Department of Food Engineering
From Batch 2013-2014

CURRICULUM

First Year (Fall Semester) Food Engineering

COURSE CODE/TITLE	SEMESTER/TERMS OFFERED	CREDITS
CY-106 Chemistry	FE Fall Semester	3+1

PREREQUISITES	Knowledge Area
Intermediate Chemistry	Engineering (Foundation)

COURSE OBJECTIVES

- To enable the students understand the fundamental concepts of chemistry (inorganic, organic, physical and analytical).
- To develop conceptual approach in solving problems and numericals.
- To enable the students make structures by using chemistry software, biochem draw.
- To apply theoretical knowledge in performing experiments.
- To develop relevance of chemistry to its hybrid fields.

COURSE TOPICS

Concept Review

Units and measurements; Gas laws; partial pressure; diffusion; problem solving with appropriate units.

Water, Solution and Colloidal

Properties of water; water as solvent; solutions; representation of concentration of solution; osmosis; Van't Hoff's Law; osmotic pressure; types and properties of colloids; adsorption and absorption; dialysis and blood; chromatography; spectrophotometry.

Introduction to Thermodynamics and Thermo chemistry

Thermochemical laws; Laws of thermodynamics as applied to biochemical systems.

Chemical Equilibrium

Equilibrium constant; temperature dependence.

Chemical Kinetics

The idea of a reaction mechanism; definition of rate and order of reaction; kinetic properties of enzymes.

Acids and Bases: Proton Transfer Equilibrium in Aqueous Solutions

Dissociation of water; ionization of weak acid and base; buffer solution: Henderson–Hasselbalch equation; electrochemical process; electrode potential; pH-meter; redox potential; respiratory regulation involving acid-base balance; applications and problems.

Review of Organic Chemistry

The covalent bond; hybridization; stereoisomerism (optical/cis-trans isomerism); functional groups and chemical reaction with physiologic analogies; alcohols (oxidation, esterification, ether formation); aldehydes & ketones (oxidation, reduction, hemiacetal and acetal formation, aldol condensation); carboxylic acids (reduction, ester formation, acid anhydride formation, salt formation, amide formation); amines.

Materials

Polymers (natural and synthetic); biomaterials (composite, metallic, ceramic, polymeric & biologic).

TEXTBOOK

- Chemistry by Martin.S.Silberberg's, 3rd edition.
- Organic Chemistry by Morrison & Boyd, 6th edition.
- Biomaterials, Principles and Applications by Joonb Park & Joseph D. Bronzino.
- Essentials of Physical Chemistry by B.S. Bahal, ArunBahal and G.D.Tuli.

COURSE CODE/TITLE	**SEMESTER/TERMS OFFERED**	**CREDITS**
FD-101 Introduction To Food Engineering	FE Fall Semester	3+0
PREREQUISITES	**Knowledge Area**	
Intermediate Physics and chemistry	Engineering (Foundation)	

COURSE OBJECTIVES

- To understand fundamental principles in different areas of Food Engineering like fluid mechanics, thermodynamics, preservation, processing.
- To understand various Refrigeration and Freezing systems.
- To understand Thermal treatment during food processing
- Get introduced to Unit operations & Preservation techniques in Food processing
- Use of mass and energy balance as a basis in Food process Analysis

COURSE TOPICS

Historical Background of Food Engineering:

Food engineering and its scope, Importance of chemistry and biological science in food engineering.

Food Processing:

Baked and snack foods, honey, syrups, confectionery, beverages, milk and fish

Thermal Techniques in Food Processing:

Heat processing of food, Freezing and cold storage, Microwave heating

Food process and plant design:

Personal cleanliness, buildings and facilities, Plant layout, Food process design

Preservation Techniques in Food Processing:

Food processing from harvest to preservation, packaging and distribution

TEXTBOOKS

- Introduction to Food Engineering; R.Paul Singh & Dennis R Heldman; Fourth Edition, AP &Elseiver.
- Casestudies in Food Processing; J.Peter Clark, Ed 2009, Springer.

COURSE CODE/TITLE	**SEMESTER/TERMS OFFERED**	**CREDITS**
HS-104 Functional English	FE Fall Semester	3+0
PREREQUISITES	**Knowledge Area**	
Intermediate	Humanities	

COURSE OBJECTIVES

- To enhance language skills and develop critical thinking.

COURSE TOPICS

Study Skill (*); advanced reading skills using variety genre and texts; listening & speaking (*); skill; oral communication skills development; precise writing; controlled & guided writing; essay writing; writing book & informal reports; informal & formal letters and memos; creating advertisements; applied grammar; sentence correction sentence completion; transformation of sentences; question tages; homonyms/homophones, sentence making, punctuation; extracts; conversations etc.; use of idioms.

COURSE CODE/TITLE	SEMESTER/TERMS OFFERED	CREDITS
PH-126 Physics	FE Fall Semester	3+1

PREREQUISITES	Knowledge Area
Elementary Physics	Natural sciences

COURSE OBJECTIVES

- To attained a common level in basic mathematically-based physics, and so laid a secure foundation in physics for their future courses within the Natural Sciences and Engineering subjects.
- To acquired a broad introduction to a range of sciences at University level.

COURSE TOPICS

Vectors:

Vectors & vector derivatives; gradient of a scalar functions; line and surface integrals; curl & divergence.

Mechanics:

Coordinate systems; motion under constant acceleration; uniform circular motion; projectilemotion; frictional forces; fluid friction; work and energy principle; angular momentum.

Elasticity:

Stress and strain; elastic properties of matter; physical basis of elasticity; tension; compression and sharing; modulus of rigidity; relation between three types of elasticity.

Wave, Optics and Laser:

Standing waves and its analytical treatments; travelling waves; interference; diffraction and polarization phenomenon; laser; stimulated emission; population inversion; laser applications.

Modern Physics:

Inadequacy of classical physics: Black body radiation; photoelectric effect; Compton scattering; De-Broglie wave particle duality hypothesis; uncertainty principle; quantum physics.

Atomic spectrum: Atomic spectra; Bohr theory and hydrogen spectrum; modification and generalization.

Nuclear physics: Properties of nuclear; nuclear stability; Alpha, Beta and Gamma decay. Radioactivity & radioactive equilibrium; secular equilibrium; radiation detectors; GM tube; counters and nuclear reactor.

Thermodynamics:

Closed and open systems; specific heats; thermal expansion; internal energy; enthalpy and specific heat of ideal gasses; heat transfer; energy transfer by work; mechanism of heat transfer; Zeroth law, first law; (application for closed and open systems); second law and third law of thermodynamics; concept of entropy; low temperature; methods of production of low temperature Joule-Kelvin effect.

TEXTBOOK.

- Raymond A. Serway and Robert J. Beichner and John W. Jewett, "Physics for Engineers and Scientists with Modern Physics",5th ed. 2007, Brooks / Cole USA.
- Paul Peter Urone "College Physics",2nded., 2000, Brooks / Cole USA.
- Halliday, Resnick and Krane, "Physics", 5th ed., 2005, John Wiley and Sons, New Dehli,India

COURSE CODE/TITLE BM-108 Computer Aided Engineering Graphics	SEMESTER/TERMS OFFERED FE Fall Semester	CREDITS 1+2
PREREQUISITES ---	**Knowledge Area** Computing	

COURSE OBJECTIVES

Introduction to assist in the creation, modification, analysis, or optimization of a design.
Describe the process of creating a technical drawing with the use of computer software
To increase the productivity of the designer, improve the quality of design, improve communications through documentation, and to create a database for manufacturing.

COURSE TOPICS

Introduction to Computer Aided Drafting:

Introduction to the Engineering design Process, Technical Graphics basics, Orthographic projection and Isometric drawings and basic concepts of Conventional engineering drawings.
Opening a new drawing, paper setting, coordinate systems: User's coordinate system (UCS), Cartesian coordinates and Polar coordinates; saving a drawing.

Creating Elementary Objects:

Apply the Commands: Grid, Ortho, Escape, Erase, Trim, Undo, Draw Lines, Circles, Ellipse, Rectangle And Arcs.

Basic Object Editing:

Apply the following commands: Move, offset, rotate, fillet, chamfer, array and mirror.

Dimensioning:

Show the following dimensioning: Linear, aligned, radial and changing dimensional setting.

Solid Modeling:

Apply the following commands to create 3-D models: Region, extrude, revolve, slice and show plan; elevation and end view of a 3-D model.

Controlling Drawings:

Apply the following commands for a given drawing: Hatching, coloring and rendering.

Text:

Apply the following commands on the given drawing: Creating text, style of text and changing text properties.

Plotting Drawings:

Apply the following commands: Plotting, print preview and printing.

TEXTBOOK

- Engineering Design Graphics with AutoCAD; James H. Earle, 12th ed. 2007, Addison Wesley.
- Technical Graphics Communication; Gary Robert Bertoline, Eric N Wiebe, Nathan W. Hartman, William A. Ross, 4th ed. 2008, McGraw Hill.
- AutoCAD 2008: A Problem Solving Approach; Sham Tickoo, 1st ed. 2007, Autodesk Press.

First Year (Spring Semester) Food Engineering

COURSE CODE/TITLE	SEMESTER/TERMS OFFERED	CREDITS
CY-108 Analytical Chemistry	FE Spring Semester	3+1

PREREQUISITES	Knowledge Area
Chemistry, Introduction to Food Engineering	Engineering (Foundation)

COURSE OBJECTIVES

- Obtaining understanding of Analytical Techniques used in food sector
- Designing testing protocols for Industrial Testing
- Analytical techniques in Quality Control
- Understanding of Analytical techniques and their use

COURSE TOPICS

Introduction to Analytical Chemistry:

Review of some basic concepts, statistical analysis; mean, median, mode, standard deviation, relative standard deviation, variance.

Gravimetric and Volumetric Analysis:

Volumetric analysis; neutralization titration, complexation titration, oxidation-reduction titration and precipitation titration; gravimetric analysis; precipitation method, thermo gravimetric method and volatisation method.

Aqueous Solution:

Standard solution, primary and secondary standards, concentration of solutions, chemical equilibrium calculation.

Potentiometric Techniques:

Potential difference and standard electrode potential, potentiometric titrations and use of potentiometry for qualitative analysis, pH meter (pH, buffer solutions, pH of polyfunctional acids).

Chromatography:

Gas chromatography, high-performance liquid chromatography, ionexchange chromatography, paper chromatography, thin layer chromatography, electrophoresis.

Spectroscopic Methods:

Molecular and atomic spectroscopy.

TEXTBOOKS

- Encyclopedia of Analytical Science; Paul Worsfold, Elen Townshend & Colin Poole; Ed 2nd,Elseiver
- Quantitative Chemical Analysis; Daniel C Harris; Eight Edition, 2010; W.H. Freeman & Company
- Vogel's Quantitative chemical Analysis
- Instrumental Methods for Food Analysis; J.R.J Pare &J.M.R Belanger,ed.1997, Elseiver

COURSE CODE/TITLE MT-114 Calculus	SEMESTER/TERMS OFFERED FE Spring Semester	CREDITS 3+0
PREREQUISITES Introduction to Mathematics	**Knowledge Area** Natural Sciences	

COURSE OBJECTIVES

- To provide a thorough understanding of the chief topics in basic calculus.
- To be able to use the basic principles of calculus and apply them in the advanced courses of the curriculum of Food Engineering.
- To familiarize with the methods employed in solving key problems related to the principles of calculus.

COURSE TOPICS

Set and Functions:

Define rational, irrational and real numbers; rounding off a numerical value to specified number of decimal places or significant figures; solving quadratic and rational inequalities in involving modulus with graphical representation. Definition of set, set operations, venn diagrams, DeMorgan's laws, Cartesian product; relations; function and their types; absolute value; greatest integer and combining functions. Graph of some well-known functions, limit of functions, continuous and discontinuous functions with graphical representation.

Propositional Logic:

Definition of proposition; statement and argument; logical operators; simple and compound proposition; various types of connectives; truth table; Tautology; contradiction; contingency & logic equivalence.

Boolean Algebra:

Definition; boolean function; duality; some basic theorems & their proofs. Two values boolean algebra, truth functions, canonical sum of product form, digital logic gates & switching circuit designs.

Complex Number:

Argand diagram; DE Moivres formula root of polynomial equations; curve and regions in the complex plane; standard functions and their inverses (exponential, circular and Hyperbolic functions).

Differential Calculus:

Differential and successive differentiation and its application: Leibnitz theorem. Taylor and Maclaurin theorems with remainders in Cauchy and Lagrange from power series. Taylor and Maclaurin series; L Hopitals rule; extreme values of a function of one variable using first and second derivative test; asymptotes of a function curvature and radous of curvature of a curve; partial differentiation exact differential and its application in computing errors; extreme values of a function of two variables with a without constrains. Solution of non-linear equation using Newton Raphson method.

Integral Calculus:

Indefinite integrals and their computational techniques; reduction formulae, definite integrals and their convergence. Beta and Gamma functions and their identities, applications of integration (centre of pressure and depth of centre of pressure).

Solid Geometry:

Coordinate system in three dimensions; direction cosines and ratios equation of a straight line, plane and sphere; curve tracing of a function of two and three variables; surfaces of revolutions; transformations (Cartesian to polar & cylindrical).

TEXTBOOK

- Calculus; Howard Anton, Irl Bivens and Stephen Davis, 7th ed. 2002, John Willey.
- Calculus; George B. Thomas, Ross L. Rinney and Maurice D. Weir, 10th ed. 2002, Addison Wesley.

COURSE CODE/TITLE	SEMESTER/TERMS OFFERED	CREDITS
EL-254 Programming with C-Language CS-103 Programming Languages (Revised)	FE Spring Semester	2 + 2

PREREQUISITES	Knowledge Area
---	Computing

COURSE OBJECTIVES

- To introduce students about basic programming techniques, computing and execution of C programme.

COURSE TOPICS

The Turbo C Programming Environment:

Setting up the integrated development environment; file used in C program development; use of integrated development environment; the basic structure of C program; explaining the printf( ) function.

C Building Blocks:

Variables; input/output; operators; comments.

Loops:

The for loop; the while loop; the do while loop.

Decisions:

The if statement, the if-else statement; the else-if construct; the switch statement; the conditional operator.

Functions: Simple functions; functions that return a value, using arguments to pass data to a function; using more than one functions; external variables; prototype versus classical K and R; preprocessor directives.

Arrays and Strings:

Arrays; referring to individual elements of the array; string; string functions; multidimensional arrays.

Pointers:

Pointer overview; returning data from functions; pointers and arrays; pointers and strings; double indirection; pointers to pointers. Structures, unions and ROM BIOS.

Turbo C Graphics Functions:

Text-mode functions graphics - mode functions. Text with graphics.

Files:

Types of disk I/O, standard, input/output binary mode and text mode; record, input/output; random access; error conditions; system level input/output; redirection.

Advanced Variables:

Storage classes, enumerated data type, renaming data type with typedef; identifiers and naming classes; type conversion and casting; labels and goto statement.

c++ and Object Oriented Programming:

Object oriented programming, some useful c++ features, classes and objects; constructors and memory allocations; inheritance; function overloading; operator overloading.

TEXTBOOK

- The Waite Group's Turbo C Programming for the PC & Turbo C++; 1988, Sam Robert Lafore.
- Let us C; YashwantKanatkur, 8th ed. 2008, Infinity Science Press.
- Turbo C/C++: The Computer Reference; 2nd ed. 1992, Herbert Schildt.

COURSE CODE/TITLE EL-232 Electronics	**SEMESTER/TERMS OFFERED** FE Spring Semester	**CREDITS** 3+1
PREREQUISITES	**Knowledge Area** Engineering (Foundation)	

COURSE OBJECTIVES

To understand the concepts of Conduction in solids, semiconductors and diodes, electronic emission devices, Simple diode circuits and applications, bipolar and field effect transistors, and amplifier circuits.

COURSE TOPICS:

Conduction in Solids

Introduction, Mechanics of conduction, Mobility, Bohr's model for the elements, Energy level diagrams for solids, Conductors, Intrinsic and extrinsic semiconductors, Electron-hole pairs in an intrinsic semiconductor, Distribution of electron and hole in conduction and valence bands, Recombination and lifetime.

Semiconductors and Diodes

Donor and acceptor impurities, Zero biased, Forward biased and reverse biased junction diodes, Junction diode current equation, Depletion barrier width and junction capacitance, Diffusion capacitance, Zero and Avalanche break down, Hall effect, Fabrication of pn junction, Diodes.

Electron Emission Devices

Types of electron emissions, Thermionic diode, Volt ampere characteristics, Child Langmuin power Law, Gas filled diode, Thermionic triode, Parameters and characteristics, Tetrode, Pentode, and beam power tubes , Parameters and characteristics.

Simple Diode Circuits and Applications

Mathematical and graphical analysis of diode circuits, The ideal and non ideal diodes, Piecewise linear models, Analysis of piecewise linear models of vacuum tube and junction diodes, The half wave rectifier, The inductance filter, The inductance capacitance filter circuits, Zener and gas diode, Voltage regulatorcircuits, Clamping and DC restorer circuits, Voltage doubler circuits, Clipping and limiting circuits.

Bipolar and Field Effect Transistors

Transistor biasing and thermal stabilization, The operating point, Bias stability, Collector to base bias, Fixed bias, Emitter feedback bias, Stabilization for the self biased circuits, Field effect transistors, Basicprinciples and theory, Types, FET characteristics, Different configurations-common gate, Common sourceand common drain, The FET, small signal model, Parameters, Biasing of the FET.

Amplifier Circuits

Introduction "h" parameters, Hybrid model for transistor, Elementary treatment, Low frequency transistor amplifier circuits, Stage cascaded LF.

TEXTBOOK

- Understanding Basic Electronics,Arrl,2nd edition, 2010

COURSE CODE/TITLE	SEMESTER/TERMS OFFERED	CREDITS
HS-105 Pakistan Studies	FE Spring Semester	2+0

PREREQUISITES	Knowledge Area
---	Humanities

COURSE OBJECTIVES

- To develop vision of historical perspective, government, politics, contemporary Pakistan, ideological background of Pakistan.

COURSE TOPICS

Historical and Ideological Perspective of Pakistan Movement:

Two nation theory; definition; significance; creation of Pakistan; factors leading to the creation of Pakistan; Quaid-e-Azam and the demand of Pakistan.

Land of Pakistan:

Geo-physical conditions; geo-political and strategic importance of Pakistan; natural resources-mineral; water and power.

Constitutional Process:

Early efforts to make a constitution - problems and issues; constitution of 1956 and its abrogation; constitution of 1962 and its abrogation; constitutional and political crisis of 1971; constitution of 1973; recent constitutional developments.

Contemporary Issues in Pakistan:

A brief survey of Pakistan economy; agricultural and industrial development in Pakistan; internal and external trade; economic planning and prospects; social issues; literacy & education in Pakistan; state of science & technology with special reference to IT education; Pakistan society and culture; environmental issues; hazards of atmospheric pollution; other forms of environmental degradation & their causes & solution; Pakistan's role in preservation of nature. Through international conventions/efforts.

Foreign Policy:

Relations of Pakistan with neighbors; super powers; Muslim world.

Human Rights:

Conceptual foundations of human rights; what are human rights? Definition; significance and importance; comparative analysis of Islamic and western perspectives of human rights; UN system for protection of human rights; an overview; UN charter; international bill of human rights; implementation mechanism; other important international treaties and conventions; the convention on the elimination of all forms of discrimination against woman; international convention on the right; of child (CRC); convention against torture (CAT); refugee convention; Pakistan's response to human rights; at national and international level; constitutional provisions; Pakistan's obligations to international treaties and documents; minority rights in Pakistan; Pakistan's stand on violation of human rights in the international perspective.

COURSE CODE/TITLE	SEMESTER/TERMS OFFERED	CREDITS
HS-127 Pakistan Studies (For Foreigners)	FE Spring Semester	2+0

PREREQUISITES	Knowledge Area
---	Humanities

COURSE OBJECTIVES

- To acquaint students with the history of creation of Pakistan.
- To provide them basic knowledge about Pakistan
- To develop their interest in Pakistan by highlighting common features in the fields of culture, language, literature and foreign affairs.

COURSE TOPICS

Land of Pakistan:

Land & People, Strategic importance, Important beautiful sights, Natural resources.

A brief Historical background:

A brief Historical survey of Muslim community in the sub-continent, British rule & its impacts, Indian re-action, Two nation theory – Origin & development, Factors leading towards the demand of a separate Muslim state, Creation of Pakistan

Government & Politics in Pakistan:

Constitution of Pakistan – A brief outline, Governmental structure – Federal & Provincial, Local Government Institutions, Political History – A brief account, Pakistan & the Muslim World, Relations with the Muslim countries.

Language and Culture:

Origins of Urdu Language, Influence of Arabic & Persian on Urdu Language & Literature, A short history of Urdu literature.

Second Year (Fall Semester) Food Engineering

COURSE CODE/TITLE	SEMESTER/TERMS OFFERED	CREDITS
BM-201 Engineering Mechanics	SE Fall Semester	3+1

PREREQUISITES	Knowledge Area
Intermediate Physics and Mathematics	Engineering (Foundation)

COURSE OBJECTIVES

- To give an introduction to the basic quantities and idealization of mechanics.
- Enable the students to resolve forces into component using parallelogram law and to express them in Cartesian vector form.
- To understand the concepts of free body diagram and apply the equations of static equilibrium for different systems.
- Identify and model various types of loading and support conditions that act on structural systems
- To learn to analyze the behavior of systems with friction.
- Enable students to apply the description of kinetic and kinematic quantities such as forces, moments, position, velocity, acceleration and to relate them to one another by applying knowledge of vector calculus.

In brief, the purpose of this course is to aware students to the actual concepts of vectors so that they could apply the principles of mechanics to any biological system.

COURSE TOPICS

Introduction:

General principles; units of measurement

Force Vectors:

Addition of vectors; Cartesian vectors; free vector; position vectors; force directed along a line.

Equilibrium of a Particle:

Conditions for the equilibrium; free body diagram; 3D force systems; force system resultants; moment of force; Virognon's theorem; cross product; moment of a couple; equivalent systems.

Equilibrium of a Rigid Body:

Equilibrium in 2D and 3D; constrains for a rigid body; redundant and improper constraints.

Friction:

Types of friction; angle of repose; application of friction.

Kinematics of a Particle:

Rectilinear motion; curvilinear motion; motion of projectile; absolute dependent motion of two particles.

Kinetics of a Particle:

Equation of motion for a system of particle; equation of motion in rectangular, cylindrical, normal and tangential coordinates; principles of work and energy for a system of particles; linear momentum; conservation of momentum; impact; angular momentum; kinematics of a rigid body; translation; rotation.

TEXTBOOK

- Engineering Mechanics Statics; R. C. Hibbeler, 12th ed. 2007, Pearson Prentice Hall.
- Engineering Mechanics Dynamics; R. C. Hibbeler, 12th ed. 2007, Pearson Prentice Hall.

COURSE CODE/TITLE	SEMESTER/TERMS OFFERED	CREDITS
FD-201 Thermodynamics	SE Fall semester	3+1
PREREQUISITES	**Knowledge Area**	
Physics	Engineering (Breadth)	

COURSE OBJECTIVES

Thermodynamics applies on the biological cellular and systems level. At this most fundamental level, thermodynamics studies the flow of energy, interconversion of energy, maintenance of cellular function and information, and the processes necessary to sustain life itself.

COURSE TOPICS:

Thermodynamics:

Thermodynamics and energy; dimensions and units; systems and control volume; properties.

Energy and Energy Transfer:

Forms of energy; energy transfer by heat and work; mechanical work; first law of thermodynamics. Pure substances; phases of pure substance; property diagrams and tables; ideal gas equations; compressibility factor. Mass and energy analysis for closed systems and control volumes; examples.

Second Law of Thermodynamics & Entropy:

Second law concepts; reversible and irreversible process; Carnot cycle; entropy; isentropic processes; increase of entropy principle. Power and Refrigeration cycles; Essential equipment.

Thermodynamics Properties for Mixture:

Maxwell relations; Clapeyron equation; Joule Thomson Coefficient; Gibbs free energy and fugacity for pure substance; criteria for phase equilibria in multi-component system; vapor-liquid equilibrium.

Chemical & Phase Equilibria:

Chemical equilibrium in single phase system; chemical reactions; combined chemical and phase equilibrium. pH as criteria for ionization of biochemicals;

TEXTBOOK

- Thermodynamics – An Engineering Approach; Cengel& Boles, 12th ed. 2016, Tata McGraw.
- Chemical, Biochemical and Engineering Thermodynamic; Stanley L. Sandler, 5th ed. 2006, John Wiley & Sons, Inc.

COURSE CODE/TITLE	SEMESTER/TERMS OFFERED	CREDITS
MT-223 Differential Equation and Fourier Series	SE Fall semester	3+0
PREREQUISITES	**Knowledge Area**	
Calculus	Natural Sciences	

COURSE OBJECTIVES

To provide students understanding of 1st order differential equations , 2nd and higher order equations, partial differential equation, Lap lace integral and transformation, and fourier series

COURSE TOPICS:

1st Order Differential Equations

Basic concept; Formation of differential equations and solution of differential equations by direct integration and by separating the variables; Homogeneous equations and equations reducible to homogeneous from; Linear differential equations of the order and equations reducible to the linear form; Bernoulli's equations and orthogonal trajectories; Application in relevant Engineering.

2nd and Higher Orders Equations

Special types of IInd order differential equations with constant coefficients and their solutions; The operator D; Inverse operator l/D; Solution of differential by operator D methods; Special

cases, Cauchy's differential equations; Simultaneous differential equations; simple application of differential equations in relevant Engineering.

Partial Differential Equation

Basic concepts and formation of partial differential equations; Linear homogeneous partial differential equations and relations to ordinary differential equations; Solution of first order linear and special types of second and higher order differential equations; D' Alembert's solution of the wave equation and two dimensional wave equations; Lagrange's solution: Various standard forms.

Lap lace Integral & Transformation

Definition, Laplace transforms of some elementary functions, first translation or shifting theorem, second translation or shifting theorem, change of scale property, Laplace transform of the nth order derivative, initial and final value theorem Laplace transform of integrals. Laplace transform of functions tn F(t) and F(t)/ t, Laplace transform of periodic function, evaluation of integrals, definition of inverse Laplace transform and inverse transforms, convolution theorem, solutions of ordinary differential using Laplace transform.

Fourier series

Periodic functions and expansion of periodic functions in Fourier series and Fourier coefficients; Expansion of function with arbitrary periods. Odd and even functions and their Fourier series; Half range expansions of Fourier series, "DFT and FFT, Fourier Spectrum".

TEXTBOOK

- Advance Engineering Mathematics Erwin Kreyszig, 7th edition
- Differential Equation A modeling Perspective Robert L. Barrelli, 1998
- Introduction to Differential Equation J. Farlaw, 1994
- Differential Equation, G. Zill

COURSE CODE/TITLE	**SEMESTER/TERMS OFFERED**	**CREDITS**
FD-203 Food Chemistry	SE Fall semester	3+0

PREREQUISITES	**Knowledge Area**
Chemistry, Organic Chemistry, Analytical Chemistry	Engineering (Foundation)

COURSE OBJECTIVES

Understand the chemistry underlying the properties and reactions of various food components

COURSE TOPICS

Chemical Composition of Foods:

Carbohydrates, proteins, lipids, water, vitamins, minerals, enzymes, phenolic compounds and pigments.

Food Additives:

Preservatives, colorants, antioxidants, sweeteners, emulsifiers.

Toxicological concepts:

Contaminants and evaluation of metals, radionucleides, pesticides, hormones, antibiotics mycotoxins, polycyclic aromatic hydrocarbons and toxic compounds naturally found in foods.

Nutritional value of food:

Calorific value and pH of food.

TEXTBOOK

- Food Chemistry, H.D Belitz, 4th edition,2009, Springer

COURSE CODE/TITLE HS-205 Islamic Studies	SEMESTER/TERMS OFFERED SE Fall Semester	CREDITS 2+0
PREREQUISITES ----	**Knowledge Area** Humanities	

COURSE OBJECTIVES

- To enhance understanding of the students regarding Islamic Studies and Islamic Civilization.

COURSE TOPICS

Thematic Study of HoyQuran:

Basic Islamic believes, Topics, Tauheed, AlAmbiya-22, Al-Baqarah-163-164, Prophet hood, A-Imran-79, AI-Hashr-7, Al- Madah-3, Here-After, AI-Hajj-5, AI-Baqarah-48, Two Hadith, Basic Islamic Practices, Al-Mu'minun-I-II, Amre-Bil-MA' Roof WA-Nahi Anil Munkar, The concept of Good & Evil, Importance & necessity of DA'Wat-e-Deen Al-Imran-110, Method of DA'Wat-e-Deen, An-Nehl-125, Al-Imran-04, Two Hadith, Unity of the Ummah,Al-Imran-103, Al-Hujurat-10, Al-Imran-64, Al-An'am-08, Kasb-e-Halal, Taha-81,AI-A'raf-32-33, AI-Baqarah-188, Two Hadith, Huquq-ul-Ibad, Right to Property, AI-Maidah-32, Right to Property, An-Nisa-29,Right of Respect & Dignity, Al-Hujurat-11-12, Freedom of Expression, Al-Baqarah-256, Right of Equality, Al-Hujurat-13, Economic Security, Al-Ma'arij24-25, Employment Opportunity on Merit, An-Nisa-58, Excession Right to Justice, An-Nisa-135, Women Rights, An-Nehl-97, Al-Ahzab-35,An-Nisa-07, Relations With Non-Muslims, Al-Mumtahanah-8-9, Al-Anfa-6, last sermon of Hajj at Arafat on 10thZil-Hajj, Translation & the important points of the sermon.

Serat Life of theHoly Prophet:

Birth, life at Makkah, declaration of Prophet hood, preaching & its difficulties, migration to Madina, brotherhood (Mawakhat) &Madina charter, the Hoy war of the prophet (Ghazwat-e-Nabawi), Hujjatu-Wida.

Islamic Civilization:

Impacts of Islamic civilization on the sub-continent, the civilization of sub-content before Islam, the political, social & moral impacts of Islamic civilization on sub-continent, academic, intellectual, social & cultural impacts of Islam on the world.

TEXTBOOK

- Islamic Studies; M. D. Zafar, 4th ed. 2003, Z Book Depo, Lahore.
- Madinatul Elm; SyedaTanveer Shah, 2nd ed. 2001, Fatimi Publisher, Karachi.
- Short History of Civilization; Prof. AnwaarHashmi, 3rd ed. 1996, Karachi Book Centre.
- Muhammad the Prophet of Islam; Dr. Khalid Alvi, 2nd ed. 2003, Dawah Academy International, Islamabad.

COURSE CODE/TITLE HS-209 Ethical Behavior (Alternate course for Non Muslim Students)	SEMESTER/TERMS OFFERED SE Fall Semester	CREDITS 2+0
PREREQUISITES ----	**Knowledge Area** Humanities	

COURSE OBJECTIVES

- To highlight the importance of Ethics in Human life.
- To acquaint students with different Ethical philosophies.
- To encourage them to apply Ethical values in their personal and collective lives.

COURSE TOPICS

Introduction to Ethics:

Definition of Ethics, Definition between normative and positive science, Problem of freewill, Method of Ethics, Uses of Ethics.

Ethical Theories:

History of Ethics: Greek Ethics, Medieval, Modern Ethics, Basic concept of right and wrong: good and evil, Utilitarianism, hedonism, self-realization: egoism, intuitionism, rationalism, Kant's moral philosophy.

Ethics & Religion:
The relation of Ethics to religion
Basic ethical principles of major religions: Hinduism, Judaism, Buddhism, Zoroastrianism,Christianity, Islam.

Ethics, Society, and moral theory:
Ethical foundation of Rights and Duties, Applied Ethics, Society as the background of moral life, Universalism and Altruism, Theories of punishment.

TEXTBOOK

- Lillie W., An Introduction to Ethics, Reprinted in 1974
- Warburton N., Philosophy: the Basic, Routledge, London

Second Year (Spring Semester) Food Engineering

COURSE CODE/TITLE FD 204 Food Biochemistry	**SEMESTER/TERMS OFFERED** SE Spring Semester	**CREDITS** 3+1
PREREQUISITES Chemistry	**Knowledge Area** Engineering (Foundation)	

COURSE OBJECTIVES
Brief review of organic chemistry; overview of cellular structures and processes; acids, bases and buffers; amino acids and peptide bonds; protein structure and function; enzymes; biochemical basis of diseases; use of biochemical measurements for diagnosis.

COURSE TOPICS

Basic Concepts of Biochemistry:
Structure and function of cell; acids, bases and buffers; amino acids and peptide bonds; protein structure and function; classification of enzymes, mechanism of enzyme reactions; co enzymes; cofactors; enzyme applications in food industry.

Protein Synthesis through Gene Expression:
Nucleic acid structure: RNA and DNA; the genome; DNA synthesis (replication); RNA synthesis (transcription); protein synthesis (translation); regulation of gene expression; recombinant DNA and biotechnology.

Bioenergetics
Thermodynamics of biological processes; adenosine triphosphate (ATP) and phosphoryl group transfers; oxidation-reduction reactions; ATP synthesis via oxidative phosphorylation in mitochondria.

Glycobiology of Foods:
Food carbohydrates; their structures and functions; nutritional carbohydrate sources; digestion of carbohydrates; glycolysis; gluconeogenesis; the pentose phosphate pathway; regulation of glycolysis and gluconeogenesis; the citric acid cycle. metabolism of glycogen and starch;

Lipid Metabolism:
Classification of Lipids; properties of fatty acid and triacylglycerol, digestion and absorption of fat. Fatty acid and triacylglycerol synthesis; cholesterol metabolism; fatty acid oxidation; ketone body synthesis and utilization.

Amino Acid Metabolism:
Protein digestion and amino acid absorption; urea cycle; nitrogen cycle and fixation, biosynthesis and degradation of amino acids.

TEXTBOOK

- Denise R. Ferrier, Biochemistry (Lippincott's Illustrated Reviews Series)., 6th ed., Williams and Wilkins, 2013.
- Albert Lehinger, David L. Nelson and Michael M. Cox, Lehninger Principles of Biochemistry, 6th ed., 2012.
- Donald Voet, Judith G. Voet, Charlotte W. Pratt, Fundamentals of Biochemistry: Life at the Molecular Level,4th ed., 2012.
- Jermy M. Berg, John L. Tymoczko, Lubert Stryer, Sara Tenney, Biochemistry ,Berg.Lubert Stryer(Author)›Visit Amazon's Lubert Stryer PageFind all the books, read about the author, and more.See search results for this author Are you an author? Learn about Author Central, 7th ed., 2011.
- Christopher K. Mathews, Kensal E. van Holde, Dean R. Appling, Spencer
- J. Anthony-Cahill. Biochemistry, Pearson, 4th ed., 2012.
- Robert K. Murray, Daryl K. Granner , Victor W. Rodwell. Harper's Illustrated Biochemistry, McGraw Hill, 29thEd., 2012.

COURSE CODE/TITLE FD-205 Fluid Mechanics	**SEMESTER/TERMS OFFERED** SE Spring Semester	**CREDITS** 3+1
PREREQUISITES Engineering Mechanics	**Knowledge Area** Engineering (Breadth)	

COURSE OBJECTIVES

Achieve an understanding of the scientific principles of fluid mechanics.
Analyze and evaluate simple systems with fluid as the working medium.

COURSE TOPICS

Introduction

Concept of fluids; fluid continuum; the no-slip condition; density; specific gravity; vapor pressure & cavitation, surface tension & capillary effects.

Fluid Statics

Pressure at a point; pressure measurement; manometry; hydrostatic force on a submerged place &curved surface;buoyancy and stability.

Fluid Kinematics

Flow kinematics; stress & strain rate;viscosity; Newtonian fluids; conservation laws; continuity, &momentum equation.

Viscous Flow

Laminar internal flow;Poiseuille and Couette flow; turbulent internal flow;
friction factor; boundary layer thickness; skin friction& drag; internal flow in pipes; external flow past immersed bodies.

Dimensional Analysis

Dimensional analysis; nature of dimensional analysis; Buckingham's Π theorem; arrangement of dimensionless group.

TEXTBOOK

- Fundamentals of Fluid Mechanics;Bruce R Munson,7^{th} edition,2012,Juhn Wiley & Sons.

COURSE CODE/TITLE	**SEMESTER/TERMS OFFERED**	**CREDITS**

MM-205 Mechanics of Materials	SE Spring Semester	3+1
PREREQUISITES Engineering Mechanics	**Knowledge Area** Engineering (Breadth)	
COURSE OBJECTIVES ● To review and understand mechanics of materials and their application		

Review mechanics of materials. Deformation; strain; elastic stress-strain behavior of materials; Introduction to stress-strain diagram, working stresses, unit design, Introduction to elastic and nonlinear continua. Poisson's ratio; Determination of forces in frames; Simple bending theory; general case of bending; Shear force and bending moment diagrams; Relationship between loading, shear force and bending moment. Stress; Skew (antisymmetric) bending Direct, shear, hydrostatic and complementary shear stresses; Bar and strut or column; Theory of buckling instability, Thin ring, Elementary thermal stress and strain; General stress-method. Theory of elasticity, Analytical solution of elasticity problems brittle fracture strain energy in tension and compression.

Analysis of bi-axial stresses, principal planes, principal stress-strain, stresses in thin walled pressure vessels. Mohr's circles of bi-axial stress. Torsion of circular shafts, coiled helical spring, strain energy in shear and torsion of thin walled tubes, torsion of non-circular sections. Shear centre and shear flow for open sections, General case of plane stresses, principal stress in shear stresses due to combined bending and torsion plane strain. Composite materials, Volume dilatation, Theories of Yielding, Thin Plates and Shells Stress Concentration

TEXTBOOK

- Mechanics of materials,Ferdinanad Beer, 6^{th} edition , 2011

COURSE CODE/TITLE FD-206 Food Enzymology	**SEMESTER/TERMS OFFERED** SE Spring Semester	**CREDITS** 2+1
PREREQUISITES Introduction to food Engineering, Food Chemistry	**Knowledge Area** Engineering (Breadth)	

COURSE OBJECTIVES:

To provide students fundamentals of enzymes used in food processing and its application to enhance food processing efficiency and quality

COURSE TOPICS:

Food Kinetics:

Chemical and biological reactions, reaction types, determination of reaction rate constants, factors effecting reaction kinetics, microbial death and enzyme kinetics, semi-continuous and continuous fermentation systems, design of a bioreactor, biomass formation kinetics, substrate consumption kinetics, inhibition kinetics, determination of oxygen transfer coefficient and specific oxygen consumption rate, determination of yield and productivity values in bioprocesses.

Reaction Rates and Theories about Reaction Rates:

Factors affecting reaction rates in foods, calculation of kinetic parameters for reactions in foods, effects of temperature on reaction rates in foods.

Kinetics of Biological Reactions:

Kinetics of biomass production, substrate utilization and product formation in cell cultures, kinetics of microbial death and enzyme inactivation. Reaction rates; theories about reaction rates; factors affecting reaction rates in foods; calculation of kinetic parameters for reactions in foods; effects of temperature on reaction rates in foods; Kinetics of biological reactions; Kinetics of biomass production; substrate utilization and product formation in cell cultures; Kinetics of microbial death and enzyme inactivation.

TEXT BOOK:

- Handbook of Food Enzymology, John R Whitaker,2003, marcel Dekker, Newyork, USA

COURSE CODE/TITLE MT-332 Advanced Calculus & Linear Algebra	SEMESTER/TERMS OFFERED SE Spring Semester	CREDITS 3+0
PREREQUISITES Calculus	Knowledge Area Natural sciences	

COURSE OBJECTIVES

Introduction to linear algebra, Euclidean spaces and transformation, advanced calculus,and vector calculus.

COURSE TOPICS

Linear Algebra:

Linearity and linear dependence of vectors, basis, dimension of a vector space, field matrix and type of matrices (singular, non- singular, symmetric, non- symmetric, upper, lower, diagonal tri-diagonal matrix), Rank of a matrix using row operations and special method, echelon and reduced echelon forms of a matrix, determination of consistency of a system of linear equation using rank, transitions matrix, basic concept of tensors, eigen value and eigen vectors of a matrix, Diagonolization, Cayley-Hamiton theorem. Applications of linear algebra in Engineering.

Euclidean Spaces and Transformation:

Geometric representation of vector, norm of vector, Euclidean inner product, projections and orthogonal projections, Euclidean n spaces n properties Cauchy-Schwarz inequality, Euclidean transformations, apply geometric transfom1ations to plane figure, composition or transformations.

Advance calculus:

Define a stationary point of a function of several variables, define local maximum and saddle point for a function of two variables the stationary points of a several variables, obtain higher partial derivatives of simple functions of two or more variables, iterated integrals, double and triple integrations with applications (area, centoroid, moment of inertia, surface area, and volume, use multiple integrals in solutions of engineering problems.

Vector Calculus:

Vector differential operator, directional derivative, gradient, divergence, curl of a vector field, and Laplacian operators with applications. (Solenoid, conservative, etc). Vector Integrations; Evaluate line integrals along simple paths, apply line integrals to calculate work done, apply Green's theorem in the plane to simple examples, evaluate surface integrals over simple surface, use the Jacobean to transform a problem a new coordinate system, apply Gauss' divergence theorem to simple problems, apply Stokes theorem to simple examples.

TEXTBOOK

- Elementary Linear Algebra, Howard Anton, 7th Edition
- Advance Engineering Mathematics, Erwin Kreyszig, 7th Edition
- Calculus & Analytical Geometry, Howard Anton, 5th Edition
- Elementary Linear Algebra, Bernald Kolman, 5th Eight

COURSE CODE/TITLE	SEMESTER/TERMS OFFERED	CREDITS
FD-301 Unit Operations in Food Engineering I	TE Fall Semester	3+1

PREREQUISITES	Knowledge Area
Int. to Food Engineering, Thermodynamics and Fluid Mechanics	Engineering (Breadth)

COURSE OBJECTIVES

- To give understanding of preliminary preparative operation, pneumatic and hydraulic conveying and agglomeration phenomena and its application

COURSE TOPICS

Preliminary preparative operation:

Cleaning, sorting, grading methods; Size reduction: Particle size distribution, classification, screening and sieving, mechanism of size reduction, machinery for crushing and grinding, disintegration of fibrous materials, energy requirements for communication of solids.

Pneumatic and Hydraulic Conveying:

Screw, vibrating, belt conveyors and elevators; Fluidization, mixing and agitation, Flow pattern and baffles, rate of mixing and power consumption, Centrifugation theory and applications.

Agglomeration Phenomena and its application:

Granulation, pelletization, tabling and storage. Filtration: Mechanism of filtration. Filter media. Flow through filter cake and/or cloth. Cake resistance and relation between thickness of cake and volume of filtrate.

TEXTBOOK

- Unit operations in Food Engineering;Albert Ibarz, 2nd edition,2012.
- Introduction to Food Engineering; R.Paul Singh & Dennis R Heldman; Fourth Edition, AP &Elseiver.2014

COURSE CODE/TITLE	SEMESTER/TERMS OFFERED	CREDITS
FD-305 Machine Design For Food Engineers	TE Fall Semester	3+0

PREREQUISITES	Knowledge Area
Thermodynamics, Mechanics of materials, Fluid Mechanics	Engineering (Breadth)

COURSE OBJECTIVES

To provide students understand design of shafts, lubrication theory and bearing design, design of tanks and piping systems, gear design, application of industrial codes, Elements of micro electro mechanical systems.

COURSE TOPICS

Introduction to Machine Design:

Mechanical Engineering Design, Design Tools and Resources, The Design Engineer's Professional Responsibilities, Safety and Product Liability

Failure Prevention:

Failures resulting from Static Loading:

Static Strength, Stress Concentration,FailureTheories,Maximum-Shear-Stress Theory for Ductile Materials, Distortion-Energy Theory for Ductile Materials,Coulomb-Mohr Theory for Ductile Materials, Failure of Ductile Materials Summary, Maximum-Normal-Stress Theory for Brittle Materials, Modifications of the Mohr Theory for Brittle Materials ,Failure of Brittle Materials, Selection of Failure Criteria, Introduction to Fracture Mechanics.

Failures resulting from Variable Loading

Introduction to Fatigue in Metals, Approach to Fatigue Failure in Analysis and Design, Fatigue-Life Methods,The Stress-Life Method, The Strain-Life Method,The Linear-Elastic Fracture Mechanics Method,The Endurance Limit,Fatigue Strength, Endurance Limit Modifying Factors, Stress Concentration and Notch Sensitivity,Characterizing Fluctuating Stresses, Fatigue Failure Criteria for FluctuatingStress,Torsional Fatigue Strength underFluctuating Stresses, Combinations of Loading Modes, Varying, Fluctuating Stresses; Cumulative Fatigue Damage,Surface Fatigue Strength,Stochastic Analysis,Road Maps and Important Design Equations for the Stress-Life Method.

Design of Mechanical Elements

Shaft and Shaft Components, Screws, Fasteners, and the Design of Nonpermanent Joints, Welding, Bonding, and the Design of Permanent Joints, Mechanical Springs, Rolling-ContactBearings, Lubrication and Journal Bearings, Gears—General, Spur and Helical Gears, Bevel and Worm Gears, Flexible Mechanical Elements, Case Study.

TEXTBOOK

- Machine design, Robert L Norton, 4th edition, 2010
- Richard G. Budynas; J.KeithNisbett, Mechanical Engineering Design, 9thed., McGRAW HILL, 2011

COURSE CODE/TITLE	**SEMESTER/TERMS OFFERED**	**CREDITS**
FD-306 Instrumentation and Measurement For Food Engineers	TE Fall Semester	3+1

PREREQUISITES	**Knowledge Area**
Electronics	Engineering (Breadth)

COURSE OBJECTIVES

To provide students understanding of instrumentation involved in food quality and process control.

COURSE TOPICS

Principles of Colour Measurement for Food, Colour Measurement of Foods by Colour Reflectance, Food Compositional Analysis Using Near Infra-red Absorption Technology
Infra-red Remote Thermometry, In-line and Off-line FTIR Measurements, Microwave Measurements of Product Variables, Pressure and Temperature Measurement in Food Process Control, Level and Flow Measurement in Food Process, Ultrasound Propagation in Foods and Ambient Gases: Principles and Applications; Ultrasonic sensors for Food Industry, Rheological Measurements of Foods, Conductance/Impedance Techniques for Microbial, Chemosensors, Biosensors, Immunosensors, Electronic Noses and Tongues.

TEXTBOOK

- Erika Kress-Rogers, Christopher J.B. Brimelow, Instrumentation and Sensors for the Food Industry.
- Ibtisam E. Tothil, Rapid and On-line Instrumentation for Food Quality Assurance.2003

COURSE CODE/TITLE	**SEMESTER/TERMS OFFERED**	**CREDITS**
MT-330 Applied Probability &Statistics	TE Fall Semester	2+1

PREREQUISITES	**Knowledge Area**
Calculus	Natural Sciences

COURSE OBJECTIVES

To acquaint students with the knowledge of statistics, measurement of central tendency and dispersion, curve fitting, simple regression and correlation, sampling and sampling distributions, statistical Inference and Testing of Hypothesis,Probability,Random Variables & Probability Distributions

COURSE TOPICS

Statistics

Introduction, Types of data & variables, presentation to data, object, classifications,Tabulation, Frequency distribution, Graphical representation, Simple & Multiple Bar diagrams, Sartorial & Pie-Diagram, Histogram, Frequency Polygon, Frequency Curves & their types.

Measure of Central Tendency and Dispersion

Statistics Averages, Median Mode, Quartiles, Range, Moments, Skewness& Kurtosis, Quartile Deviation, Mean Deviation, Standard Deviation, Variance & its coefficient, Practical Significance in related problems.

Curve Fitting

Introduction, fitting of a first and second degree curve, fitting of exponential and logarithmic curves related problems, Principle of least squares, Second order Statistics & Time series not in bit detail.

Simple Regression & Correlation

Introduction, Scatter diagrams, Correlation & its Coefficient, Regression lines, RankCorrelation & its Coefficient, Probable Error (P.E), Related problems.

Sampling and Sampling Distributions

Introduction, Population, Parameter & Statistics, Objects of sampling, Sampling distribution of Mean, Standard errors, Sampling & Non-Sampling Errors, Random Sampling, Sampling with & without replacement, Sequential Sampling, Central limit theorem with practical significance in related problems.

Statistical Inference and Testing of Hypothesis

Introduction, Estimation, Types of Estimates, Confidence interval, Tests of Hypothesis, Chi-Square distribution/test, one tails & two tails tests. Application in related problems.

Probability

Basic concepts, Permutation & Combination, Definitions of probability, Laws of probability,Conditional probability, Baye's rule. Related problems in practical significance.

Random Variables

Introduction, Discrete & Continuous random variables, Random Sequences and transformations, Probability distribution, Probability density function, Distribution function, Mathematical expectations, Moment Generating Function (M.G.F.), Markoverandom walks chain/Related problems.

Probability Distributions

Introduction, Discrete probability distributions, Binomial, Poisson, Hyper geometric & Negative binomial distributions. Continuous probability distribution, Uniform, Exponential & Normal distributions & their practical significance.

TEXTBOOK

- Basic Statistics for Business & Economics, Blind, D.A. & R.D. Mason, Irwin Publishers
- Advanced Engineering Mathematics, Erwin Kreyszig, 8th Edition, John Wiley & Sons Publication
- Probability and Mathematical Statistics, Lester D. Taylor. 1974, Harper & Row, Publishers New York.

COURSE CODE/TITLE	SEMESTER/TERMS OFFERED	CREDITS

HS-304 Business Communication and Ethics	TE Fall Semester	3+0
PREREQUISITES English	**Knowledge Area** Humanities	

COURSE OBJECTIVES

- To enable students to understand and communicate both orally and in writing in a work environment.
- To help the students understand various ethical positions on business / work issues.
- To train them as good and efficient communicators.

COURSE TOPICS

- **Communication Skills (oral):**
- Definitions and Conditions,
- Modes:verbal, non-verbal, vocal, non-vocal, sender, Receiver, en-coding, decoding, noise, context, emotional maturity, relationships, etc.
- Language, perception,
- Non-verbal, body language, physical appearance, cultural differences etc.
- Personal and interpersonal skills / perceptions.
- Communication dilemmas and problems
- Public Speaking – speaking situation, persuasion,
- Making presentations,
- Interviews

- **Business Writing:**
  - Formal / Business letters, e-mails: a) job applications and resumes/ cv, b) enquiries, c) complaints / adjustments, d) orders, e) quotations, f) banking etc.
  - Memos: layout, language, style
  - Meeting management: notice, agenda, conducting / participating, writing minutes.
  - Contracts and agreements (basic theoretical knowledge and comprehension),
  - Research / scientific reports: types, structure, layout / presentation, writing process etc.
  - Tenders (basic theoretical knowledge and comprehension)

- **Engineering / Business Ethics:**
- Need and objectives for code of ethics and its importance
- Type of ethics, involvement and impact in daily life
- Problems / conflicts / dilemmas in application (case studies)
- Sexual Harassment / discrimination in the workplace
  - why it occurs,
  - myths regarding sexual harassment,
  - how to deal withit,
  - gender equality,
  - respect etc.

Codes of conduct:

- Pakistan Engineering Council
- Code for Gender Justice,
- Brief study of other codes of conduct.
- Lesikar& Pettit,*Report writing for Business,*McGraw Hill

TEXTBOOK

No one text book is recommended

REFERENCE BOOKS:

- Roach, Gant & Allyn Perrigo& Bacon,Business and Professional Communication
- Guffey, Mary (2007), Business Communication,Thomson
- Bovee&Thill, Business Communication Essentials, Prentice Hall
- Burton &Dimbleby,Teaching Communication, Routledge

- Boatright J**.,** Ethics and the Conduct of Business,Prentice Hall
- Ashley A., Handbook of Commercial Correspondence,ELBS
- Flederman, Engineering Ethics, McGraw Hill
- Wheatley Doris, Report writing, Penguin
- Osborne & Motley,Improving Communication, Houghton / Mifflin

Third Year (Spring Semester) Food Engineering

COURSE CODE/TITLE	**SEMESTER/TERMS OFFERED**	**CREDITS**
FD-304 Food Microbiology	TE Spring Semester	3+1
PREREQUISITES	**Knowledge Area**	
Introduction to Biology	Engineering (Breadth)	

COURSE OBJECTIVES

The objective of this course is to provide students with food microbiology concepts, microbial metabolism of food components, factors affecting the growth and survival of microorganisms, microbial examination and spoilage of food Bacterial and non bacterial agents of food borne illness Beneficial activities of microorganisms in food and controlling the microbiological quality of food.

COURSE TOPICS

The scope and development of food microbiology:

Microorganisms in food, food spoilage/preservation, food safety. Micro-organism in atmosphere, soil, air, water, equipments, plants and animal, raw meat, raw and pasteurized milk, vegetables fruits and nuts, canned foods, sugars and confectionaries, soft drinks etc.

Microbial Metabolism of Food Components:

Metabolism of food carbohydrates, fermentation, anaerobic aerobic respiration, metabolism of food proteins, metabolism of food lipids.

Factors affecting the Growth and Survival of Micro-organism:

Intrinsic factors: pH, moisture contents, oxidation reduction potential, nutrient content. Extrinsic factors: temperature of storage, concentration of gases, humidity.

Microbial Spoilage and Examination of Food:

Spoilage: Spoilage of various foods causes of spoilage, types of spoilage. Examination: Sampling, microbial test procedures, indicator organisms, food poisoning organisms, food spoilage organisms.

Bacterial and Non-bacterial Agents of Food Borne Illness:

Aeromonashydrophilia, Bacillus cereus and other species, Brucella, Compylobecter, Clostridium botulinum, Clostridium perfringens, Listeria monocytogenesis, Mycobacterium species, PlesiomonasShigelloids, Samonella, Shigella, Vibrio, Yersinia, Enterocolitica, Scombrotoric fish poisoning. Helminths and Nematodes, Protozoa, Toxigenic algae and fungi, food borne viruses, Spongiform encephalopathies.

Beneficial activities of microbes in food:

Fermented and microbial food; yeast, lactic acid bacteria, fermented milks, cheese, fermented vegetable and meats.

Controlling the Microbiological Quality of Food:

Food preservation, microbial control.

TEXTBOOK

- Food Microbiology,Martin R Adams, 3rd edition, 2007, RSC Publishing

COURSE CODE/TITLE	SEMESTER/TERMS OFFERED	CREDITS
FD-307 Heat and Mass Transfer	TE Spring Semester	3+1

PREREQUISITES	Knowledge Area
Thermodynamics	Breadth

COURSE OBJECTIVES

The objective of this course is to provide students understanding of conduction , convection and radiation and its application in food processing.

To develop understanding of mass transfer during processing and its application.

COURSE TOPICS

Introduction

Overview, Energy transfer and energy balance for closed & for steady-flow systems, surface energy balance,heat transfer mechanisms, 1-dheat conduction and its cases, general heat conduction equation, boundary and initial conditions, solution of one dimensional heat conduction problems, heat generation in solids.

Steady Heat Conduction

Steady heat conduction in plane walls, thermal contact resistance, generalize thermal resistance networks, heat conduction in cylinders and spheres, critical radius of insulation, finned surfaces, heat transfer in common configurations.

Transient Conduction

Lumped system analysis, transient heat conduction with spatial effects in large plane walls, long cylinders and in spheres.

Numerical Methods in Heat Conduction

Need for numerical techniques, finite difference formulations for differential equations.

Fundamentals of Heat Convection

Physical mechanisms of convection, velocity and thermal boundary layer, derivation of differential convection equation.

External Forced Convection

Drag force & heat transfer in external flow, flow over flat plates, flow across cylinders, spheres& tube banks.

Fundamentals of thermal radiation

Thermal radiation, blackbody radiation, atmospheric and solar radiation.

Radiation Heat transfer

The view factor and its relations, black and diffused grey surfaces.

Heat Exchangers

Types of heat exchangers, heat transfer coefficient, analysis of heat exchangers, log mean temperature difference.

Intorduction to mass transfer

Analogy b/w heat & mass transfer, mass diffusion, boundary conditions, steady mass diffusion through wall, mass convection.

Boiling and condensation

Boiling heat transfer, pool boiling, flow boiling, condensation heat transfer.

TEXTBOOK

- Heat Transfer-A Practicals Approach, McGraw Hill, 2nd Edition-2003, Çengel, Y.A, USA
- Fundamentals of Heat and Mass Transfer; 7th edition;2011;Theodore L. Bergman

COURSE CODE/TITLE	SEMESTER/TERMS OFFERED	CREDITS
BF-303 Applied Economics for Engineers	TE Spring Semester	3+0
PREREQUISITES	**Knowledge Area**	
---	Management Sciences	

COURSE OBJECTIVES

This course introduces students to fundamental economic concepts and theory, including demand, supply, and the formation of equilibrium prices in product and resource markets. In addition, the course offers an introduction to applied fields such as industrial organization (market structure), labor economics, unionism, international trade, and public economics.

COURSE TOPICS

Introduction:

Basic concepts and principles of economics, micro & macro economic theory, the problem of scarcity, basic concepts of engineering economy, financial effectiveness and non monetary factors.

Economic Environment:

Consumer and producer goods; goods and services, demand and supply concept, market equilibrium, elasticity of demand and supply, measure of economic worth, price supply-demand relationship, revenue, cost and profit function.

Basic Cost Concept and Break Even Analysis:

Types of cost and cost curves (fixed cost, variable cost, average cost, marginal cost, total cost….) determination of costs/ revenue, numerical and graphical presentation, practical application, BEA as a management tool for achieving financial / operational efficiency.

Elementary Financial Analysis:

Basic accounting equation, development and interpretation of financial statements (income statement, balance sheet).

Cash flow, working capital management, financial ratio analysis

a) Time value of money and financial returns:
Concept of simple, compound and effective interest rate, less often then compounding period and more often than once year, present value, future value and annuities concepts, uniform gradient and geometric sequence of cash flow.

b) Project selection and comparing Alternatives Techniques:
Net present value, annual worth analysis, internal rate of return, benefit cost ratio analysis, pay back period.

Depreciation and Taxes:

Depreciation concept, economic life, methods of depreciations (straight line, SYD approach, declining balance, etc), gain (loss) on the disposal of asset, depreciation as tax shield.

Business Organizations and Financial Institutions:

Types of ownership, single ownership, partnership corporation, types of stock, joint stock companies, banking and specialized credit institution.

Introduction to Production Management to Production Concept):

Basic production function, stages of production, returns to scale, production lead time, production rate, capacity, operations, planning and control, order processing, scheduling, material requisitions planning, line of balance.

Linear Programming:

Mathematical statement of LP problem, graphical solution, simplex method, duality problem.

TEXTBOOK

- Engineering Economy; Anthony Tarquim, 5th ed. WCB/McGraw-Hill
- Engineering Economy; Paul Degarmo, 11th ed. Prentice Hall, Inc.

COURSE CODE/TITLE MT-442 Numerical Method	SEMESTER/TERMS OFFERED TE Spring semester	CREDITS 3+0
PREREQUISITES ----	**Knowledge Area** Natural Sciences	

COURSE OBJECTIVES

- To provide understanding of error analysis, linear operations, difference equations, solution of linear and non-linear equations, interpolation and curve fitting, numerical integration and differentiation

COURSE TOPICS

Error Analysis

Types of errors (relative, Absolute, inherent, round off, truncation), significant digits and numerical instability, flow chart.Use any Computational tools to Analysis the Numerical Solutions.

Linear Operators

Functions of operators, difference operators and the derivative operators, identities.

Difference Equations

Linear homogeneous and non homogeneous difference equations.

Solution of Non-linear Equations

Numerical methods for finding the roots of transcendental and polynomial equations (Secant, Newton – Raphson Chebyshev and Graeffe's root squaring methods), rate of convergence and stability of an iterative method.

Solution of Linear Equations

Numerical methods for finding the solutions of system of linear equations (Gauss-Elimination, Gauss-Jordan Elimination, triangularization, Cholesky, Jacobi and Gauss – Seidel).

Interpolation &- Curve Fitting

Lagrange's, Newton, Hermit, Spline, least squares approximation. (Linear and non-linear curves).

Numerical Integration & Differentiation

Computation of integrals using simple Trapezoidal rule, 1/3th Simpson's rule, 3/8th Simpson's rule, Composite Simpson's and Trapezoidal rules, computation of solutions of differential equations using (Euler method, Euler modified method, RungeKutta method of order 4). Numerical Solutions of Partial differential Equations, Optimization problem (Simplex Method). Steepest Ascent and Steepest Descent Methods.

TEXTBOOK

- Numerical Methods for Engineering Science and Mathematics. (2^{nd}ed.) by Prof. Mumtaz Khan, Dec.
- Ordinary and Partial Differential Equations with Numerical Techniques for Engineering Science and Mathematics, (2^{nd} ed.) by Prof. Mumtaz Khan, April.

COURSE CODE/TITLE FD-308 Unit Operations in Food Engineering-II	SEMESTER/TERMS OFFERED TE Spring Semester	CREDITS 3+1
PREREQUISITES Unit Operations in Food Engineering-II	**Knowledge Area** Engineering (Breadth)	

COURSE OBJECTIVES

To give understanding of Humidification and Cooling Towers, Drying, Distillation, Absorption, Liquid-Liquid Extraction, Leaching, Adsorption, Crystallization, Membrane separation, Evaporation

COURSE TOPICS

Humidification and Cooling Towers:

Wet-bulb and adiabatic saturation temperature; Cooling Towers types, features, outline design.

Drying:

General principles, Rate of drying, Diffusion and Capillary drying, Classification and selection of dryers.

Distillation:

The fractionating column. Calculation of number of plates required for binary separations. Lewis-Sorel, McCabe-Thiele methods. Column Design diameter and height.

Absorption:

Extension of design techniques. Wetted wall columns and determination of transfer coefficients. Equipments for gas absorption.

Liquid-Liquid Extraction:

Introduction, Extraction Processes, Extraction equipment.

Leaching:

General principles, Factors influencing the rate of extraction.

Adsorption:

The nature of adsorbents, Adsorption equilibria. Adsorption equipments and regeneration of spent adsorbents.

Crystallization:

Growth and properties of crystals, saturation and nucleation, crystallization rate, impurities, effect of temperature on solubility.

Membrane separation:

General theory of separations based upon equilibrium and rate processes. Theory, design and analyses of ion exchange processes along with industrial applications.

Evaporation:

Single effect and multiple effect evaporators.

TEXTBOOK

- Unit operations in food engineering. Albert Ibarz, Gustavo V. Barbosa-Cánovas. 2007, CRC Press.
- Calculations in Food and Chemical Engineering. Jackson, A.T. and Lamb, J. 1991. McMillan Press.
- Unit Operations of Chemical Engineering. McCabe, W.L., Smith, J.C. and Harriot, P. 1993. 5th Ed., McGraw-Hill.
- Fundamentals of Food Engineering. Charm, S.E. 1971. AVI.
- Food Engineering Operations. Brennan, J.G., Buttlers, J.R. and Cowell, N.D. 1990. Elsevier Applied Science.

Fourth Year (Fall Semester) Food Engineering

COURSE CODE/TITLE	**SEMESTER/TERMS OFFERED**	**CREDITS**
FD-402 Food Quality Control	BE Fall semester	3+0
PREREQUISITES	**Knowledge Area**	

Analytical chemistry, Food Chemistry	Engineering (Depth)

COURSE OBJECTIVES

To understand quality, CCPs, and nutritional quality control.

COURSE TOPICS

Definition of Quality:

Quality assurance, total quality concepts; evolution of quality activities in the history.

Principles of total Quality Management:

Quality Management System and ISO-9000 standards; functions of Quality Assurance Department and its relations with other departments.

Description of Critical Control Points:

HACCP, GMP systems; classification of food quality attributes; definition and objective evaluation of sensory food attributes, sensory test techniques.

Nutritional Quality Control:

Approximate analysis of foods; statistical quality control tools.

TEXTBOOK

- Food Analysis: Theory and Practices. Pomeranz, Y and Melcoan C.E. 2002. 3rd Ed., Kluwer.
- Mark Clute, Food Industry Quality Control System,2009CRC Press Taylor & Francis Group
- J. Andres Vasconcellos, Quality Assurance For The Food Industry, 2004, CRC Press Taylor & Francis Group.
- Imtiaz Ali, Food Quality Assurance Principles And Practices, 2003CRC Press Taylor & Francis Group

COURSE CODE/TITLE	**SEMESTER/TERMS OFFERED**	**CREDITS**
FD-406 Process Control in Food Industry	BE Fall Semester	3+0
PREREQUISITES	**Knowledge Area**	
Food Quality Control, Unit Operations in Food Engineering I and II	Engineering (Depth)	

COURSE OBJECTIVES

To provide comprehensive orientation about importance of process control in the food industry, mathematical modeling, Types and selection of controllers in food processing

COURSE TOPICS

Importance of Process Control in the Food industry:

Importance; introduction to process control principles; definition of control objectives.

Mathematical Modeling:

Basics of mathematical modeling; process control elements; definition of open and closed loop systems; transfer functions and block diagrams.

Types and Selection of Controllers:

Types and selection of control schemes; Process control of selected food engineering operations.

Process:

Bioreactors, blanching, pasteurization and sterilization, drying, freezing, evaporation and concentration, baking and extrusion.

Text books:

- Introduction to Process Control by Jose A. Romagnoli, Ahmet Palazoglu, 2nd ed. 2012, CRC Press.
- Chemical Process control by George Stepehnopolous, 2006,Pearson Educatio

COURSE CODE/TITLE CH-407 Industrial Organization and Management	SEMESTER/TERMS OFFERED BE Fall Semester	CREDITS 3+0
PREREQUISITES ----------	**Knowledge Area** Management	

COURSE OBJECTIVES

To provide comprehensive orientation about Company and Organization, Facility Location and Layout Planning, Operation Planning and Control, Marketing and Distribution, Total Quality Management, Project Management, Maintenance Management, Financial Management, Human Resources, Other Topics and Recent Trends in Management

COURSE TOPICS

Introduction and History, Company and Organization, Facility Location and LayoutPlanning, Operation Planning and Control, Marketing and Distribution, Total Quality Management, Project Management, Maintenance Management, Financial Management, Human Resources, Other Topics and Recent Trends in Management

Text books:

J.Heizer Barry Render,11th edition, Operations Management,2013.

COURSE CODE/TITLE FD-410 Food Processing	SEMESTER/TERMS OFFERED BE Fall Semester	CREDITS 3+0
PREREQUISITES Unit Operations in Food Engineering I and Unit operations in Food Engineering II	**Knowledge Area** Engineering (Depth)	

COURSE OBJECTIVES

To provide comprehensive orientation about Company and Organization, Facility Location and Layout Planning, Operation Planning and Control, Marketing and Distribution, Total Quality Management, Project Management, Maintenance Management, Financial Management, Human Resources, Other Topics and Recent Trends in Management

COURSE TOPICS

Processing/Preservation Technologies:

Blanching, Fermentation, Canning, Dehydration, Extrusion, Chilling, Freezing, Aseptic processing, Sterilization, Pasteurization, Ohmic heating.

Preservation concerns in Food Processing:

Food packaging fundamentals, Food Toxicology, Environmental hazards.

Sanitation and Quality:

Food Plant Sanitation Requirement: Sanitation, need for a sanitation program, Sanitizers, Pest Control, Quality Assurance.

Product Development:

Product development basics, sensory evaluation of foods.

TEXTBOOK

- Potter and Hotchkiss, Food science, 5th ed., Chapman and Hall publishers, New York.
- Fellows, P.J., Food Processing Technology, Principles and practice, Ellis Horwood, New York, 2000.
- Zeki Berk ,Food Process Engineering And Technology, 2009 Elsevier Inc

Fourth Year (Spring Semester) Food Engineering

COURSE CODE/TITLE FD-408 Food Regulations and Legislation	SEMESTER/TERMS OFFERED BE Spring Semester	CREDITS 2+0
PREREQUISITES Food Quality Control	**Knowledge Area** Engineering (Depth)	

COURSE OBJECTIVES

This course provides core knowledge about the local and international regulations for Food Processing.

COURSE TOPICS

Pakistan Standards:

Standards and Quality Control Authority: functions, authorities.

Pure Food Rules:

Background, definitions, significant features, enforcement, amendments; Food inspector and public analyst: qualifications, duties, powers.

Food Adulteration:

Adulterants, health hazards, methods of detection.

Food Labelling:

Perspectives on nutrition labeling; Islamic food laws and regulations: sources, principles, lawful foods, unlawful foods; Consumer laws in Pakistan.

International Food Laws:

Introduction; The World Trade Organization (WTO) - the agreement on the application of sanitary and phytosanitary measures; GATT; Codex Alimentarius: general, procedural manual, standards, codes, legal force.

TEXT BOOK

- The Manual of Food Laws. Mobin Ahmed Siddiqui,2016
- Islamic codex alimentarius. Awan JA 1992. Sci. Tech. in Islamci World 10(1): 7-18
- International standards for food safety. Rees N and Watson D. 2000. Kluwer Sci Pub, New York.

COURSE CODE/TITLE FD-407 Food Packaging	SEMESTER/TERMS OFFERED BE Spring semester	CREDITS 2+1
PREREQUISITES ---	**Knowledge Area** Engineering (Depth)	

COURSE OBJECTIVES

To develop understanding of various packing materials including polymer, packing, food preservation technologies and packaging guidelines.

COURSE TOPICS

Polymer:

Introduction; structure and related properties of plastic polymers; optical and mechanical properties of thermoplastic polymers; permeability of thermoplastic polymers and its processing.

Packing:

Paper and paper based packaging materials; metal packaging materials and its corrosion. Glass packaging materials; deteriorative reactions in food.

Food Preservation and Processing Techniques:

Techniques, shelf life of foods; Aseptic packaging of foods; packaging of microwavable and flesh foods?; packaging of horticulture, dairy cereal and snack foods; packaging of beverages; safety and legislative aspects of packaging.

Packaging Guidelines:

Retail containers, shipping containers; Factors influencing design and selection of packaging materials: product, distribution, marketing, packaging operation, cost.

Printing Processes:

Inks, adhesives. Filling and labeling; Safety and legislation; Novel food packaging techniques; Food labeling: importance, types, methods.

TEXTBOOK

- Novel food packaging techniques. Raija Ahvenainen. 2003.CRC Press, Boca Raton, New York Washington, DC.
- Food packaging science and technology. Lee, D.S., K.M Yam, and L. Piergiovanni, 2008. CRC Press, Taylor and Francis Group, Boca Raton, Florida, USA.
- Food packaging: principles and practices.3rd edition, Robertson, G.L. 2013. CRC Press, Taylor & Francis Group, Boca Raton, Florida, USA.

COURSE CODE/TITLE FD-411 Food Plant Layout and Design	**SEMESTER/TERMS OFFERED** BE Spring semester	**CREDITS** 2+1
PREREQUISITES Introduction to Food Engineering, Industrial Organization and management	**Knowledge Area** Engineering (Depth)	

COURSE OBJECTIVES

To develop understanding of plant layout, and enable to design food process and plant layout

COURSE TOPICS

Plant design and layout: Objectives and functions, financial requirements, plant location, site selection, space requirement, building design and construction, floors, drains, walls, doors, windows, ceiling, ventilation, lighting, auxiliary facilities. Food plant equipment, layout of equipment, requirements, design, construction, choice of material.

Selection of novel products from food industry through market survey, food product development. Selection of the local preparation of the plant layout, material and energy balances. Design of the major units and sizing, auxiliary equipment including services, health and safety considerations, plant and product cost estimation.

Use of computer for layout, environmental impact, material handling and equipment process flow chart.

TEXTBOOK

- James, M.More., Plant Layout and Design,MacMillian Publishing Co., New York,1976.
- Antonio López Gómez, Gustavo V. Barbosa-Cánovas. Food plant design. Taylor & Francis inc., 2007.
- Max S. Peters, Klaus D. Timmerhaus, Plant Design And Economics For Chemical Engineers,5TH Edition 2003,McGrawhill

ELECTIVES

COURSE CODE/TITLE FD-403 Food Biotechnology	**SEMESTER/TERMS OFFERED** Electives	**CREDITS** 2+1
PREREQUISITES	**Knowledge Area**	

Biology	Engineering (Depth)

COURSE OBJECTIVES

To become familiar with the biotechnology concepts, and its application to metabolism and fermentation, genetics.

COURSE TOPICS

Biotechnology:

Introduction, history.

Microbial Metabolism:

Developments in metabolic and biochemical engineering: metabolites, range of fermentation processes, components of fermentation processes; Isolation and preservation of industrially important microorganisms.

Industrial Fermentations:

Media, design and types of fermentors, process variables in fermentation, recovery, purification of fermentation products; Production of organic acids, enzymes, amino acids, single cell proteins, carotenoids and fermented food products.

Microbial Genetics:

Conjugation, transduction, transformation; Legal and social aspects of food biotechnology.

TEXTBOOK

- Fundamentals of food biotechnology. Lee, B.H. 1996. VCH Pub. Inc., New York.

COURSE CODE/TITLE	**SEMESTER/TERMS OFFERED**	**CREDITS**
FD-404Sugar & Confectionery	Electives	2+1

PREREQUISITES	**Knowledge Area**
Introduction to Food Engineering	Engineering (Depth)

COURSE OBJECTIVES

To provide understanding of sugar industries, nutrition value and its application in confectionery processing, seasoning and snacks.

COURSE TOPICS

Sugar Industry in Pakistan:

Composition and properties of Molasses Sugarcane and sugar beet and honey: production, quality; Indigenous technology for small scale sugar production: *gur, khund, shaker*; Raw sugar manufacturing: unit operations, Bagging, storage; Factors affecting sugar processing; Quality criteria: raw and refined sugar; Specialty sugar products: brown or soft sugar, liquid sugar; Sugar industry byproducts and their uses.

Nutrition Value:

Caloric and non-caloric sweeteners; Nutritional Value, Sweetening Power, Processing, Toxicology and Safety. Packaging, By-products and their Utilization. Quality Control. Non-Nutritive Sweeteners.

Confectionery:

Significance, classification, industries in Pakistan. Ingredients, manufacturing - high boiled sweets, caramel, toffee, fudge, gums.

Sugar free Confectionery:

Need, ingredients, manufacture; Chewing gum technology; Chocolate confectionery.

Snack Foods:

History, manufacture - potato, nuts, cereal, meat and fish based; Puffed and baked snacks.

Seasonings:

Ingredients, formulations, applications; Quality control; Packaging.

TEXTBOOK

- Sugar Processing and By-Products of the Sugar Industry ,Antonio Valdes Delgado,2001
- The Science of Sugar Confectionery,Edwards William P,2000, RSC

COURSE CODE/TITLE	**SEMESTER/TERMS OFFERED**	**CREDITS**
FD-409Postharvest Technology	Electives	2+1
PREREQUISITES	**Knowledge Area**	
Unit operations in Food Engineering I and II, Food Quality Control	Engineering (Depth)	

COURSE OBJECTIVES

This course provides understanding postharvest techniques, and preservation techniques to increase shelf life.

COURSE TOPICS

Introduction:

Production, losses, causes, trade.

Fruit Ripening:

Changes during ripening, recommended conditions, commercial practices, water loss, respiration activity; Harvesting and handling methods; Maturity assessment of different fruits and vegetables.

Ripening Process:

Respiration, climacteric and non-climacteric patterns, pectic substances, ripening conditions; Postharvest physiology of fruits and vegetables; Postharvest treatments: coatings, curing, vapor heat treatment, hot water treatment, degreening; Storage: refrigerated, CA, hypobaric, MAS.

Packaging:

Types, design, modified atmospheric packaging, recycling.

Cold Chain:

Packing house operations, transportation; Safety and quality of fruits and vegetables;

Postharvest Technology of Cereals:

Harvesting, threshing, drying, storage and handling; New developments in postharvest technology.

Text Book

- Florkowski, W. J. & R. L Shewfelt, B. Brueckner, and S. E. Prussia. 2009. Postharvest Handling; A Systems Approach (2nd Ed.). Academic Press.
- Kader, A. A. 2002. Postharvest Technology of Horticulture Crop (3rd Ed.). University of California. Agriculture and natural Resources. California.
- Kitinoja, L. and A. A. Kader. 2003. Small-Scale postharvest handling practices. A manual for Horticultural Crops (4th Ed.). University of California, Davis, Postharvest Technology Research and Information Centre.

COURSE CODE/TITLE	**SEMESTER/TERMS OFFERED**	**CREDITS**
FD-412 Dairy Processing	Electives	2+1
PREREQUISITES	**Knowledge Area**	

Unit operations in Food Engineering I and II	Engineering (Depth)

COURSE OBJECTIVES

This course provides understanding of dairy processing techniques, and preservation techniques to increase shelf life.

COURSE TOPICS

Milk:

Production statistics, importance, standards, major constituents; Factors influencing raw milk quality.

Milk Handling:

Manual and machine milking, farm cooling, collection, reception, analyses at different levels, transportation.

Unit Operations in Milk Processing:

Cream separation, bactofugation, filtration, thermization, standardization, homogenization, pasteurization, sterilization, UHT, aseptic packaging, storage, distribution, effect on milk constituents.

Technology:

Chemistry, microbiology of industrial products and quality control: evaporated, condensed and powder milks, butter, yogurt, cheese, ice cream, *khoa*, *gulabjamun*, *burfi*, *rabri*, *paneer*, *dahi*, *lassi*, *kheer*, *desi ghee*; Milk by-products: dried whey, casein.

COURSE CODE/TITLE	**SEMESTER/TERMS OFFERED**	**CREDITS**
FD-413Cereal Processing	Electives	2+1
PREREQUISITES	**Knowledge Area**	
Unit operations in Food Engineering I and II	Engineering (Depth)	

COURSE OBJECTIVES

This course provides understanding of Cereal processing techniques, processing of cereal products and preservation techniques to increase shelf life.

COURSE TOPICS

Cereal Grains:

importance, production, structure, composition, nutrition: Grain grades and grading; Storage: methods, types, role of temperature and moisture, safe storage methods; Dry milling process: cleaning, tempering, conditioning;.

Grinding and Sieving:

Types of grinding machines; Sieving process: principles, types of sifters; Flour treatment and quality assessment; Rheology of doughs and batters. Maize - wet milling: production of starch, oil, protein. Rice: Drying, milling, parboiling; Processing of rice and oats; Malting and brewing; Production of breakfast cereals and snack foods; Feed and industrial uses of cereals..

COURSE CODE/TITLE	**SEMESTER/TERMS OFFERED**	**CREDITS**
FD-414Beverage Processing	Electives	2+1
PREREQUISITES	**Knowledge Area**	
Unit operations in Food Engineering I and II	Engineering (Depth)	

COURSE OBJECTIVES

This course provides understanding of Beverage processing techniques and preservation techniques to increase shelf life.

COURSE TOPICS

Beverage industry in Pakistan:

Beverages: classification – still, carbonated, alcoholic; Beverage ingredients: water, fruit components, sweeteners, flavorings, colorings, preservatives; Manufacture of soft drinks and fruit juices: mixing, pasteurization, homogenization, filling, packing and storage.

Carbonation:
History, CO_2, gas volume; Soft drinks and fruit juices: ingredient specifications, manufacturing problems, changes in color, appearance, flavor;

Packaging Types:
Interactions; Shelf life Issues: microbiological problems; Bottled water: legislation, water treatment, filling, quality issues; Fermented beverages: introduction, types, role of microorganisms.

Regulations and Standards:
Statuary requirement: labeling, nutrition claims.

COURSE CODE/TITLE FD-415Meat , Poultry and egg	**SEMESTER/TERMS OFFERED** Electives	**CREDITS** 2+1
PREREQUISITES	**Knowledge Area** Engineering (Depth)	
COURSE OBJECTIVES This course provides understanding of meat slaughtering, and its preservation techniques		
COURSE TOPICS **Poultry industry in Pakistan:** Factors affecting poultry quality: breed, age, sex, genotype, rearing conditions and practices; Bird selection: weight, quality; Primary poultry processing: live-bird, stunning, slaughtering, scalding, plucking, evisceration, giblet harvesting, whole-carcass and cuts packaging; Portioning and deboning operations; Preservation: freezing, canning, drying, chemical treatments, irradiation. **Packaging:** Materials, selection; Quality assurance: parameters, drug and feed residues. **Eggs:** Identification, grading, composition, quality characteristics, handling, storage; Egg processing: drying, freezing - whole, white, yolk; Functional properties and applications in food processing; Quality control during processing.		

COURSE CODE/TITLE FD-416 Food Product Development	**SEMESTER/TERMS OFFERED** Electives	**CREDITS** 2+1
PREREQUISITES	**Knowledge Area** Engineering (Depth)	
COURSE OBJECTIVES This course provides understanding of food product design, steps involve in design cycle.		
COURSE TOPICS **Process:** Food product development: strategy, design, development, commercialization, evaluation; Key to new product success and failure. **Consumer Tends:** Food product development: consumer behavior, food choices, sensory needs, consumer role; Preference mapping and food product development: conducting trials, analyzing, recent developments; Case study of consumer-oriented food product development: reduced-calorie foods - healthy eating, marketing and technological challenges, success factors; Case study: reduced -calorie on-the-go beverages; The ethics of food production and consumption. Genemitically Modified food.		

COURSE CODE/TITLE FD-417 Oil and Fat Processing	**SEMESTER/TERMS OFFERED** Electives	**CREDITS** 2+1
PREREQUISITES	**Knowledge Area**	

	Engineering (Depth)

COURSE OBJECTIVES

This course provides understanding of oil and fat processing and processing techniques.

COURSE TOPICS

Physical and Chemical Characteristics:

Oils and fats: importance, sources, production, uses; Characteristics of oils and fats. Oil bearing materials: pre-treatment, storage.

Extraction Methods:

Rendering, expression, solvent extraction; Processing: degumming, refining, bleaching, deodorization, fractionation, winterization, hydrogenation, interesterification, esterification, emulsification, stabilization; Spoilage: oxidative and hydrolytic rancidity – chemistry, prevention - use of antioxidants; Manufacture of frying oils, margarine, mayonnaise; Byproducts of fats and oils industry and their uses.

Text books:

- Vegetable Oils in Food Technology, *Composition, Properties and Uses, Second* Edition, Edited by Frank D. Gunstone.
- Fats and Oils: Formulating and Processing for Applications, Third Edition By Richard D. O'Brien,2003
- Edible Oil Processing, edited by Wolf Hamm, Richard J. Hamilton, Gijs Calliauw,2013

COURSE CODE/TITLE	**SEMESTER/TERMS OFFERED**	**CREDITS**
FD-418 Food Plant Hygiene and Sanitation	Electives	2+1
PREREQUISITES	**Knowledge Area** Engineering (Depth)	

COURSE OBJECTIVES

This course provides understanding of food plant hygiene and sanitation.

COURSE TOPICS

Food Sanitation:

Importance of sanitation in food industry; Introduction to Hazard Analysis and Critical Control Points (HACCP).

Practices:

Food processing systems; sanitation standard operating procedures (SSOP); cleaning compounds; sanitizers; pest control; waste product handling.

COURSE CODE/TITLE	**SEMESTER/TERMS OFFERED**	**CREDITS**
CH-405 Industrial Safety and Maintenance Management	Electives	3+0
PREREQUISITES	**Knowledge Area** Engineering (Depth)	

COURSE OBJECTIVES

This course provides understanding of food plant hygiene and sanitation.

COURSE TOPICS

Introduction: Accident and loss statistics, public perception of chemical industry, the accident process, some significant disasters as case studies; Toxicology: how toxicants enter and are eliminated from biological organisms, effects of toxicants, dose versus response models, threshold limit values.

Industrial Hygiene: Government regulations, identification and evaluation and control of various exposures in chemical industry. Fires and explosions: fire triangle, flammability characteristics of liquids and vapors. Design to prevent fires and explosions. Hazard identification and risk assessment. Accident investigations and case histories.

Forms of maintenance, scheduling of maintenance. Computerized Maintenance. Non destructive testing techniques. Forms of corrosion, prevention and inhibition,; Preparation for startup and shutdown. Preventive and predictive maintenance.