratory Experiments:	
1	Assignments on Newton forward /backward, Lagrange's interpolation
2	Assignments on numerical integration using Trapezoidal rule, Simpson's 1/3 rule, Weddle's rule
3	Assignments on numerical solution of a system of linear equations using Gauss elimination and Gauss-Seidel iterations
4	Assignments on numerical solution of Algebraic Equation by Regular-falsi and Newton Raphson methods.
5	Assignments on ordinary differential equation: Euler's and Runga-Kutta methods.
6	Introduction to Software Packages: Matlab / Scilab / Labview / Mathematica
7	**Generate** Various types of DOE using Minitab,/Design Expert,
8	**Perform** regression analysis using Minitab,/Design Expert /SPSS

9	**Construct** graphical displays of science/engineering data and interpret the role of such displays in data analysis.
10.	Assignment on performing ANOVA for a given data
11	Perform sensory evaluation for a food product using fuzzy logic

Text and Reference Books:

Special Remarks (If any): Nil