SRM UNIVERSITY
(Under section 3 of UGC Act 1956)

# B.Tech. (Full Time) - Food Process Engineering
# Curriculum & Syllabus
# 2013 – 2014

**Volume – I**
(all courses except open electives)

**FACULTY OF ENGINEERING AND TECHNOLOGY**
**SRM UNIVERSITY**
**SRM NAGAR, KATTANKULATHUR – 603 203**

## STUDENT OUTCOMES

The curriculum and syllabus for B.Tech programs (2013) conform to outcome based teaching learning process. In general, **ELEVEN STUDENT OUTCOMES** (a-k) have been identified and the curriculum and syllabus have been structured in such a way that each of the courses meets one or more of these outcomes. Student outcomes describe what students are expected to know and be able to do by the time of graduation. These relate to the skills, knowledge, and behaviors that students acquire as they progress through the program. Further each course in the program spells out clear instructional objectives which are mapped to the student outcomes.

**The student outcomes are**

(a) An ability to apply knowledge of mathematics, science, and engineering

(b) An ability to design and conduct experiments, as well as to analyze and interpret data

(c) An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

(d) An ability to function on multidisciplinary teams

(e) An ability to identify, formulate, and solve engineering problems

(f) An understanding of professional and ethical responsibility

(g) An ability to communicate effectively

(h) The broad education necessary to understand the impact of engineering solutions in global, economic, environmental, and societal context

(i) A recognition of the need for, and an ability to engage in life-long learning

(j) A knowledge of contemporary issues

(k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

**B. Tech. Food Process Engineering**
**Curriculum – 2013**
**(Applicable for students admitted from the academic year 2013-14 onwards)**

| SEMESTER I | | | | | | |
|---|---|---|---|---|---|---|
| **Course Code** | **Category** | **Course Name** | **L** | **T** | **P** | **C** |
| PD1001 | G | SOFT SKILLS I | 1 | 0 | 1 | 1 |
| MA1011 | B | MATRICES AND CALCULUS | 3 | 2 | 0 | 4 |
| PY1001 | B | PHYSICS | 3 | 0 | 0 | 3 |
| PY1002 | B | PHYSICS LAB | 0 | 0 | 2 | 1 |
| CY1001 | B | CHEMISTRY | 3 | 0 | 0 | 3 |
| CY1002 | B | CHEMISTRY LAB | 0 | 0 | 2 | 1 |
| LE1002 | G | VALUE EDUCATION | 1 | 0 | 0 | 1 |
| CE1001 | E | BASIC CIVIL ENGINEERING | 2 | 0 | 0 | 2 |
| **Courses From Table I** | | | | | | |
| Student shall register for minimum 20 credits in I semester and minimum 20 credits in II semester. However student shall have registered for all the courses enlisted under Semester I and II as well the courses in Table I by the time the registration process is complete in II semester.<br>Keeping this in mind student shall register for the courses in I and II semesters. | | | | | | |

**Legend:**
**L -** Number of lecture hours per week
**T -** Number of tutorial hours per week
**P -** Number of practical hours per week
**C -** Number of credits for the course

**Category of courses:**
**G -** General
**B** - Basic Sciences
**E** - Engineering Sciences and Technical Arts
**P** - Professional Subjects

| SEMESTER II | | | | | | |
|---|---|---|---|---|---|---|
| **Course Code** | **Category** | **Course Name** | **L** | **T** | **P** | **C** |
| PD1002 | G | SOFT SKILLS II | 1 | 0 | 1 | 1 |
| MA1012 | B | MULTIPLE INTEGRALS AND DIFFERENTIAL EQUATIONS | 3 | 2 | 0 | 4 |
| PY1003 | B | MATERIAL SCIENCE | 2 | 0 | 2 | 3 |
| CY1003 | B | PRINCIPLES OF ENVIRONMENTAL SCIENCE | 2 | 0 | 0 | 2 |
| LE1001 | G | ENGLISH | 1 | 2 | 0 | 2 |
| FP1001 | P | FOOD ENGINEERING | 3 | 2 | 0 | 4 |
| FP1002 | P | FOOD ENGINEERING LAB | 0 | 0 | 4 | 2 |
| **Courses From Table I** | | | | | | |
| Student shall register for minimum 20 credits in I semester and minimum 20 credits in II semester. However student shall have registered for all the courses enlisted under Semester I and II as well the courses in Table I by the time the registration process is complete in II semester. Keeping this in mind student shall register for the courses in I and II semesters. | | | | | | |

**TABLE I**

**COURSES WHICH CAN BE REGISTERED FOR EITHER IN I OR II SEMESTER**

| SEMESTER I / II | | | | | | |
|---|---|---|---|---|---|---|
| **Course Code** | **Category** | **Course Name** | **L** | **T** | **P** | **C** |
| CS1001 | G | PROGRAMMING USING MATLAB | 0 | 1 | 2 | 2 |
| BT1001 | B | BIOLOGY FOR ENGINEERS | 2 | 0 | 0 | 2 |
| ME1001 | E | BASIC MECHANICAL ENGINEERING | 2 | 0 | 0 | 2 |
| EE1001 | E | BASIC ELECTRICAL ENGINEERING | 2 | 0 | 0 | 2 |
| EC1001 | E | BASIC ELECTRONICS ENGINEERING | 2 | 0 | 0 | 2 |
| ME1004 | E | WORKSHOP PRACTICE | 0 | 0 | 3 | 2 |
| ME1005 | E | ENGINEERING GRAPHICS | 0 | 1 | 4 | 3 |
| NC1001/ NS1001/ SP1001/ YG1001 | G | *NCC/NSS/NSO/YOGA | 0 | 0 | 1 | 1 |

*NCC-National Cadet Corps
NSS-National Service Scheme
NSO-National Sports Organization (India)

| SEMESTER III | | | | | | |
|---|---|---|---|---|---|---|
| **Course Code** | **Category** | **Course Name** | **L** | **T** | **P** | **C** |
| LE1003/ LE1004/ LE1005/ LE1006/ LE1007 | G | GERMAN LANGUAGE PHASE I / FRENCH LANGUAGE PHASE I/ JAPANESE LANGUAGE PHASE I / KOREAN LANGUAGE PHASE I / CHINESE LANGUAGE PHASE I | 2 | 0 | 0 | 2 |
| PD1003 | G | APTITUDE I | 1 | 0 | 1 | 1 |
| MA1013 | B | FOURIER SERIES, PARTIAL DIFFERENTIAL EQUATIONS AND ITS APPLICATIONS | 4 | 0 | 0 | 4 |
| CE1051 | P | APPLIED MECHANICS AND STRENGTH OF MATERIALS | 3 | 0 | 0 | 3 |
| CH1040 | P | TRANSPORT PROCESS IN FOOD ENGINEERING | 3 | 0 | 0 | 3 |
| ME1055 | P | KINEMATICS OF MACHINERY | 3 | 0 | 0 | 3 |
| FP1003 | P | FOOD MICROBIOLOGY | 3 | 0 | 3 | 5 |
| **TOTAL** | | | **19** | **0** | **4** | **21** |
| **Total Contact Hours** | | | **23** | | | |

| SEMESTER IV | | | | | | |
|---|---|---|---|---|---|---|
| **Course Code** | **Category** | **Course Name** | **L** | **T** | **P** | **C** |
| LE1008/ LE1009/ LE1010/ LE1011/ LE1012 | G | GERMAN LANGUAGE PHASE II / FRENCH LANGUAGE PHASE II/ JAPANESE LANGUAGE PHASE II / KOREAN LANGUAGE PHASE II / CHINESE LANGUAGE PHASE II | 2 | 0 | 0 | 2 |
| PD1004 | G | APTITUDE II | 1 | 0 | 1 | 1 |
| CH1039 | P | STOICHIOMETRY AND ENGINEERING THERMODYNAMICS | 3 | 0 | 0 | 3 |
| FP1004 | P | FOOD BIOCHEMISTRY | 3 | 0 | 3 | 5 |
| FP1005 | P | UNIT OPERATIONS IN FOOD PROCESSING | 3 | 0 | 3 | 5 |
| FP1006 | P | POST HARVEST TECHNOLOGY OF FRUITS AND VEGETABLES | 3 | 0 | 3 | 5 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | P | *Dep. Elective –I* | 3 | 0 | 0 | 3 |
| **TOTAL** | | | **18** | **0** | **10** | **24** |
| **Total Contact Hours** | | | **28** | | | |

| **SEMESTER V** | | | | | | |
|---|---|---|---|---|---|---|
| **Course Code** | **Category** | **Course Name** | **L** | **T** | **P** | **C** |
| PD1005 | G | APTITUDE III | 1 | 0 | 1 | 1 |
| FP1007 | P | GRAIN PROCESSING | 3 | 0 | 0 | 3 |
| FP1008 | P | DAIRY PLANT ENGINEERING | 3 | 0 | 3 | 5 |
| FP1009 | P | ENGINEERING PROPERTIES OF FOODS | 2 | 1 | 3 | 4 |
| FP1010 | P | FOOD ANALYSIS LABORATORY | 0 | 0 | 4 | 2 |
| FP1047 | P | INDUSTRIAL TRAINING I (Training to be undergone after IV semester) | 0 | 0 | 1 | 1 |
| | P | *Dep. Elective –II* | 3 | 0 | 0 | 3 |
| | | *Open Elective I* | 3 | 0 | 0 | 3 |
| **TOTAL** | | | **15** | **1** | **12** | **22** |
| **Total Contact Hours** | | | **28** | | | |

| **SEMESTER VI** | | | | | | |
|---|---|---|---|---|---|---|
| **Course Code** | **Category** | **Course Name** | **L** | **T** | **P** | **C** |
| PD1006 | G | APTITUDE IV | 1 | 0 | 1 | 1 |
| ME1056 | P | REFRIGERATION AND COLD CHAIN | 3 | 0 | 0 | 3 |
| MA1016 | B | BIOSTATISTICS FOR FOOD PROCESS ENGINEERING | 4 | 0 | 0 | 4 |
| FP1011 | P | FOOD FERMENTATION TECHNOLOGY | 3 | 0 | 3 | 5 |
| FP1012 | P | COMPUTER AIDED DRAFTING IN FOOD PROCESSING | 0 | 1 | 3 | 3 |
| FP1013 | P | FOOD PROCESS EQUIPMENT DESIGN AND DRAWING LAB | 0 | 0 | 4 | 2 |
| FP1049 | P | MINOR PROJECT | 0 | 0 | 2 | 1 |
| | P | *Dep. Elective III* | 3 | 0 | 0 | 3 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | *Open Elective II* | 3 | 0 | 0 | 3 |
| | | *Open Elective III* | 3 | 0 | 0 | 3 |
| **TOTAL** | | | **20** | **1** | **13** | **28** |
| **Total Contact Hours** | | | **34** | | | |

| **SEMESTER VII** | | | | | | |
|---|---|---|---|---|---|---|
| **Course Code** | **Category** | **Course Name** | **L** | **T** | **P** | **C** |
| FP1014 | P | FOOD SAFETY AND REGULATIONS | 3 | 0 | 0 | 3 |
| FP1015 | P | BAKERY & CONFECTIONERY TECHNOLOGY | 3 | 0 | 3 | 5 |
| FP1016 | P | FOOD PACKAGING TECHNOLOGY | 3 | 0 | 0 | 3 |
| FP1017 | P | INSTRUMENTATION FOR FOOD ANALYSAIS | 3 | 0 | 0 | 3 |
| FP1018 | P | PROCESSING OF SPICES AND PLANTATION CROPS | 3 | 0 | 0 | 3 |
| FP1048 | P | INDUSTRIAL TRAINING II (Training to be undergone after VI semester) | 0 | 0 | 1 | 1 |
| | P | *Dep. Elective IV* | 3 | 0 | 0 | 3 |
| | P | *Dep. Elective V* | 3 | 0 | 0 | 3 |
| **TOTAL** | | | **21** | **0** | **4** | **24** |
| **Total Contact Hours** | | | **25** | | | |

| **SEMESTER VIII** | | | | | | |
|---|---|---|---|---|---|---|
| **Course Code** | **Category** | **Course Name** | **L** | **T** | **P** | **C** |
| FP1050 | P | MAJOR PROJECT / PRACTICE SCHOOL | 0 | 0 | 24 | 12 |
| **Total** | | | **0** | **0** | **24** | **12** |
| **Total Contact Hours** | | | **24** | | | |

| DEPARTMENT ELECTIVES | | | | | | |
|---|---|---|---|---|---|---|
| **SEMESTER IV** | | | | | | |
| **Course Code** | **Category** | **Course Name** | **L** | **T** | **P** | **C** |
| FP1101 | P | FAT & OIL PROCESSING TECHNOLOGY | 3 | 0 | 0 | 3 |
| FP1102 | P | CANE SUGAR TECHNOLOGY | 3 | 0 | 0 | 3 |
| FP1103 | P | BOILER & STEAM ENGINEERING | 3 | 0 | 0 | 3 |
| **SEMESTER V** | | | | | | |
| FP1104 | P | FOOD BIOTECHNOLOGY | 3 | 0 | 0 | 3 |
| FP1105 | P | ENZYME TECHNOLOGY | 3 | 0 | 0 | 3 |
| FP1106 | P | BIOCHEMISTRY OF PROCESSING & PRESERVATION OF FOODS | 3 | 0 | 0 | 3 |
| **SEMESTER VI** | | | | | | |
| FP1107 | P | MEAT, POULTRY & FISH PROCESSING | 3 | 0 | 0 | 3 |
| FP1108 | P | FOOD PLANT LAYOUT AND DESIGN | 3 | 0 | 0 | 3 |
| FP1109 | P | BEVERAGE PROCESSING | 3 | 0 | 0 | 3 |
| **SEMESTER VII** | | | | | | |
| FP1110 | P | FOOD ADDITIVES | 3 | 0 | 0 | 3 |
| FP1111 | P | FOOD INDUSTRY WASTE MANAGEMENT | 3 | 0 | 0 | 3 |
| FP1112 | P | MANAGEMENT OF FOOD PROCESSING INDUSTRIES | 3 | 0 | 0 | 3 |
| FP1113 | P | EMERGING NON THERMAL METHODS OF FOOD PRESERVATION | 3 | 0 | 0 | 3 |
| FP1114 | P | NUTRACEUTICALS AND FUNCTIONAL FOODS | 3 | 0 | 0 | 3 |
| FP1115 | P | NANOTECHNOLOGY IN FOOD PROCESSING | 3 | 0 | 0 | 3 |

**Summary of credits**

| Category | I | II | III | IV | V | VI | VII | VIII | Total | % |
|---|---|---|---|---|---|---|---|---|---|---|
| **G( Excluding open and departmental electives)** | 8 | | 3 | 3 | 1 | 1 | | | **16** | 8.89 |
| **B( Excluding open and departmental electives)** | 23 | | 4 | | | 3 | | | **30** | 16.67 |
| **E( Excluding open and departmental electives)** | 13 | | | | | | | | **13** | 7.22 |
| **P( Excluding open and departmental electives)** | 6 | | 14 | 18 | 15 | 14 | 18 | 12 | **97** | 53.89 |
| ***Open Elective*** | | | | | 3 | 6 | | | **9** | 5.00 |
| ***Dep. Elective*** | | | | 3 | 3 | 3 | 6 | | **15** | 8.33 |
| **Total** | 50 | | 21 | 24 | 22 | 27 | 24 | 12 | **180** | 100 |

**SEMESTER I**

| | | | | | |
|---|---|---|---|---|---|
| **PD1001** | **SOFT SKILLS-I** | **L** | **T** | **P** | **C** |
| | Total Contact Hours - 30 | **1** | **0** | **1** | **1** |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

To enhance holistic development of students and improve their employability skills.

**INSTRUCTIONAL OBJECTIVES**

| | |
|---|---|
| 1. | To develop inter personal skills and be an effective goal oriented team player. |
| 2. | To develop professionals with idealistic, practical and moral values. |
| 3. | To develop communication and problem solving skills. |
| 4. | To re-engineer attitude and understand its influence on behavior. |

**UNIT I - SELF ANALYSIS** **(4 hours)**

SWOT Analysis, Who am I, Attributes, Importance of Self Confidence, Self Esteem

**UNIT II - ATTITUDE** **(4 hours)**

Factors influencing Attitude, Challenges and lessons from Attitude.

**Change Management**

Exploring Challenges, Risking Comfort Zone, Managing Change

**UNIT III - MOTIVATION** **(6 hours)**

Factors of motivation, Self talk, Intrinsic & Extrinsic Motivators.

**UNIT IV - GOAL SETTING** **(6 hours)**

Wish List, SMART Goals, Blue print for success, Short Term, Long Term, Life Time Goals.

**Time Management**

Value of time, Diagnosing Time Management, Weekly Planner To do list, Prioritizing work.

**UNIT V - CREATIVITY** **(10 hours)**

Out of box thinking, Lateral Thinking

**Presentation**

**ASSESSMENT**

1. A practical and activity oriented course which has continuous assessment for 75 marks based on class room interaction, activities etc.
2. Presentation – 25 marks

**TEXT BOOK**

1. INSIGHT, 2012, "*Career Development Centre"*, SRM Publications.

**REFERENCES**


1. Covey Sean, "*Seven Habits of Highly Effective Teens"*, New York, Fireside Publishers, 1998.
2. Carnegie Dale, "*How to win Friends and Influence People"*, New York: Simon & Schuster, 1998.
3. Thomas A Harris, "*I am ok, You are ok*", New York-Harper and Row, 1972.
4. Daniel Coleman, "*Emotional Intelligence"*, Bantam Book, 2006.


| PD1001 SOFT SKILLS-I | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Designed by** | | **Career Development Centre** | | | | | | | | | | |
| 1. | Student outcome | a | b | c | d | e | f | g | h | i | j | k |
| | | | | | X | | X | X | | X | | |
| 2. | Mapping of instructional objectives with student outcome | | | | 1 | | 2 | 3 | | 4 | | |
| 3. | Category | General (G) | | Basic Sciences(B) | | | Engineering Sciences and Technical Arts(E) | | | Professional Subjects(P) | | |
| | | X | | -- | | | -- | | | -- | | |
| 4. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

| | MATRICES AND CALCULUS | L | T | P | C |
|---|---|---|---|---|---|
| | Total No. of Contact Hours = 75 Hours | **3** | **2** | **0** | **4** |
| **MA1011** | (Common to BT, BI, BME, BP, GE, FPE) | | | | |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

To impart analytical ability in solving mathematical problems as applied to the respective branches of Engineering.

**INSTRUCTIONAL OBJECTIVES**

1. To apply advanced matrix knowledge to Engineering problems.

| | |
|---|---|
| 2. | To improve their ability in trigonometry. |
| 3. | To equip themselves familiar with the concepts of Differential calculus |
| 4. | To expose to the concept of integral calculus |
| 5. | To familiarize with the applications of differential and integral calculus |

**UNIT I - MATRICES** **(12 hours)**

Review types of matrices, properties. Inverse matrix Cramer's rule for solving a system of linear equations. – Rank of Matrix – Consistency and Inconsistency of a system of m linear equations in 'n' unknowns –Cayley Hamilton theorem – Eigen values and Eigen vectors of a real matrix.

**UNIT II - TRIGONOMETRY** **(12 hours)**

Review of complex numbers. De Moiver's theorem and its applications. Expansion of $\sin n\theta$, $\cos n\theta$ in terms of $\sin\theta$ and $\cos\theta$. Expansion of $\tan n\theta$ in terms of $\tan\theta$. Expansion of $\sin^n\theta$ and $\cos^n\theta$ in terms of sines and cosines of multiples of $\theta$.Hyperbolic functions and inverse hyperbolic functions.

**UNIT III - DIFFERENTIAL CALCULUS** **(12 hours)**

Differentiation and Derivatives of simple functions – Successive Differentiation – Various forms of Algebraic and Trigonometric functions – Problems.

**UNIT IV - INTEGRAL CALCULUS** **(12 hours)**

Methods of integration – Definite integrals and its properties-Reduction formula for $e^{ax}x^n$, $\sin^n x$, $\cos^n x$, $\sin^n x\cos^m x$ (without proof)-Problems.

**UNIT V - APPLICATIONS OF DIFFERENTIAL CALCULUS & INTEGRAL CALCULUS** **(12 hours)**

Applications of differential calculus & integral calculus. Tangent & Normal-Radius of curvature – Velocity and acceleration . Integral calculus – Length & Area.

**TEXT BOOKS**


1. Kreyszig.E, "*Advanced Engineering Mathe*matics", 10th edition, John Wiley & Sons. Singapore, 2012.
2. GanesanK., Sundarammal Kesavan, Ganapathy Subramanian K.S.& SrinivasanV., "*Engineering Mathematics*", Gamma publications, Revised Edition, 2013.

**REFERENCES**


1. Grewal B.S, "*Higher Engg Maths"*, Khanna Publications, 42nd Edition,2012.
2. Veerajan, T., *"Engineering Mathematics I*", Tata McGraw Hill Publishing Co., New Delhi, 5th edition, 2006.
3. Kandasamy P etal. "*Engineering Mathematics"*, Vol.I (4th revised edition), S.Chand &Co., New Delhi,2000.
4. Narayanan S., Manicavachagom Pillay T.K., Ramanaiah G., "*Advanced Mathematics for Engineering students"*, Volume I (2nd edition), S.Viswanathan Printers and Publishers, 1992.
5. Venkataraman M.K., "*Engineering Mathematics – First Year (2nd edition*)", National Publishing Co., Chennai,2000.


| **MA 1011 MATRICES AND CALCULUS** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Designed by** | | **Department of Mathematics** | | | | | | | | | | |
| 1. | Student outcome | a | b | c | d | e | f | g | h | i | j | k |
| | | X | | | | X | | | | | | |
| 2. | Mapping of instructional objectives with student outcomes | 1-5 | | | | 1-5 | | | | | | |
| 3. | Category | General (G) | Basic Sciences(B) | | | Engineering Sciences and Technical Arts(E) | | | | Professional Subjects(P) | | |
| | | -- | X | | | -- | | | | -- | | |
| 4. | Approval | 23rd Meeting of academic council, May 2013 | | | | | | | | | | |

| **PY1001** | **PHYSICS** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | Total Contact Hours-45 | **3** | **0** | **0** | **3** |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

The purpose of this course is to provide an understanding of physical concepts and underlying various engineering and technological applications. In addition, the course is expected to develop scientific temperament and analytical skill in students, to enable them logically tackle complex engineering problems in their chosen area of application.

**INSTRUCTIONAL OBJECTIVES**

| | |
|---|---|
| 1. | To understand the general scientific concepts required for technology |
| 2. | To apply the Physics concepts in solving engineering problems |
| 3. | To educate scientifically the new developments in engineering and technology |
| 4. | To emphasize the significance of Green technology through Physics principles |

**UNIT I–MECHANICAL PROPERTIES OF SOLIDS AND ACOUSTICS (9 hours)**

**Mechanical properties of solids:** Stress-strain relationship – Hooke's law – Torsional Pendulum – Young's modulus by cantilever – Uniform and non-uniform bending –– Stress-strain diagram for various engineering materials – Ductile and brittle materials – Mechanical properties of Engineering materials (Tensile strength, Hardness, Fatigue, Impact strength, Creep) – Fracture – Types of fracture (Elementary ideas).

**Acoustics:** Intensity – Loudness – Absorption coefficient and its determination – Reverberation – Reverberation time – Factors affecting acoustics of buildings and their remedies – Sources and impacts of noise – Sound level meter – Strategies on controlling noise pollution – Ultrasonic waves and properties – Methods of Ultrasonic production (Magnetostriction and Piezoelectric) – Applications of Ultrasonics in Engineering and medicine.

**UNIT II–ELECTROMAGNETIC WAVES, CIRCUITS AND APPLICATIONS (9 hours)**

Del operator – grad, div, curl and their physical significances - displacement current –Maxwell's equations (derivation) – Wave equation for electromagnetic waves – Propagation in free space – Poynting theorem – Characteristic of Transverse electric and magnetic waves – Skin depth – Rectangular and circular waveguides – High powered vacuum-based cavity magnetrons – Applications including radars, microwave oven and lighting systems.

**UNIT III– LASERS AND FIBER OPTICS (9 hours)**

**Lasers:** Characteristics of Lasers – Einstein's coefficients and their relations – Lasing action – Working principle and components of $CO_2$ Laser, Nd-YAG Laser, Semiconductor diode Laser, Excimer Laser and Free electron Laser – Applications in Remote sensing, holography and optical switching – Mechanism of Laser cooling and trapping.

**Fiber Optics:** Principle of Optical fiber – Acceptance angle and acceptance cone – Numerical aperture – V-number – Types of optical fibers (Material, Refractive index and mode) – Photonic crystal fibers – Fiber optic communication – Fiber optic sensors.

**UNIT IV– QUANTUM MECHANICS AND CRYSTAL PHYSICS (9 hours)**

**Quantum mechanics:** Inadequacies of Classical Mechanics – Duality nature of electromagnetic radiation – De Broglie hypothesis for matter waves – Heisenberg's uncertainty principle –Schrödinger's wave equation – Particle confinement in 1D box (Infinite Square well potential). **Crystal Physics:** Crystal directions – Planes and Miller indices – Symmetry elements – Quasi crystals –

Diamond and HCP crystal structure – Packing factor – Reciprocal lattice – Diffraction of X-rays by crystal planes – Laue method and powder method – Imperfections in crystals.

**UNIT V– GREEN ENERGY PHYSICS (9 hours)**

Introduction to Green energy – **Solar energy:** Energy conversion by photovoltaic principle – Solar cells – **Wind energy:** Basic components and principle of wind energy conversion systems – **Ocean energy:** Wave energy – Wave energy conversion devices – Tidal energy – single and double basin tidal power plants – Ocean Thermal Electric Conversion (OTEC) – **Geothermal energy:** Geothermal sources (hydrothermal, geo-pressurized hot dry rocks, magma) – **Biomass:** Biomass and bio-fuels – bio-energies from wastages – **Fuel cells**: $H_2O_2$ – **Futuristic Energy:** Hydrogen – Methane Hydrates – Carbon capture and storage (CCS).

* One problem sheet consisting of 10 to 15 problems is to be prepared for each unit and discussed in the class.
* Few problems based on design considerations related to appropriate branches of engineering can be incorporated in each problem sheet.

**TEXT BOOKS**


1. Thiruvadigal, J. D., Ponnusamy,S. Sudha.D. and Krishnamohan M., "*Physics forTechnologists"*, Vibrant Publication, Chennai, 2013.
2. Dattu R.Joshi, *"Engineering Physics"*,Tata McGraw- Hill,New Delih,2010.


**REFERENCES**


1. Wole Soboyejo, "*Mechanical Properties of Engineered Materials*", Marcel Dekker Inc., 2003.
2. Frank Fahy, "*Foundations of Engineering Acoustics*", Elsevier Academic Press, 2005.
3. Alberto Sona, "*Lasers and their applications*", Gordon and Breach Science Publishers Ltd., 1976.
4. David J. Griffiths, "*Introduction to electrodynamics*", 3rd ed., Prentice Hall, 1999.
5. Leonard. I. Schiff, "*Quantum Mechanics"*, Third Edition, Tata McGraw Hill, 2010.
6. Charles Kittel, "*Introduction to Solid State Physics*", Wiley India Pvt. Ltd, 7th ed., 2007.
7. Godfrey Boyle, "*Renewable Energy: Power sustainable future*", 2nd edition, Oxford University Press, UK, 2004.

| PY1001 PHYSICS | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Designed by** | | **Department of Physics and Nanotechnology** | | | | | | | | | | |
| 1. | Student outcome | a | b | c | d | e | f | g | h | i | j | k |
| | | x | | x | | x | | | | | | X |
| 2. | Mapping of instructional objectives with student outcome | 1 | | 4 | | 2 | | | | | | 3 |
| 3. | Category | General (G) | | Basic Sciences (B) | | Engineering Sciences and Technical Arts(E) | | | | Professional Subjects(P) | | |
| | | -- | | X | | -- | | | | -- | | |
| 4. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

| PY1002 | PHYSICS LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | Total Contact Hours – 30 | **0** | **0** | **2** | **1** |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

The purpose of this course is to develop scientific temper in experimental techniques and to reinforce the physics concepts among the engineering students

**INSTRUCTIONAL OBJECTIVES**

| | |
|---|---|
| 1. | To gain knowledge in the scientific methods and learn the process of measuring different Physical variables |
| 2. | Develop the skills in arranging and handling different measuring instruments |
| 3. | Get familiarized with experimental errors in various physical measurements and to plan / suggest on how the contributions could be made of the same order, so as to minimize the errors. |

**LIST OF EXPERIMENTS**

1. Determination of Young's modulus of a given material – Uniform / Non-uniform bending methods.
2. Determination of Rigidity modulus of a given material – Torsion pendulum
3. Determination of dispersive power of a prism – Spectrometer
4. Determination of laser parameters – divergence and wavelength for a given laser source –laser grating/ Particle size determination using laser
5. Study of attenuation and propagation characteristics of optical fiber cable
6. Calibration of voltmeter / ammeter using potentiometer

7. Construction and study of IC regulation properties of a given power supply
8. Study of electrical characteristics of a solar cell
9. Mini Project – Concept based Demonstration

**TEXT BOOKS**


1. Thiruvadigal, J. D., Ponnusamy, S.Sudha.D. and Krishnamohan M., "*Physics for Technologists"*, Vibrant Publication, Chennai, 2013.
2. R.K.Shukla and Anchal Srivastava, "*Practical Physics*", 1st Edition, New Age International (P) Ltd, New Delhi, 2006.


**REFERENCES**


1. SouiresG.L., "*Practical Physics"*, 4thEdition, Cambridge University, UK, 2001.
2. ChattopadhyayD., Rakshit P. C. and SahaB., "*An Advanced Course in Practical Physics*", 2nd ed., Books & Allied Ltd., Calcutta, 1990.


| PY1002 PHYSICS LABORATORY | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course Designed by | | Department of Physics and Nanotechnology | | | | | | | | | | |
| 1. | Student Outcome | a | b | c | d | e | f | g | h | i | j | k |
| | | x | x | | | x | | | | | | |
| 2. | Mapping of instructional objectives with student outcome | 1 | 3 | | | 2 | | | | | | |
| 3. | Category | General (G) | Basic Sciences(B) | | | Engineering Sciences and Technical Arts (E) | | | | Professional Subjects (P) | | |
| | | -- | X | | | -- | | | | -- | | |
| 4. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

| CY1001 | CHEMISTRY | L | T | P | C |
|---|---|---|---|---|---|
| | Total Contact Hours – 45 | **3** | **0** | **0** | **3** |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

To enable the students to acquire knowledge in the principles of chemistry for engineering applications

**INSTRUCTIONAL OBJECTIVES**

| | |
|---|---|
| 1. | The quality of water and its treatment methods for domestic and industrial applications. |
| 2. | The classification of polymers, different types of polymerizations, preparation, |

| | |
|---|---|
| | properties and applications of important polymers and FRPs. |
| 3. | The phase rule and its application to one and two component systems. |
| 4. | The principle, types and mechanism of corrosion and protective coatings. |
| 5. | The classification and selection of lubricants and their applications. |
| 6. | The basic principles, instrumentation and applications of analytical techniques |

**UNIT I-WATER TREATMENT (9 hours)**

Water quality parameters: Physical, Chemical & Biological significance - Hardness of water - estimation of hardness (EDTA method) - Dissolved oxygen – determination (Winkler's method), Alkalinity - determination - disadvantages of using hard water in boilers: Scale, sludge formation - disadvantages - prevention - treatment: Internal conditioning - phosphate, carbon and carbonate conditioning methods - External: Zeolite, ion exchange methods - desalination - reverse osmosis and electrodialysis - domestic water treatment.

**UNIT II - POLYMERS AND REINFORCED PLASTICS (9 hours)**

Classification of polymers - types of polymerization reactions - mechanism of addition polymerization: free radical, ionic and Ziegler - Natta - effect of structure on the properties of polymers - strength, plastic deformation, elasticity and crystallinity -Preparation and properties of important resins: Polyethylene, PVC, PMMA, Polyester, Teflon, Bakelite and Epoxy resins - compounding of plastics - moulding methods - injection, extrusion, compression and calendaring - reinforced plastics - FRP – Carbon and Glass- applications.

**UNIT III - PHASE EQUILIBRIA, LUBRICANTS AND ADHESIVES (9 hours)**

Phase rule: Statement - explanation of the terms involved - one component system (water system only). Condensed phase rule - thermal analysis - two component systems: simple eutectic, Pb-Ag; compound formation, Zn-Mg.

Lubricants: Classification –solid, semi solid, liquid, emulsion- properties – selection of lubricants for different purposes, Adhesives: classification-natural, synthetic, inorganic- Adhesive action - applications.

**UNIT IV- CORROSION AND ITS CONTROL (9 hours)**

Corrosion: Basic concepts - mechanism of chemical, electrochemical corrosion - Pilling Bedworth rule – Types of Electrochemical corrosion - galvanic corrosion - differential aeration corrosion - pitting corrosion - stress corrosion – Measurement of corrosion (wt. loss method only) - factors influencing corrosion. Corrosion control: Cathodic protection - sacrificial anodic method - corrosion inhibitors. Protective coatings: surface preparation for metallic coatings - electro

plating (copper plating) and electroless plating (Nickel plating) - chemical conversion coatings - anodizing, phosphating & chromate coating.

**UNIT V- INSTRUMENTAL METHODS OF ANALYSIS (9 hours)**

Basic principles, instrumentation and applications of potentiometry, UV - visible spectroscopy, infrared spectroscopy, atomic absorption spectroscopy and flame photometry .

**TEXT BOOKS**


1. Kamaraj.P & Arthanareeswari. M, "*Applied Chemistry", 9th Edition*, Sudhandhira Publications, 2012.
2. Dara. S.S, "*A Text book of Engineering Chemistry"*, 10th Edition, S.Chand & Company Ltd., New Delhi, 2003


**REFERENCES**


1. Jain.P.C and Monika Jain, "*Engineering Chemistry*", Danpat Rai publishing company (P) Ltd, New Delhi, 2010.
2. Helen P Kavitha, "*Engineering Chemistry – I", Scitech* Publications, 2nd edition, 2008.


| CY1001 CHEMISTRY | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Designed by** | | **Department of Chemistry** | | | | | | | | | | |
| 1. | Student Outcome | a | b | c | d | e | f | g | h | i | j | k |
| | | x | x | x | | x | | | | | | x |
| 2. | Mapping of instructional objective with student outcome | 1-6 | 1,5 | 3 | | 2 | | | | | | 4 |
| 3. | Category | General (G) | | Basic Sciences(B) | | Engineering Sciences and Technical Arts(E) | | | | | Professional Subjects (P) | |
| | | -- | | X | | -- | | | | | -- | |
| 4. | Approval | 23rdMeeting of Academic Council, May 2013 | | | | | | | | | | |

| CY1002 | CHEMISTRY LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | Total Contact Hours – 30 | 0 | 0 | 2 | 1 |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

To apply the concepts of chemistry and develop analytical skills for applications in engineering.

**INSTRUCTIONAL OBJECTIVES**

| | |
|---|---|
| 1. | To enable the students to understand the basic concepts involved in the analyses. |

**LIST OF EXPERIMENTS**

1. Preparation of standard solutions
2. Estimation of total, permanent and temporary hardness by EDTA method
3. Conductometric titration - determination of strength of an acid
4. Estimation of iron by potentiometry.
5. Determination of molecular weight of polymer by viscosity average method
6. Determination of dissolved oxygen in a water sample by Winkler's method
7. Determination of Na / K in water sample by Flame photometry (Demonstration)
8. Estimation of Copper in ore
9. Estimation of nickel in steel
10. Determination of total alkalinity and acidity of a water sample
11. Determination of rate of corrosion by weight loss method.

**REFERENCES**


1. Kamaraj & Arthanareeswari, Sudhandhira Publications "*Practical Chemistry*" (work book) , 2011.
2. Helen P. Kavitha "*Chemistry Laboratory Manual*", Scitech Publications, 2008.


| CY1002 CHEMISTRY LABORATORY | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course Designed by | | Department of Chemistry | | | | | | | | | | |
| 1. | Student Outcomes | a | b | c | d | e | f | g | h | i | j | k |
| | | X | x | | | | | | | | | X |
| 2. | Mapping of instructional objectives with student outcome | 1 | 1 | | | | | | | | | 1 |

| | | | | | |
|---|---|---|---|---|---|
| 3. | Category | General (G) | Basic Sciences(B) | Engineering Sciences and Technical Arts(E) | Professional Subjects(P) |
| | | -- | x | -- | -- |
| 4. | Approval | 23rd Meeting of Academic Council, May 2013 | | | |

| | | | | | |
|---|---|---|---|---|---|
| **LE1002** | **VALUE EDUCATION** | **L** | **T** | **P** | **C** |
| | Total Contact Hours- 15 | **1** | **0** | **0** | **1** |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

To provide guiding principles and tools for the development of the whole person recognizing that the individual is comprised of Physical, Intellectual, Emotional and Spiritual dimensions.

**INSTRUCTIONAL OBJECTIVES**

| | |
|---|---|
| 1. | To help individuals think about and reflect on different values. |
| 2. | To deepen understanding, motivation and responsibility with regard to making personal and social choices and the practical implications of expressing them in relation to themselves, others, the community and the world at large |
| 3. | To inspire individuals to choose their own personal, social, moral and spiritual values and be aware of practical methods for developing and deepening |

**UNIT I- INTRODUCTION (3 hours)**

Definition, Relevance, Types of values, changing concepts of values

**UNIT II- INDIVIDUAL AND GROUP BEHAVIOUR (3 hours)**

Personal values – Self – Strengths (self-confidence, self-assessment, self-reliance, self-discipline, determination, self-restraint, contentment, humility, sympathy and compassion, gratitude, forgiveness) Weaknesses (Influences -- Peer pressure, familial and societal expectations, media)

**UNIT III- SOCIETIES IN PROGRESS (3 hours)**

Definition of society; Units of society; Communities – ancient and modern – Agents of change – Sense of survival, security, desire for comfort and ease sense of belonging, social consciousness and responsibility

**UNIT IV- ENGINEERING ETHICS** **(3 hours)**

Definition- Societies for engineers – Code of Ethics – Ethical Issues involved in cross border research -- Ethical and Unethical practices – case studies – situational decision making

**UNIT V- SPIRITUAL VALUES** **(3 hours)**

What is religion? -- Role of religion – Misinterpretation of religion – moral policing – Consequences -- Religion as spiritual quest – Aesthetics and religion

**TEXT BOOK**

1. Department of English and Foreign Languages SRM University, "*Rhythm of Life"*, SRM Publications, 2013.

**REFERENCE**

1. Values **(**Collection of Essays). Published by: "*Sri Ramakrishna Math"*, Chennai-4. 1996.

| **LE1002 VALUE EDUCATION** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Designed by** | | **Department of English and Foreign Languages** | | | | | | | | | | |
| 1. | Student Outcomes | a | b | c | d | e | f | g | h | i | j | k |
| | | | | | | | X | | | x | | |
| 2. | Mapping of instructional objectives with student outcome | | | | | | 1-3 | | | 1-3 | | |
| 3. | Category | General (G) | | Basic Sciences(B) | | Engineering Sciences and Technical Arts(E) | | | | Professional Subjects(P) | | |
| | | x | | -- | | -- | | | | -- | | |
| 4. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

| **CE1001** | **BASIC CIVIL ENGINEERING** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | Total Contact Hours=30 | **2** | **0** | **0** | **2** |
| | Prerequisite | | | | |
| | Nil | | | | |
| **PURPOSE** | | | | | |
| To get exposed to the glimpses of Civil Engineering topics that is essential for an Engineer. | | | | | |
| **INSTRUCTIONAL OBJECTIVES** | | | | | |
| 1. | To know about different materials and their properties | | | | |

| | |
|---|---|
| 2. | To know about engineering aspects related to buildings |
| 3. | To know about importance of surveying and the transportation systems |
| 4. | To get exposed to the rudiments of engineering related to dams, water supply, and sewage disposal |

**UNIT I- BUILDING MATERILAS (6hours )**

Introduction – Civil Engineering – Materials: Bricks – composition – classifications – properties –uses. Stone – classification of rocks – quarrying – dressing – properties –uses. Timber - properties –uses –ply wood. Cement – grades –types – properties –uses. Steel – types – mild steel – medium steel – hard steel – properties – uses – market forms. Concrete – grade designation – properties – uses.

**UNIT II- MATERIAL PROPERTIES (6hours )**

Stress – strain – types – Hook's law – three moduli of elasticity – poisons ratio – relationship – factor of safety. Centroid - center of gravity – problems in symmetrical sections only (I, T and channel sections).Moment of inertia, parallel, perpendicular axis theorems and radius of gyration (definitions only).

**UNIT III -BUILDING COMPONENTS (6hours )**

Building – selection of site – classification – components.Foundations –functions – classifications – bearing capacity. Flooring – requirements – selection – types – cement concrete marble – terrazzo floorings. Roof – types and requirements.

**UNIT IV-SURVEYING AND TRANSPORTATION (6hours )**

Surveying – objectives – classification – principles of survey.Transportation – classification – cross section and components of road – classification of roads. Railway – cross section and components of permanent way –functions. Water way – docks and harbor – classifications – components. Bridge – components of bridge.

**UNIT V- WATER SUPPLY AND SEWAGE DISPOSAL (6hours )**

Dams – purpose – selection of site – types –gravity dam (cross section only). Water supply – objective – quantity of water – sources – standards of drinking water – distribution system. Sewage – classification – technical terms – septic tank – components and functions.

**TEXT BOOKS**

1. Raju K.V.B., Ravichandran P.T., "*Basics of Civil Engineering"*, Ayyappa Publications, Chennai, 2012.
2. Rangwala,S.C.," *Engineering Material"s*, Charotar Publishing House, Anand, 2012.

**REFERENCES**

1. Ramesh Babu, "*Civil Engineering"*, VRB Publishers, Chennai, 2000.
2. National Building Code of India, Part V, "*Building Material"s*, 2005.
3. Surendra Singh, "*Building Material"s*, Vikas Publishing Company, New Delhi, 1996.

<table>
<tr><th colspan="13">CE1001 - BASIC CIVIL ENGINEERING</th></tr>
<tr><td colspan="2">Course Designed by</td><td colspan="11">Department of Civil Engineering</td></tr>
<tr><td rowspan="2">1.</td><td rowspan="2">Student Outcomes</td><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td><td>f</td><td>g</td><td>h</td><td>i</td><td>j</td><td>k</td></tr>
<tr><td>x</td><td></td><td></td><td></td><td>x</td><td></td><td></td><td></td><td></td><td></td><td>x</td></tr>
<tr><td>2.</td><td>Mapping of instructional objectives with student outcome</td><td>1 - 4</td><td></td><td></td><td></td><td>1-4</td><td></td><td></td><td></td><td></td><td></td><td>2-4</td></tr>
<tr><td rowspan="2">3.</td><td rowspan="2">Category</td><td colspan="2">General (G)</td><td colspan="2">Basic Sciences(B)</td><td colspan="4">Engineering Sciences and Technical Arts(E)</td><td colspan="3">Professional Subjects(P)</td></tr>
<tr><td colspan="2">--</td><td colspan="2">--</td><td colspan="4">x</td><td colspan="3">--</td></tr>
<tr><td>4.</td><td>Approval</td><td colspan="11">23rd Meeting of Academic Council, May 2013</td></tr>
</table>

**SEMESTER II**

| | | | | | |
|---|---|---|---|---|---|
| **PD1002** | **SOFT SKILLS-II** | **L** | **T** | **P** | **C** |
| | Total Contact Hours – 30 | **1** | **0** | **1** | **1** |
| | Prerequisite | | | | |
| | Nil | | | | |

| **PURPOSE** | |
|---|---|
| To enhance holistic development of students and improve their employability skills. | |
| **INSTRUCTIONAL OBJECTIVES** | |
| 1. | To develop inter personal skills and be an effective goal oriented team player. |
| 2. | To develop professionals with idealistic, practical and moral values. |
| 3. | To develop communication and problem solving skills. |
| 4. | To re-engineer attitude and understand its influence on behavior. |

**UNIT I - INTERPERSONAL SKILLS (6 hours)**

Understanding the relationship between Leadership Networking & Team work, Realizing Ones Skills in Leadership, Networking & Team Work, and Assessing Interpersonal Skills Situation description of Interpersonal Skill.

**Team Work**

Necessity of Team Work Personally, Socially and Educationally

**UNIT II - LEADERSHIP (4 hours)**

Skills for a good Leader, Assessment of Leadership Skills

**Change Management**

Exploring Challenges, Risking Comfort Zone, Managing Change

**UNIT III - STRESS MANAGEMENT (6 hours)**

Causes of Stress and its impact, how to manage & distress, Understanding the circle of control, Stress Busters.

**Emotional Intelligence**

What is Emotional Intelligence, emotional quotient why Emotional Intelligence matters, Emotion Scales.Managing Emotions.

**UNIT IV - CONFLICT RESOLUTION (4 hours)**

Conflicts in Human Relations – Reasons Case Studies, Approaches to conflict resolution.

**UNIT V - DECISION MAKING** **(10 hours)**

Importance and necessity of Decision Making, process of Decision Making, Practical way of Decision Making, Weighing Positives & Negatives.

**Presentation**

**ASSESSMENT**

1. A practical and activity oriented course which has a continuous assessment for 75 marks based on class room interaction, activities etc.,
2. Presentation - 25 marks.

**TEXT BOOK**

1. INSIGHT, 2009. "*Career Development Ce*ntre", SRM Publications.

**REFERENCES**

1. Covey Sean, "*Seven Habit of Highly Effective Teens"*, New York, Fireside Publishers, 1998.
2. Carnegie Dale, "*How to win Friends and Influence People"*, New York: Simon & Schuster, 1998.
3. Thomas A Harris, "*I am ok, You are ok"* , New York-Harper and Row, 1972.
4. Daniel Coleman, *Emotional Intelligence*, Bantam Book, 2006.

| PD1002 - SOFT SKILLS-II | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Designed by** | | **Career Development Centre** | | | | | | | | | | |
| 1. | Student Outcome | a | b | c | d | e | f | g | h | i | j | K |
| | | | | | X | | X | X | | X | | |
| 2. | Mapping of instructional objectives with student outcome | | | | 1 | | 2 | 3 | | 4 | | |
| 3. | Category | General (G) | | Basic Sciences(B) | | | Engineering Sciences and Technical Arts (E) | | | Professional Subjects(P) | | |
| | | X | | -- | | | -- | | | -- | | |
| 4. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| **MA 1012** | **MULTIPLE INTEGRALS AND DIFFERENTIAL EQUATIONS** | **L** | **T** | **P** | **C** |
| | Total No. of Contact Hours - 75 Hours | **3** | **2** | **0** | **4** |
| | (Common to Bio group) | | | | |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

To impart analytical ability in solving mathematical problems as applied to the respective branches of Engineering.

**INSTRUCTIONAL OBJECTIVES**

| | |
|---|---|
| 1. | To understand maxima and minima of two and three variables. |
| 2. | To expose to the concepts of Differential equations |
| 3. | To expose to the concepts of Multiple integrals. |
| 4. | To expose to the concept of vector calculus |
| 5. | To expose to the concept of three dimensional analytical geometry. |

**UNIT I - FUNCTIONS OF SEVERAL VARIABLES (12 hours)**

Functions of two variables – partial derivatives – total differentiation – Taylor's expansion – maxima and minima of functions of two and three variables - Jacobians.

**UNIT II- DIFFERENTIAL EQUATIONS (12 hours)**

Differential equations of first order–Linear equations of second order with constant coefficients and variable coefficients – method of variation of parameters.

**UNIT III- MULTIPLE INTEGRALS (12 hours)**

Double integration in Cartesian and polar coordinates – Change of order of integration –Triple integration in Cartesian coordinates.

**UNIT IV - VECTOR CALCULUS (12 hours)**

Review of Vector Algebra.Gradient, divergence and curl – solenoidal, and irrotational fields – directional derivatives – line integrals – surface integrals – volume integrals, Integral theorems (without proof) and its applications**-** cubes and parallelepipeds only

**UNIT V - THREE DIMENSIONAL ANALYTICAL GEOMETRY (12 hours)**

Direction cosines and direction ratios of a line – angle between two lines. Equation of a plane – equation of straight line – shortest distance between two skew lines – coplanar lines.

**TEXT BOOKS**


1. Kreyszig.E, *"Advanced Engineering Mathematics"*, 10th edition, John Wiley & Sons. Singapore, 2012.
2. GanesanK., Sundarammal Kesavan, Ganapathy K.S.Subramanian & V.Srinivasan, *"Engineering Mathematics"*, Gamma publications, Revised Edition, 2013.


**REFERENCES**


1. Grewal B.S, Higher *"Engineering Mathematics"*, Khanna Publications, 42nd Edition, 2012.
2. Veerajan, T., *"Engineering Mathematics I"*, Tata McGraw Hill Publishing Co., New Delhi, 5th edition, 2006.
3. Kandasamy P etal. "*Engineering Mathematics"*, Vol.I (4th revised edition), Chand S.&Co., New Delhi, 2000.
4. Narayanan S., Manicavachagom Pillay T.K., Ramanaiah G., "*Advanced Mathematics for Engineering students",* Volume I (2nd edition), Viswanathan S.Printers and Publishers, 1992.
5. Venkataraman M.K., "*Engineering Mathematics* – First Year (2nd edition)", National Publishing Co., Chennai, 2000.


| **MA 1012 MULTIPLE INTEGRALS AND DIFFERENTIAL EQUATIONS** | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Designed by** | | **Department of Mathematics** | | | | | | | | | | | |
| 1. | Student outcome | a | b | c | d | e | f | g | h | i | j | k |
| | | X | | | | X | | | | | | |
| 2. | Mapping of instructional objectives with student outcomes | 1-5 | | | | 1-5 | | | | | | |
| 3. | Category | General (G) | | Basic Sciences (B) | | | Engg. Sci.& Tech. Arts E) | | | Professional Subjects(P) | | |
| | | -- | | X | | | -- | | | -- | | |
| 4. | Approval | 23rd Meeting of academic council, May 2013 | | | | | | | | | | |

| PY1003 | MATERIALS SCIENCE | L | T | P | C |
|---|---|---|---|---|---|
| | Total Contact Hours - 60 | 2 | 0 | 2 | 3 |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

The course introduces several advanced concepts and topics in the rapidly evolving field of material science. Students are expected to develop comprehension of the subject and to gain scientific understanding regarding the choice and manipulation of materials for desired engineering applications.

**INSTRUCTIONAL OBJECTIVES**

| | |
|---|---|
| 1. | To acquire basic understanding of advanced materials, their functions and properties for technological applications |
| 2. | To emphasize the significance of materials selection in the design process |
| 3. | To understand the principal classes of bio-materials and their functionalities in modern medical science |
| 4. | To get familiarize with the new concepts of Nano Science and Technology |
| 5. | To educate the students in the basics of instrumentation, measurement, data acquisition, interpretation and analysis |

**UNIT I– ELECTRONIC AND PHOTONIC MATERIALS (6 hours)**

**Electronic Materials:** Fermi energy and Fermi–Dirac distribution function – Variation of Fermi level with temperature in intrinsic and extrinsic semiconductors – Hall effect – Dilute Magnetic Semiconductors (DMS) and their applications

**Superconducting Materials:** Normal and High temperature superconductivity – Applications.

**Photonic Materials:** LED – LCD – Photo conducting materials – Photo detectors – Photonic crystals and applications – Elementary ideas of Non-linear optical materials and their applications.

**UNIT II– MAGNETIC AND DIELECTRIC MATERIALS (6 hours)**

**Magnetic Materials:** Classification of magnetic materials based on spin – Hard and soft magnetic materials – Ferrites, garnets and magnetoplumbites – Magnetic bubbles and their applications – Magnetic thin films – Spintronics and devices (Giant magneto resistance, Tunnel magneto resistance and Colossal magneto resistance).

**Dielectric Materials:** Polarization mechanisms in dielectrics – Frequency and temperature dependence of polarization mechanism – Dielectric loss – Dielectric

waveguide and dielectric resonator antenna – Piezoelectric, pyroelectric and ferroelectric materials and their applications.

**UNIT III– MODERN ENGINEERING AND BIOMATERIALS (6 hours)**

**Modern Engineering Materials:** Smart materials – Shape memory alloys – Chromic materials (Thermo, Photo and Electro) – Rheological fluids – Metallic glasses – Advanced ceramics – Composites.

**Bio-materials:** Classification of bio-materials (based on tissue response) – Comparison of properties of some common biomaterials – Metallic implant materials (stainless steel, cobalt-based and titanium-based alloys) – Polymeric implant materials (Polyamides, polypropylene, Acrylic resins and Hydrogels) – Tissue replacement implants – Soft and hard tissue replacements – Skin implants – Tissue engineering – Biomaterials for organ replacement (Bone substitutes) – Biosensor.

**UNIT IV– INTRODUCTION TO NANOSCIENCE AND NANOTECHNOLOGY(6 hours)**

Basic concepts of Nanoscience and Nanotechnology – Quantum wire – Quantum well – Quantum dot – fullerenes – Graphene – Carbon nanotubes – Material processing by chemical vapor deposition and physical vapor deposition – Principle of SEM, TEM, AFM, Scanning near-field optical microscopy (SNOM) – Scanning ion-conducting microscopy (SCIM) – Potential uses of nanomaterials in electronics, robotics, computers, sensors, sports equipment, mobile electronic devices, vehicles and transportation – Medical applications of nanomaterials.

**UNIT V– MATERIALS CHARACTERIZATION (6 hours)**

X-ray diffraction, Neutron diffraction and Electron diffraction– X-ray fluorescence spectroscopy – Fourier transform Infrared spectroscopy (FTIR) – Ultraviolet and visible spectroscopy (UV-Vis) – Thermogravimetric Analysis (TGA) – Differential Thermal Analysis (DTA) – Differential Scanning Calorimetry (DSC).

**PRACTICAL EXPERIMENTS (30 hours)**

1. Determination of resistivity and band gap for a semiconductor material – Four probe method / Post-office box
2. Determination of Hall coefficient for a semiconducting material
3. To study V-I characteristics of a light dependent resistor (LDR)
4. Determination of energy loss in a magnetic material – B-H curve
5. Determination of paramagnetic susceptibility – Quincke's method
6. Determination of dielectric constant for a given material
7. Calculation of lattice cell parameters – X-ray diffraction
8. Measurement of glucose concentration – Electrochemical sensor

9. Visit to Advanced Material Characterization Laboratory (Optional)

**TEXT BOOKS**

1. Thiruvadigal, J. D., Ponnusamy,S..Sudha.D. and Krishnamohan M., "*Materials Sciences"*, Vibrant Publication, Chennai, 2013.
2. Rajendran.V, "*Materials Science*",Tata McGraw- Hill,New Delhi,2011.

**REFERENCES**


1. Rolf E. Hummel, "*Electronic Properties of Materials"*, 4th ed., Springer, New York, 2011.
2. Dennis W. Prather, "*Photonic Crystals: Theory, Applications, and Fabrication"*, John Wiley & Sons, Hoboken, 2009.
3. James R. Janesick, "*Scientific Charge-Coupled Devices",* Published by SPIE - The International Society for Optical Engineering, Bellingham, Washington, 2001.
4. David M. Pozar, "*Microwave Engineering*", 3rd ed., John Wiley & Sons, 2005.
5. F. Silver and C. Dillion, "*Biocompatibility: Interactions of Biological and Implantable Materials*", VCH Publishers, New York, 1989.
6. Severial Dumitriu, "*Polymeric Biomaterials*" Marcel Dekker Inc, CRC Press, Canada 2001.
7. CaoG., "*Nanostructures and Nanomaterials: Synthesis, Properties and Applications*", Imperial College Press, 2004.
8. T.Pradeep, "*A Text Book of Nanoscience and Nanotechnology*", Tata McGraw Hill, New Delhi, 2012.
9. Sam Zhang, "*Materials Characterization Techniques*", CRC Press, 2008.


| **PY1003 MATERIALS SCIENCE** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Designed by** | | **Department of Physics and Nanotechnology** | | | | | | | | | | |
| 1. | Student Outcome | a | b | c | d | e | f | g | h | i | j | k |
| | | x | x | | x | x | | | | | | X |
| 2. | Mapping of instructional objectives with student outcome | 1 | 5 | | 4 | 2 | | | | | | 3 |
| 3. | Category | General (G) | | Basic Sciences(B) | | Engineering Sciences and Technical Arts (E) | | | | Professional Subjects(P) | | |
| | | -- | | x | | -- | | | | -- | | |
| 4. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

| CY1003 | PRINCIPLES OF ENVIRONMENTAL SCIENCE | L | T | P | C |
|---|---|---|---|---|---|
| | Total Contact Hours - 30 | 2 | 0 | 0 | 2 |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

The course provides a comprehensive knowledge in environmental science, environmental issues and the management.

**INSTRUCTIONAL OBJECTIVES**

To enable the students

| | |
|---|---|
| 1. | To gain knowledge on the importance of environmental education and ecosystem. |
| 2. | To acquire knowledge about environmental pollution- sources, effects and control measures of environmental pollution. |
| 3. | To understand the treatment of wastewater and solid waste management. |
| 4. | To acquire knowledge with respect to biodiversity, its threats and its conservation and appreciate the concept of interdependence. |
| 5. | To be aware of the national and international concern for environment for protecting the environment |

**UNIT I- ENVIRONMENTAL EDUCATION AND ECOSYSTEMS (6 hours)**

Environmental education: Definition and objective. Structure and function of an ecosystem – ecological succession –primary and secondary succession - ecological pyramids – pyramid of number, pyramid of energy and pyramid of biomass.

**UNIT II- ENVIRONMENTAL POLLUTION (6 hours)**

Environmental segments – structure and composition of atmosphere - Pollution – Air, water, soil , thermal and radiation – Effects – acid rain, ozone layer depletion and green house effect – control measures – determination of BOD, COD, TDS and trace metals.

**UNIT III- WASTE MANAGEMENT (6 hours)**

Waste water treatment (general) – primary, secondary and tertiary stages.
Solid waste management: sources and effects of municipal waste, bio medical waste - process of waste management.

**UNIT IV- BIODIVERSITY AND ITS CONSERVATION (6 hours)**

Introduction: definition - genetic, species and ecosystem diversity – bio diversity hot spots - values of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values - threats to biodiversity: habitat loss, poaching of wildlife – endangered and endemic species of India, Conservation of biodiversity: in-situ and ex-situ conservations.

**UNIT V- ENVIRONMENTAL PROTECTION (6 hours)**

National concern for environment: Important environmental protection acts in India – water, air (prevention and control of pollution) act, wild life conservation and forest act – functions of central and state pollution control boards - international effort – key initiatives of Rio declaration, Vienna convention, Kyoto protocol and Johannesburg summit.

**TEXT BOOKS**


1. Kamaraj.P & Arthanareeswari.M, "*Environmental Science – Challenges and Changes"*, 4th Edition, Sudhandhira Publications, 2010.
2. Sharma.B.K. and Kaur, "*Environmental Chemistry",* Goel Publishing House, Meerut, 1994.


**REFERENCES**


1. De.A.K., "*Environmental Chemistry"*, New Age International, New Delhi, 1996.
2. Helen P Kavitha, "*Principles of Environmental Science*", Sci tech Publications, 2nd Edition, 2008.


| **CY1003 – PRINCIPLES OF ENVIRONMENTAL SCIENCE** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Designed by** | | **Department of Chemistry** | | | | | | | | | | |
| 1. | Student Outcome | a | b | c | d | e | f | g | h | i | j | k |
| | | | | x | | x | x | | x | x | x | |
| 2. | Mapping of instructional objective with student outcome | | | 5 | | 2 | 4 | | 1,3 | 3 | 2, 5 | |
| 3. | Category | General (G) | | Basic Sciences(B) | | Engineering Sciences and Technical Arts (E) | | | | Professional Subjects(P) | | |
| | | -- | | x | | -- | | | | -- | | |
| 4. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

| LE1001 | ENGLISH | L | T | P | C |
|---|---|---|---|---|---|
| | Total Contact Hours-45 | 1 | 2 | 0 | 2 |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

To help students achieve proficiency in English and develop their professional communication skills to meet the demand in the field of global communication to enable them to acquire placement anywhere with ease and confidence.

**INSTRUCTIONAL OBJECTIVES**

| | |
|---|---|
| 1. | To enable students improve their lexical, grammatical and communicative competence. |
| 2. | To enhance their communicative skills in real life situations. |
| 3. | To assist students understand the role of thinking in all forms of communication. |
| 4. | To equip students with oral and appropriate written communication skills. |
| 5. | To assist students with employability and job search skills. |

**UNIT I- INVENTIONS** **(9 hours)**

1. Grammar and Vocabulary – Tense and Concord:
2. Listening and Speaking – Common errors in Pronunciation (Individual sounds); Process description (Describing the working of a machine, and the manufacturing process)
3. Writing – Interpretation of data (Flow chart, Bar chart)
4. Reading -- (Reading Comprehension -- Answering questions)

**UNIT II- ECOLOGY** **(9 hours)**

1. Grammar and Vocabulary – Error Analysis – Synonyms and Antonyms, Parallelisms
2. Listening and Speaking - Conducting Meetings
3. Writing – Notice, Agenda, Minutes , letters to the editor via email : Email etiquette
4. D Reading Comprehension – Summarizing and Note-making

**UNIT III- SPACE** **(9 hours)**

1. Grammar and Vocabulary – tense and concord; word formation
2. Listening and Speaking – Distinction between native and Indian English (Speeches by TED and Kalam) – accent, use of vocabulary and rendering;
3. Writing – Definitions and Essay writing

4. Reading Comprehension – Predicting the content

**UNIT IV- CAREERS** **(9 hours)**

1. Grammar and Vocabulary –Homonyms and Homophones
2. Listening and Speaking – – Group Discussion
3. Writing Applying for job, cover letter and resume
4. Reading, etymology (roots ; idioms and phrases), Appreciation of creative writing.

**UNIT V- RESEARCH** **(9 hours)**

1. Grammar and Vocabulary – Using technical terms, Analogies
2. Listening and Speaking -- Presentation techniques (Speech by the learner)
3. Writing – Project Proposal
4. Reading Comprehension -- Referencing Skills for Academic Report Writing (Research Methodology – Various methods of collecting data) Writing a report based on MLA Handbook

**TEXTBOOK**

1. Department of English and Foreign Languages. "*English for Engineers*", SRM University Publications, 2013.

**REFERENCES**


1. Dhanavel, S.P. "*English and Communication Skills for Students of Science and Engineering*"**,** Orient Blackswan Ltd., 2009.
2. Meenakshi Raman and Sangeetha Sharma**.** "*Technical Communication-Principles and Practice*", Oxford University Press, 2009.
3. Day, R A. Scientific English:"*A Guide for Scientists and Other Professionals*", 2nd ed. Hyderabad: Universities Press, 2000.


| **LE1001 ENGLISH** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Designed by** | | **Department of English and Foreign Languages** | | | | | | | | | | |
| 1. | Student Outcome | a | b | c | d | e | f | g | h | i | j | k |
| | | | | | x | | x | X | | x | | |
| 2. | Mapping of instructional objectives with student outcome | | | | 1-5 | | 1-5 | 1-5 | | 1-5 | | |
| 3. | Category | General (G) | | Basic Sciences(B) | | Engineering Sciences andTechnical Arts (E) | | | | Professional Subjects (P) | | |
| | | x | | -- | | -- | | | | -- | | |
| 4. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

| FP1001 | FOOD ENGINEERING | L | T | P | C |
|---|---|---|---|---|---|
| | Total Contact Hours – 75 | 3 | 2 | 0 | 4 |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

To emphasize the various processing methods involved in converting raw material into quality food products.

**INSTRUCTIONAL OBJECTIVES**

The students are exposed to

1. Processing of food material
2. Drying technology for food products

**UNITI-INTRODUCTION (9 hours)**

Scope and importance of Food Process Engineering- preliminary operations – cleaning, grading, sorting, washing, cutting – equipments used.

**UNIT II-PROCESSING METHODS (12 hours)**

Blanching- pasteurization – sterilization- extrusion cooking- micro wave processing - Concepts and equipment used.

**UNIT III-PRESERVATION BY DRYING (14 hours)**

Moisture content- definition, methods of determination, problems on moisture removal.Equilibrium moisture content- methods, models.Hysterises effect.Psychrometry chart. Drying-mechanisms-constant rate period and falling rate period- methods and equipment used. Water activity – concepts and importance.

**UNIT IV-PRESERVATION BY LOW TEMPERATURE (12 hours)**

Refrigeration, Freezing-Theory, freezing time calculation, methods of freezing, freezing equipments, freeze drying, freeze concentration, thawing.

**UNIT V-FOOD CONVERSION OPERATION (13 hours)**

Size reduction- Solid foods and liquid foods- Theory and equipments used, Problems on energy requirement.

**TEXT BOOKS**

1. Paul Singh R. and Dennis R Heldman, "*Introduction to Food Engineering*'' Third edition. Academic press, London, 2004.

2. Fellows, P.J, "*Food processing Technology: Principles and practice*". Second edition, Woodhead Publishing limited, Cambridge,2005.
3. Sahay, K.M. and K.K. Singh, "*UNIT Operations in Agricultural Processing''*. Vikas Publishing House Pvt. Ltd., New Delhi, 2003.

**REFERENCES**

1. Dennis, R.H, "*Food Process Engineering''*Academic *Publishing* andPress, King Saud University, 1981.
2. Rao, M.A. Syed S.H. Rizvi, and Ashim K. Datta, "*Engineering properties of foods''*CRC Press2010.

| **FP1001 FOOD ENGINEERING** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Designed by** | | **Department of Food Process Engineering** | | | | | | | | | | |
| 1. | Student Outcome | a | b | c | d | e | f | g | h | i | j | k |
| | | X | | | | | | | | | | |
| 2. | Mapping of instructional objective with student outcome | 1-2 | | | | | | | | | | |
| 3. | Category | General (G) | | Basic Sciences(B) | | Engineering Sciences and Technical Arts (E) | | | | | Professional Subjects(P) | |
| | | -- | | -- | | -- | | | | | x | |
| 4. | Broad area | Basic Bio Sciences | | Food Engineering | | Product Development | | | | | Industrial Application | |
| | | -- | | x | | -- | | | | | -- | |
| 5. | Approval | 23rdMeeting of Academic Council, May 2013 | | | | | | | | | | |

| **FP1002** | **FOOD ENGINEERING LABORATORY** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | Total Contact Hours - 60 | **0** | **0** | **4** | **2** |
| | Prerequisite | | | | |
| | FP1001 Food Engineering | | | | |

**PURPOSE**

This course helps the students to experimentally verify the theoretical concepts they learnt in the course FP1001 fundamentals of food process engineering.

**INSTRUCTIONAL OBJECTIVES**

| | |
|---|---|
| 1. | To study the drying and rehydration characteristics of food materials |
| 2. | To study the properties and pretreatment of food materials. |

**LIST OF EXPERIMENTS**

1. Experiment on water activity determination of food materials.
2. Experiment on moisture content determination of food materials.
3. Experiment on extrusion
4. Experiment on pretreatment of food materials.
5. Experiment on microwave cooking
6. Experiments on determination of drying rate of given food materials
7. Experiments on rehydration characteristics of dried foods
8. Experiments on peeling of food materials.
9. Experiments on freeze drying
10. Experiments on size reduction
11. Experiments on physical properties
12. Experiments on freezing point determination of food.

**TEXT BOOKS**


1. Food Process Engineering Lab manual, "*Department of Food Process Engineering"*, SRM University.
2. Fellows, P.J., "*Food processing Technology: Principles and practice*". Second edition, Woodhead publishing limited. Cambridge, 2005.


**REFERENCE**


1. Sahay, K.M. and K.K. Singh. "*UNIT Operations in Agricultural Processing*". Vikas Publishing House Pvt. Ltd., New Delhi 2003.


| **FP1002FOOD ENGINEERING LABORATORY** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Designed by** | | **Department of Food Process Engineering** | | | | | | | | | | |
| 1. | Student Outcome | a | b | c | d | e | f | g | h | i | j | k |
| | | | X | | | | | | | | | |
| 2. | Mapping of instructional objectives with student outcome | | 1 - 2 | | | | | | | | | |
| 3. | Category | General (G) | | Basic Sciences(B) | | Engineering Sciences andTechnical Arts (E) | | | | | Professional Subjects (P) | |
| | | -- | | -- | | -- | | | | | X | |
| 4. | Broad area | Basic Bio Sciences | | Food Engineering | | Product Development | | | | | Industrial Application | |
| | | -- | | X | | -- | | | | | -- | |
| 5. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

**SEMESTER I/II**

| | | | | | |
|---|---|---|---|---|---|
| **CS1001** | **PROGRAMMING USING MATLAB** | **L** | **T** | **P** | **C** |
| | Total Contact Hours – 45 | **0** | **1** | **2** | **2** |
| | Prerequisite | | | | |
| | Nil | | | | |

| | |
|---|---|
| **PURPOSE** | |
| This Lab Course will enable the students to understand the fundamentals and programming knowledge in MATLAB. | |
| **INSTRUCTIONAL OBJECTIVES** | |
| 1. | To learn the MATLAB environment and its programming fundamentals |
| 2. | Ability to write Programs using commands and functions |
| 3. | Able to handle polynomials, and use 2D Graphic commands |

**LIST OF EXPERIMENTS**

1. Practicing MATLAB environment with simple exercises to familiarize Command Window, History, Workspace, Current Directory, Figure window, Edit window, Shortcuts, Help files.
2. Data types, Constants and Variables, Character constants, operators, Assignment statements.
3. Control Structures: For loops, While, If control structures, Switch, Break, Continue statements.
4. Input-Output functions, Reading and Storing Data.
5. Vectors and Matrices, commands to operate on vectors and matrices, matrix Manipulations.
6. Arithmetic operations on Matrices, Relational operations on Matrices, Logical operations on Matrices.
7. Polynomial Evaluation, Roots of Polynomial, Arithmetic operations on Polynomials.
8. Graphics: 2D plots, Printing labels, Grid & Axes box, Text in plot, Bar and Pie chart.

**TEXT BOOK**

1. BansalR.K., GoelA.K., SharmaM.K., "*MATLAB and its Applications in Engineering*", Pearson Education, 2012.

**REFERENCES**


1. Amos Gilat, *"MATLAB-An Introduction with Applications"*, Wiley India, 2009.
2. Stephen.J.Chapman, *"Programming in MATLAB for Engineers"*, Cengage Learning, 2011.


| CS1001 PROGRAMMING USING MATLAB | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Designed by** | | **Department of Computer Science and Engineering** | | | | | | | | | | |
| 1. | Student Outcome | a | b | c | d | e | f | g | h | i | j | k |
| | | x | X | | | | | | | | | x |
| 2. | Mapping of instructional objective with student outcome | 2,3 | 1-3 | | | | | | | | | 1 |
| 3. | Category | General (G) | Basic Sciences(B) | | | Engineering Sciences and Technical Arts (E) | | | | Professional Subjects(P) | | |
| | | X | -- | | | -- | | | | -- | | |
| 4. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

| **BT1001** | **BIOLOGY FOR ENGINEERS** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | Total Contact Hours - 30 | **2** | **0** | **0** | **2** |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

The purpose of this course is to provide a basic understanding of biological mechanisms of living organisms from the perspective of engineers. In addition, the course is expected to encourage engineering students to think about solving biological problems with engineering tools.

**INSTRUCTIONAL OBJECTIVES**

| | |
|---|---|
| 1. | To familiarize the students with the basic organization of organisms and subsequent building to a living being |
| 2. | To impart an understanding about the machinery of the cell functions that is ultimately responsible for various daily activities. |
| 3. | To provide knowledge about biological problems that require engineering expertise to solve them |

**UNIT I- BASIC CELL BIOLOGY (6hours)**

Introduction: Methods of Science-Living Organisms: Cells and Cell theory Cell Structure and Function, Genetic information, protein synthesis, and protein

structure, Cell metabolism-Homoeostasis- Cell growth, reproduction, and differentiation.

**UNIT II- BIOCHEMISTRY AND MOLECULAR ASPECTS OF LIFE (5 hours)**

Biological Diversity --Chemistry of life: chemical bonds--Biochemistry and Human biology--Protein synthesis—Stem cells and Tissue engineering.

**UNIT III- ENZYMES AND INDUSTRIAL APPLICATIONS (5 hours)**

Enzymes: Biological catalysts, Proteases, Carbonic anhydrase, Restriction enzymes, and Nucleoside monophosphate kinases—Photosynthesis

**UNIT IV- MECHANOCHEMISTRY (7 hours)**

Molecular Machines/Motors—Cytoskeleton—Bioremediation—Biosensors

**UNIT V- NERVOUS SYSTEM, IMMUNE SYSTEM, AND CELL SIGNALIN(7 hours)**

Nervous system--Immune system- General principles of cell signaling

**TEXT BOOK**


1. ThyagaRajanS., SelvamuruganN., RajeshM. P., NazeerR. A., Richard W. Thilagaraj, S. Barathi, and M. K. Jaganathan, "*Biology for Engineers*," Tata McGraw-Hill, New Delhi, 2012.


**REFERENCES**


1. Jeremy M. Berg, John L. Tymoczko and Lubert Stryer, "*Biochemistry*," W.H. Freeman and Co. Ltd., 6th Ed., 2006.
2. Robert Weaver, "*Molecular Biology*," MCGraw-Hill, 5th Edition, 2012.
3. Jon Cooper, "*Biosensors A Practical Approach*" Bellwether Books, 2004.
4. Martin Alexander, "*Biodegradation and Bioremediation,"* Academic Press, 1994.
5. Kenneth Murphy, "*Janeway's Immunobiology*," Garland Science; 8th edition, 2011.
6. Eric R. Kandel, James H. Schwartz, Thomas M. Jessell, *"Principles of Neural Science"*, McGraw-Hill, 5th Edition, 2012.


| BT1001 BIOLOGY FOR ENGINEERS | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course Designed by | | Department of Biotechnology | | | | | | | | | | |
| 1. | Student Outcome | a | b | c | d | e | f | g | h | i | j | k |
| | | x | | | x | | | | | | x | |
| 2. | Mapping of instructional objectives with student outcome | 1 | | | 2 | | | | | | 3 | |

| | | | | | |
|---|---|---|---|---|---|
| 3. | Category | General (G) | Basic Sciences(B) | Engineering Sciences and Technical Arts (E) | Professional Subjects(P) |
| | | | x | | |
| 4. | Approval | 23rd Meeting of Academic Council, May 2013 | | | |

| | | | | | |
|---|---|---|---|---|---|
| **ME1001** | **BASIC MECHANICAL ENGINEERING** | **L** | **T** | **P** | **C** |
| | Total Contact Hours – 30 | **2** | **0** | **0** | **2** |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

To familiarize the students with the basics of Mechanical Engineering.

**INSTRUCTIONAL OBJECTIVES**

| | |
|---|---|
| 1. | To familiarize with the basic machine elements |
| 2. | To familiarize with the Sources of Energy and Power Generation |
| 3. | To familiarize with the various manufacturing processes |

**UNIT I– MACHINE ELEMENTS– I (5 hours)**

**Springs:** Helical and leaf springs – Springs in series and parallel. **Cams:** Types of cams and followers – Cam profile.

**UNIT II- MACHINE ELEMENTS– II (5 hours)**

**Power Transmission:** Gears (terminology, spur, helical and bevel gears, gear trains). Belt drives (types). Chain drives. Simple Problems.

**UNIT III- ENERGY (10 hours)**

**Sources:** Renewable and non-renewable (various types, characteristics, advantages/disadvantages). **Power Generation:** External and internal combustion engines – Hydro, thermal and nuclear power plants (layouts, element/component description, advantages, disadvantages, applications). Simple Problems.

**UNIT IV - MANUFACTURING PROCESSES - I (5 hours)**

**Sheet Metal Work:** Introduction – Equipments – Tools and accessories – Various processes (applications, advantages / disadvantages). **Welding:** Types – Equipments – Tools and accessories – Techniques employed -applications, advantages / disadvantages – Gas cutting – Brazing and soldering.

**UNIT V - MANUFACTURING PROCESSES– II (5 hours)**

**Lathe Practice:** Types - Description of main components – Cutting tools – Work holding devices – Basic operations. Simple Problems.**Drilling Practice:** Introduction – Types – Description – Tools.Simple Problems.

**TEXT BOOKS**


1. Kumar, T., Leenus Jesu Martin and Murali, G., *"Basic Mechanical Engineering"*, Suma Publications, Chennai, 2007.
2. Prabhu, T. J., Jai Ganesh, V. and Jebaraj, S., *"Basic Mechanical Engineering"*, Scitech Publications, Chennai, 2000.


**REFERENCES**


1. Hajra Choudhary, S.K. and HajraChoudhary, A. K., "*Elements of Workshop Technology", Vols. I & II*, Indian Book Distributing Company Calcutta, 2007.
2. Nag, P.K., "*Power Plant Engineering"*, Tata McGraw-Hill, New Delhi, 2008.
3. Rattan, S.S., "*Theory of Machines"*, Tata McGraw-Hill, New Delhi, 2010.


| **ME1001 BASIC MECHANICAL ENGINEERING** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Designed by** | | **Department of Mechanical Engineering** | | | | | | | | | | |
| 1. | Student Outcome | a | b | c | d | e | f | g | h | i | j | k |
| | | X | | | | x | | | | | | |
| 2. | Mapping of instructional objectives with student outcome | 1- 3 | | | | 1- 3 | | | | | | |
| 3. | Category | General (G) | Basic sciences(B) | | | Engineering sciences and technical art (E) | | | | Professional subjects (P) | | |
| | | -- | -- | | | X | | | | -- | | |
| 4. | Approval | 23rd Meeting of the Academic Council , May 2013 | | | | | | | | | | |

| **EE1001** | **BASIC ELECTRICAL ENGINEERING** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | Total Contact Hours - 30 | **2** | **0** | **0** | **2** |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

This course provides comprehensive idea about circuit analysis, working principles of machines and common measuring instruments.

| INSTRUCTIONAL OBJECTIVES | |
|---|---|
| 1. | Understand the basic concepts of magnetic circuits, AC & DC circuits. |
| 2. | Explain the working principle, construction, applications of DC & AC machines and measuring instruments. |
| 3. | Gain knowledge about the fundamentals of wiring and earthing |

**UNIT I – FUNDAMENTALS OF DC CIRCUITS (6 hours)**

Introduction to DC and AC circuits, Active and passive two terminal elements, Ohms law, Voltage-Current relations for resistor, inductor, capacitor , Kirchhoff's laws, Mesh analysis, Nodal analysis, Ideal sources –equivalent resistor, current division, voltage division

**UNIT II – MAGNETIC CIRCUITS (6 hours)**

Introduction to magnetic circuits-Simple magnetic circuits-Faraday's laws, induced emfs and inductances

**UNIT III – AC CIRCUITS (6 hours)**

Sinusoids, Generation of AC, Average and RMS values, Form and peak factors, concept of phasor representation, J operator.Analysis of R-L, R-C, R-L-C circuits. Introduction to three phase systems - types of connections, relationship between line and phase values.

**UNIT IV–ELECTRICAL MACHINES & MEASURING INSTRUMENTS (6 hours)**

Working principle, construction and applications of DC machines and AC machines (1 - phase transformers, single phase induction motors: split phase, capacitor start and capacitor start & run motors). Basic principles and classification of instruments -Moving coil and moving iron instruments.

**UNIT V– ELECTRICAL SAFETY, WIRING &INTRODUCTION TO POWER SYSTEM (6 hours)**

Safety measures in electrical system- types of wiring- wiring accessories-staircase, fluorescent lamps & corridor wiring- Basic principles of earthing-Types of earthing- Simple layout of generation, transmission & distribution of power.

**TEXT BOOK**

1. DashS.S.,SubramaniC.,VijayakumarK.,*"BasicElectrical Engineering",* First edition,Vijay Nicole Imprints Pvt.Ltd,2013.

**REFERENCES**


1. Smarajt Ghosh, "*Fundamentals of Electrical & Electronics Engineering*", Second edition, PHI Learning, 2007.
2. MethaV.K., Rohit Metha, "*Basic Electrical Engineering*", Fifth edition, S.Chand & Co, 2012.
3. Kothari D. P and Nagrath IJ,"*Basic Electrical Engineering*", Second edition, Tata McGraw - Hill, 2009.
4. BhattacharyaS. K.,"*Basic Electrical and Electronics Engineering"*, First edition, Pearson Education, 2011.


| **EE1001 - BASIC ELECTRICAL ENGINEERING** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Designed by** | | **Department of Electrical and Electronics Engineering** | | | | | | | | | | |
| 1. | Student Outcome | a | b | c | d | e | f | g | h | i | j | k |
| | | X | | | | x | | | | | | |
| 2. | Mapping of instructional objectives with student outcome | 1- 3 | | | | 1 | | | | | | |
| 3. | Category | General (G) | | Basic sciences(B) | | Engineering sciences and technical art (E) | | | | Professional subjects (P) | | |
| | | -- | | -- | | X | | | | -- | | |
| 4. | Approval | 23rd Meeting of the Academic Council , May 2013 | | | | | | | | | | |

| **EC1001** | **BASIC ELECTRONICS ENGINEERING** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | Total Contact Hours – 30 | **2** | **0** | **0** | **2** |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

This course provides comprehensive idea about working principle, operation and characteristics of electronic devices, transducers, Digital Electronics and Communication Systems.

**INSTRUCTIONAL OBJECTIVES**

At the end of the course students will be able to gain knowledge about the

| | |
|---|---|
| 1. | Fundamentals of electronic components, devices, transducers |
| 2. | Principles of digital electronics |
| 3. | Principles of various communication systems |

**UNIT I- ELECTRONIC COMPONENTS (4 hours)**

**Passive components** – resistors, capacitors & inductors (properties, common types, I-V relationship and uses).

**UNIT II- SEMICONDUCTOR DEVICES (7 hours)**

**Semiconductor Devices -** Overview of Semiconductors - basic principle, operation and characteristics of PN diode, zener diode, BJT, JFET, optoelectronic devices (LDR, photodiode, phototransistor, solar cell, optocouplers)

**UNIT III- TRANSDUCERS (5 hours)**

**Transducers -** Instrumentation – general aspects, classification of transducers, basic requirements of transducers, passive transducers - strain gauge, thermistor, Hall-Effect transducer, LVDT, and active transducers – piezoelectric and thermocouple.

**UNIT IV- DIGITAL ELECTRONICS (7 hours)**

Number systems – binary codes - logic gates - Boolean algebra, laws & theorems - simplification of Boolean expression - implementation of Boolean expressions using logic gates - standard forms of Boolean expression.

**UNIT V- COMMUNICATION SYSTEMS (7 hours)**

Block diagram of a basic communication system – frequency spectrum - need for modulation - methods of modulation - principles of AM, FM, pulse analog and pulse digital modulation – AM / FM transmitters & receivers (block diagram description only)

**TEXT BOOKS**


1. ThyagarajanT., SendurChelviK.P., RangaswamyT.R., *"Engineering Basics: Electrical, Electronics and Computer Engineering"*, New Age International, Third Edition, 2007.
2. Somanathan NairB., DeepaS.R., "*Basic Electronics",* I.K. International Pvt. Ltd., 2009.


**REFERENCES**


1. Thomas L. Floyd, *"Electronic Devices",* Pearson Education, 9th Edition, 2011.
2. Rajput R.K., *"Basic Electrical and Electronics Engineering"*, Laxmi Publications, First Edition, 2007.

| EC1001 BASIC ELECTRONICS ENGINEERING | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Designed by** | | **Department of Electronics and Communication Engineering** | | | | | | | | | | |
| 1. | Student Outcome | a | b | c | d | e | f | g | h | i | j | k |
| | | X | | | | | | | | | | |
| 2. | Mapping of instructional objectives with student outcome | 1,2,3 | | | | | | | | | | |
| 3. | Category | General (G) | Basic Sciences(B) | | | Engineering Sciences &Technical Arts (E) | | | | | Professional Subjects (P) | |
| | | -- | -- | | | x | | | | | -- | |
| 4. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

| ME1004 | WORKSHOP PRACTICE | L | T | P | C |
|---|---|---|---|---|---|
| | Total Contact Hours – 45 | 0 | 0 | 3 | 2 |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

To provide the students with hands on experience on different trades of engineering like fitting, carpentry, smithy, welding and sheet metal.

**INSTRUCTIONAL OBJECTIVES**

1. To familiarize with the basics of tools and equipments used in fitting, carpentry, sheet metal, welding and smithy
2. To familiarize with the production of simple models in the above trades.

**UNIT I-FITTING** **(9 hours)**

Tools & Equipments – Practice in filing.
Making Vee Joints, Square, Dovetail joints and Key making - plumbing.
Mini project – Assembly of simple I.C. engines.

**UNIT II-CARPENTRY** **(9 hours)**

Tools and Equipments- Planning practice.
Making Half Lap, Dovetail, Mortise &Tenon joints.
Mini project - model of a single door window frame.

**UNIT III-SHEET METAL** **(9 hours)**

Tools and equipments– practice.
Making rectangular tray, hopper, scoop, etc.
Mini project - Fabrication of a small cabinet, dust bin, etc.

**UNIT IV-WELDING** **(9 hours)**

Tools and equipments -
Arc welding of butt joint, Lap joint, Tee fillet.
Demonstration of gas welding, TIG & MIG welding.

**UNIT V-SMITHY** **(9 hours)**

Tools and Equipments –
Making simple parts like hexagonal headed bolt, chisel.

**TEXT BOOK**

1. Gopal, T.V., Kumar, T., and Murali, G., "*A first course on workshop practice – Theory, Practice and Work Book"*, Suma Publications, Chennai, 2005.

**REFERENCE BOOKS**

1. Kannaiah,P., and Narayanan, K. C., "*Manual on Workshop Practice"*, Scitech Publications, Chennai, 1999.
2. Venkatachalapathy, V. S., "*First year Engineering Workshop Practice"*, Ramalinga Publications, Madurai, 1999.
3. Laboratory Manual.

| **ME1004 - WORKSHOP PRACTICE** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Designed by** | | **Department of Mechanical Engineering** | | | | | | | | | | |
| 1. | Student Outcome | a | b | c | d | e | f | g | h | i | j | k |
| | | | × | × | | | | × | | | | |
| 2. | Mapping of instructional objectives with student outcome | | 1, 2 | 1, 2 | | | | 1, 2 | | | | |
| 3. | Category | General (G) | Basic Sciences(B) | | | Engineering Sciences &Technical Arts (E) | | | | | Professional Subjects (P) | |
| | | -- | -- | | | x | | | | | -- | |
| 4. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

| ME1005 | ENGINEERING GRAPHICS | L | T | P | C |
|---|---|---|---|---|---|
| | Total Contact Hours – 75 | 0 | 1 | 4 | 3 |
| | Prerequisite | | | | |
| | Nil | | | | |

| PURPOSE | |
|---|---|
| 1. | To draw and interpret various projections of 1D, 2D and 3D objects. |
| 2. | To prepare and interpret the drawings of buildings. |

| INSTRUCTIONAL OBJECTIVES | |
|---|---|
| 1. | To familiarize with the construction of geometrical figures |
| 2. | To familiarize with the projection of 1D, 2D and 3D elements |
| 3. | To familiarize with the sectioning of solids and development of surfaces |
| 4. | To familiarize with the Preparation and interpretation of building drawing |

**First Angle Projection is to be followed - Practice with Computer Aided Drafting tools**

**UNIT I- FUNDAMENTALS OF ENGINEERING GRAPHICS (2 hours)**

Lettering – Two dimensional geometrical constructions – Conics – Representation of three-dimensional objects – Principles of projections – Standard codes – Projection of points.

**UNIT II- PROJECTION OF LINES AND SOLIDS (4 hours)**

Projection of straight lines – Projection of planes - Projection of solids – Auxiliary projections.

**UNIT III- SECTIONS AND DEVELOPMENTS (3 hours)**

Sections of solids and development of surfaces.

**UNIT IV- PICTORIAL PROJECTIONS (4 hours)**

Conversion of Projections: Orthographic projection – Isometric projection of regular solids and combination of solids.

**UNIT V- BUILDING DRAWING (2 hours)**

Plan, Elevation and section of single storied residential (or) office building with flat RCC roof and brick masonry walls having not more than 3 rooms (planning / designing is not expected in this course) with electrical wiring diagram.

**PRACTICAL (60 hours)**

**TEXT BOOKS**

1. Venugopal, K. and Prabhu Raja, V., "*Engineering Graphics"*, Eighth Edition (Revised), New Age International Publishers, Chennai, 2007.
2. Natarajan, K.V., "*A Text Book of Engineering Graphics"*, 21st Edition, Dhanalakshmi Publishers, Chennai, 2012.
3. Jeyapoovan, T., "*Engineering Drawing and Graphics using AutoCAD"*, Vikas Publishing House Pvt. Ltd., New Delhi, 2010.

**REFERENCE BOOKS**

1. Bethune, J.D., *"Engineering Graphics with AutoCAD 2013*", PHI Learning Private Limited, Delhi, 2013.
2. Bhatt, N.D., "*Elementary Engineering Drawing (First Angle Projection)"*, Charotar Publishing Co., Anand, 1999.
3. Narayanan, K. L. and Kannaiah, P., "*Engineering Graphics"*, Scitech Publications, Chennai, 1999.
4. Shah, M. B. and Rana, B. C., "*Engineering Drawing"*, Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2005.

| **ME1005 ENGINEERING GRAPHICS** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Designed by** | | **Department of Mechanical Engineering** | | | | | | | | | | |
| 1. | Student Outcome | a | b | c | d | e | f | g | H | i | j | k |
| | | | x | x | | | | x | | | | |
| 2. | Mapping of instructional objectives with student outcome | | 1-4 | 1-4 | | | | 1-4 | | | | |
| 3. | Category | General (G) | | Basic sciences(B) | | Engineering sciences and technical art (E) | | | | Professional subjects (P) | | |
| | | -- | | -- | | X | | | | -- | | |
| 4. | Approval | 23rd Meeting of the Academic Council , May 2013 | | | | | | | | | | |

| **NC1001/ NS1001/ SP1001/ YG1001** | **NATIONAL CADET CORPS (NCC)/ NATIONAL SERVICE SCHEME (NSS)/ NATIONAL SPORTS ORGANIZATION (NSO) / YOGA** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | Total Contact Hours – 15 (minimum, but may vary depending on the course) | **0** | **0** | **1** | **1** |
| | Prerequisite | | | | |
| | Nil | | | | |

| PURPOSE | |
|---|---|
| To imbibe in the minds of students the concepts and benefits of NCC/NSS/NSO/YOGA and make them practice the same | |
| **INSTRUCTIONAL OBJECTIVES** | |
| 1. | To enable the students to gain knowledge about NCC/NSS/NSO/YOGA and put the same into practice |

**UNIT I - NATIONAL CADET CORPS (NCC)**

Any student enrolling as a member of National Cadet Core (NCC) will have to attend sixteen parades out of twenty parades each of four periods over a span of academic year.

Attending eight parades in first semester will qualify a student to earn the credits specified in the curriculum. Grading shall be done based on punctuality, regularity in attending the parades and the extent of active involvement.

**UNIT II - NATIONAL SERVICE SCHEME (NSS)**

A student enrolling as member of NSS will have to complete 60 hours of training / social service to be eligible to earn the credits specified in the curriculum.

Grading shall be done by the faculty member handling the course based on punctuality, regularity in attending the classes and the extent of active involvement.

**UNIT III - NATIONAL SPORTS ORGANIZATION (NSO)**

Each student must select one of the following games/sports events and practice for one hour per week. An attendance of 75% is compulsory to earn the credits specified in the curriculum. Grading shall be done by the faculty member handling the course based on punctuality, regularity in attending the classes and the extent of active involvement.

List of games/sports:

Basket Ball, Football, Volley Ball, Ball Badminton, Cricket, Throw-ball, Track events

Field events or any other game with the approval of faculty member.

**UNIT IV - YOGA**

Benefits of Agnai Meditation -Meditation - Agnai, Asanas, Kiriyas, Bandas, Muthras Benefits of santhi Meditation - Meditation Santhi Physical Exercises (I & II)Lecture& Practice - Kayakalpa Yoga Asanas, Kiriyas, Bandas, Muthras

Analysis of Thought - Meditation Santhi Physical Exercises III & IV

Benefits of Thuriyam - Meditation Thuriyam Kayakalpa Asanas, Kiriyas, Bandas, Muthras
Attitude - Meditation Thuriyam Kayakalpa Asanas, Kiriyas, Bandas, Muthras
Importance of Arutkappy & Blessings - Meditation Thuriyam Kayakalpa Asanas, Kiriyas, Bandas, Muthras
Benefits of Blessings - Meditation Santhi Kayakalpa Asanas, Kiriyas, Bandas, Muthras

**Assessment**

An attendance of 75% is compulsory to earn the credits specified in the curriculum. Grading shall be done by the faculty member handling the course based on punctuality, regularity in attending the classes and the extent of active involvement.

**REFERENCES**


1. Yogiraj Vethathiri Maharishi, "*Yoga for Modern Age*", Vethathiri Publishers, 1989
2. Vethathiri Maharishi, T., "*Simplified Physical Exercises*", Vethathiri Publishers, 1987.


| **NC1001/ NS1001/ SP1001/ YG1001** | | **NATIONAL CADET CORPS (NCC)/ NATIONAL SERVICE SCHEME (NSS)/ NATIONAL SPORTS ORGANIZATION (NSO)/YOGA** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Designed by** | | **NCC/NSS/NSO/YOGA UNITS** | | | | | | | | | | |
| 1. | Student Outcome | a | b | C | d | e | f | g | h | i | j | k |
| 2. | Mapping of instructional objectives with student outcome | | | | X | | | | | X | | |
| 3. | Category | General (G) | Basic Sciences(B) | | | Engineering Sciences and Technical Arts (E) | | | | Professional Subjects(P) | | |
| | | X | -- | | | -- | | | | -- | | |
| 4. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

**SEMESTER – III**

| | | | | | |
|---|---|---|---|---|---|
| **LE1003** | **GERMAN LANGUAGE PHASE I** | **L** | **T** | **P** | **C** |
| | Total Contact Hours – 30 | **2** | **0** | **0** | **2** |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

Germany offers infinite opportunities for students of engineering for higher studies, research and employment in Germany. B.Tech Students are offered German Language during their second year. Knowledge of the language will be helpful for the students to adjust themselves when they go for higher studies.

**INSTRUCTIONAL OBJECTIVES**

| | |
|---|---|
| 1. | To introduce the language, phonetics and the special characters in German language |
| 2. | To introduce German culture & traditions to the students. |
| 3. | By the end of Phase – I, the students will be able to introduce themselves and initiate a conversation.. |
| 4. | We endeavor to develop the ability among the students to read and understand small texts written in German |
| 5. | To enable the students to elementary conversational skills. |

**UNIT I** (**6 hours)**

**Wichtige Sprachhandlungen:** Phonetics – Sich begrüßen - Sich und andere vorstellen formell / informell - Zahlen von 1 bis 1 Milliarde - verstehen & sprechen **Grammatik:** regelmäßige Verben im Präsens - "sein" und haben im Präsens - Personalpronomen im Nominativ

**UNIT II** **(6 hours)**

**Wichtige Sprachhandlungen** Telefon Nummern verstehen und sprechen Uhrzeiten verstehen und sagen Verneinung "nicht und kein" (formell und informell) **Grammatik** : Wortstellung – Aussagesatz – W-Frage und Satzfrage (Ja/Nein Frage) Nomen buchstabieren und notieren bestimmter und unbestimmter Artikel und Negativartikel im Nom. & Akkusativ

**UNIT III** **(6 hours)**

**Wichtige Sprachhandlungen** Tageszeiten verstehen und über Termine sprechen -Verabredungen verstehen - Aufgaben im Haushalt verstehen **Grammatik** Personalpronomen im Akkusativ und Dativ - W-Fragen "wie, wer, wohin,wo, was

usw.- Genitiv bei Personennamen - Modalverben im Präsens “können, müssen, möchten”

**UNIT IV** **(6 hours)**

**Wichtige Sprachhandlungen** Sich austauschen, was man kann, muss – Bezeichnungen Lebensmittel – Mengenangaben verstehen – Preise verstehen und Einkaufzettel schreiben

**Grammatik** Wortstellung in Sätzen mit Modalverben – Konnektor ”und” – “noch”-kein-------mehr – “wie viel, wie viele, wie alt, wie lange” –Possessivartikel im Nominativ.

**UNIT V** **(6 hours)**

**Wichtige Sprachhandlungen** Freizeitanzeigen verstehen – Hobbys und Sportarten Anzeigen für Freizeitpartner schreiben bzw. darauf antworten – Vorlieben und Abneigungen ausdrucken

**Grammatik** Verben mit Vokalwechsel im Präsens – Modalverben im Präsens “ dürfen, wollen und mögen - “haben und sein” im Präteritum – regelmäßige Verben im Perfekt – Konnektoren “denn, oder, aber

**TEXT BOOK**

1. Studio d A1. Deutsch als Fremdsprache with CD.(Kursbuch und Sprach training).

**REFERENCES**

1. German for Dummies
2. Schulz Griesbach

<table>
<tr><th colspan="13">LE1003 GERMAN LANGUAGE PHASE I</th></tr>
<tr><th colspan="2">Course Designed by</th><th colspan="11">Department of English and Foreign Languages</th></tr>
<tr><td rowspan="2">1.</td><td rowspan="2">Student Outcomes</td><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td><td>f</td><td>g</td><td>h</td><td>i</td><td>j</td><td>k</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td>x</td><td></td><td></td><td></td><td></td></tr>
<tr><td>2.</td><td>Mapping of instructional objectives with student outcome</td><td></td><td></td><td></td><td></td><td></td><td></td><td>1-5</td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">3.</td><td rowspan="2">Category</td><td colspan="2">General (G)</td><td colspan="2">Basic Sciences(B)</td><td colspan="3">Engineering Sciences and Technical Arts(E)</td><td colspan="3">Professional Subjects(P)</td></tr>
<tr><td colspan="2">X</td><td colspan="2">--</td><td colspan="3">-</td><td colspan="3">-</td></tr>
<tr><td>4.</td><td>Approval</td><td colspan="11">23rd Meeting of Academic Council, May 2013</td></tr>
</table>

| LE1004 | FRENCH LANGUAGE PHASE I | L | T | P | C |
|---|---|---|---|---|---|
| | Total Contact Hours - 30 | 2 | 0 | 0 | 2 |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

To enable the student learners acquire a basic knowledge of the French language and concepts of general French for everyday interactions and technical French at the beginner's level and also to get to know the culture of France.

**INSTRUCTIONAL OBJECTIVES**

| | |
|---|---|
| 1. | To enable students improve their grammatical competence. |
| 2. | To enhance their listening skills. |
| 3 | To assist students in reading and speaking the language. |
| 4. | To enhance their lexical and technical competence. |
| 5. | To help the students introduce themselves and focus on their communication skills. |

**UNIT I** **(6 hours)**

1. Grammar and Vocabulary: Usage of the French verb "se presenter", a verb of self- introduction and how to greet a person- "saluer"
2. Listening and Speaking – The authentic sounds of the letters of the French alphabet and the accents that play a vital role in the pronunciation of the words.
3. Writing – correct spellings of French scientific and technical vocabulary.
4. Reading -- Reading of the text and comprehension – answering questions.

**UNIT II** **(6 hours)**

1. Grammar and Vocabulary – Definite articles , "prepositions de lieu" subject pron ouns
2. Listening and Speaking – pronunciation of words like Isabelle, presentez and la liaison – vous etes, vous appelez and role play of introducing each other – group activity
3. Writing – particulars in filling an enrollment / registration form
4. Reading Comprehension – reading a text of a famous scientist and answering questions.

**UNIT III** **(6 hours)**

1. Grammar and Vocabulary – verb of possession "avoir' and 1st group verbs "er", possessive adjectives and pronouns of insistence- moi, lui..and numbers from 0 to 20
2. Listening and Speaking –nasal sounds of the words like feminine, ceinture , parfum and how to ask simple questions on one's name, age, nationality, address mail id and telephone number.
3. Writing –conjugations of first group verbs and paragraph writing on self – introduction and introducing a third person.
4. Reading Comprehension – reading a text that speaks of one's profile and answering questions

**UNIT IV** **(6 hours)**

1. Grammar and Vocabulary –negative sentences, numbers from 20 to 69, verb "aimer"and seasons of the year and leisure activities.
2. Listening and Speaking – To express one's likes and dislikes and to talk of one's pastime activities (sports activities), je fais du ping-pong and nasal sounds of words – janvier, champagne
3. Writing- conjugations of the irregular verbs – faire and savoir and their usage. Paragraph writing on one's leisure activity- (passé temps favori)
4. Reading- a text on seasons and leisure activities – answering questions.

**UNIT V** **(6 hours)**

1. Grammar and Vocabulary – les verbes de direction- to ask one's way and to give directions, verbes- pouvoir and vouloir and 2nd group verbs , a droite, la premiere a gauche and vocabulary relating to accommodation.
2. Listening and Speaking – to read and understand the metro map and hence to give one directions – dialogue between two people.
3. Writing –paragraph writing describing the accommodation using the different prepositions like en face de, derriere- to locate .
4. Reading Comprehension -- a text / a dialogue between two on location and directions- ou est la poste/ la pharmacie, la bibliotheque?.....

**TEXT BOOK**

1. Tech French

**REFERENCES**

1. French for Dummies.
2. French made easy-Goyal Publishers
3. Panorama

| LE1004 FRENCH LANGUAGE PHASE I | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Designed by** | | **Department of English and Foreign Languages** | | | | | | | | | | |
| 1. | Student Outcomes | a | b | c | d | e | f | g | h | i | j | k |
| | | | | | | | | x | | | | |
| 2. | Mapping of instructional objectives with student outcome | | | | | | | 1-5 | | | | |
| 3. | Category | General (G) | | Basic Sciences(B) | | Engineering Sciences and Technical Arts(E) | | | | Professional Subjects(P) | | |
| | | X | | -- | | - | | | | - | | |
| 4. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

| LE 1005 | JAPANESE LANGUAGE PHASE I | L | T | P | C |
|---|---|---|---|---|---|
| | Total Contact Hours- 30 | **2** | **0** | **0** | **2** |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

To enable students achieve a basic exposure on Japan, Japanese language and culture. To acquire basic conversational skill in the language.

**INSTRUCTIONAL OBJECTIVES**

| | |
|---|---|
| 1. | To help students learn the Japanese scripts viz. hiragana and a few basic kanji. |
| 2. | To make the students acquire basic conversational skill. |
| 3 | To enable students to know about Japan and Japanese culture. |
| 4. | To create an advantageous situation for the students to have better opportunity for employability by companies who have association with Japan. |

**UNIT I** **(8 hours)**

1. Introduction to Japanese language. Hiragana Chart 1 - vowels and consonants and related vocabulary.
2. Self introduction
3. Grammar – usage of particles wa, no, mo and ka and exercises
4. Numbers (1-100)
5. Kanji – introduction and basic kanjis – naka, ue, shita, kawa and yama
6. Greetings, seasons, days of the week and months of the year
7. Conversation – audio
8. Japan – Land and culture

**UNIT II** (**8 hours)**

1. Hiragana Chart 1 (contd.) and related vocabulary
2. Grammar – usage of kore, sore, are, kono, sono, ano, arimasu and imasu. Particles – ni (location) and ga. Donata and dare.
3. Numbers (up to 99,999)
4. Kanji – numbers (1-10, 100, 1000, 10,000 and yen)
5. Family relationships and colours.
6. Conversation – audio
7. Festivals of Japan

**UNIT III** (**5 hours)**

Hiragana Charts 2&3, double consonants, vowel elongation and related vocabulary
Lesson 3
Grammar - particles ni (time), kara, made and ne. Koko, soko, asoko and doko.
Time expressions (today, tomorrow, yesterday, day before, day after)
Kanji – person, man, woman, child, tree and book
Directions – north, south, east and west

**UNIT IV** **(5 hours)**

Grammar - directions,-kochira, sochira, achira and dochira. Associated vocabulary (mae, ushiro, ue, shita, tonari, soba, etc.)
Conversation – audio
Japanese art and culture like ikebana, origami, etc.

**UNIT V** **(4hours)**

Kanji – hidari, migi, kuchi
Japanese sports and martial arts

**TEXT BOOK**

1. First lessons in Japanese, ALC Japan

**REFERENCES**

1. Japanese for dummies. Wiley publishing co. Inc., USA.
2. Kana workbook, Japan foundation

| LE1005 JAPANESE LANGUAGE PHASE I | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course Designed by | | Department of English and Foreign Languages | | | | | | | | | | |
| 1. | Student Outcomes | a | b | c | d | e | f | g | h | i | j | k |
| | | | | | | | | x | | | | |
| 2. | Mapping of instructional objectives with student outcome | | | | | | | 1-4 | | | | |
| 3. | Category | General (G) | | Basic Sciences(B) | | Engineering Sciences and Technical Arts(E) | | | | Professional Subjects(P) | | |
| | | X | | -- | | - | | | | - | | |
| 4. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

| LE1006 | KOREAN LANGUAGE PHASE I | L | T | P | C |
|---|---|---|---|---|---|
| | Total Contact Hours-30 | 2 | 0 | 0 | 2 |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

To enable students achieve a basic exposure on Korea, Korean language and culture. To acquire basic conversational skill in the language.

**INSTRUCTIONAL OBJECTIVES**

| | |
|---|---|
| 1. | To help students learn the scripts. |
| 2. | To make the students acquire basic conversational skill. |
| 3 | To enable students to know about Korean culture. |
| 4. | To create an advantageous situation for the students to have better opportunity for employability by companies who have association with Korea. |

**UNIT I** **(6 hours)**

Lesson 1 < Introduction to Korean Language >, Lesson2 < Consonants and Vowels >, <Basic Conversation, Vocabularies and Listening >

**UNIT II** (**10 hours)**

Lesson 3<Usage of "To be" >, Lesson 4 < Informal form of "to be">, Lesson 5 <Informal interrogative form of "to be">, Lesson 6 <To be, to have, to stay>, < Basic Conversation, Vocabularies and Listening >

**UNIT III** (**10 hours**)

Lesson 7 < Interrogative practice and Negation >, < Basic Conversation, Vocabularies and Listening >

**UNIT IV** **(4 hours)**

Lesson 8 < Korean Culture and Business Etiquette >, < Basic Conversation, Vocabularies and Listening

**TEXT BOOK**

1. Korean Through English 1(Basic Korean Grammar and Conversation).

**REFERENCES**

1. Bharati Korean (Intermediate Korean Grammar).
2. Hand-outs.
3. Various visual mediums such Movie CD, Audio CD.
4. Collection of vocabularies for engineering field.

| **LE1006KOREAN LANGUAGE PHASE I** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Designed by** | | **Department of English and Foreign Languages** | | | | | | | | | | |
| 1. | Student Outcomes | a | b | c | d | e | f | g | h | i | j | k |
| | | | | | | | | x | | | | |
| 2. | Mapping of instructional objectives with student outcome | | | | | | | 1-4 | | | | |
| 3. | Category | General (G) | | Basic Sciences(B) | | Engineering Sciences and Technical Arts(E) | | | | Professional Subjects(P) | | |
| | | X | | -- | | - | | | | - | | |
| 4. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

| **LE1007** | **CHINESE LANGUAGE PHASE I** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | Total Hontact Hours- 30 | **2** | **0** | **0** | **2** |
| | Prerequisite | | | | |
| | NIL | | | | |

**PURPOSE**

To enable students achieve a basic exposure on China, Chinese language and culture. To acquire basic conversational skill in the language.

| INSTRUCTIONAL OBJECTIVES | |
|---|---|
| 1. | To help students learn the Chinese scripts. |
| 2. | To make the students acquire basic conversational skill. |
| 3 | To enable students to know about China and Chinese culture. |
| 4. | To create an advantageous situation for the students to have better opportunity for employability by companies who have association with china. |

**UNIT I**

Introduction of Chinese Language

**UNIT II**

**Phonetics and Notes on pronunciation**

**a) 21 Initials:**

b p m f d t n l g k h j q x z c s zh ch sh r

**b) 37 Finals:**

| | | | | | |
|---|---|---|---|---|---|
| a | o | e | I | u | ü |
| ai | ou | ei | ia | ua | üe |
| an | ong | en | ian | uai | üan |
| ang | eng | iang | uan | ün | |
| ao | er | iao | uang | | |
| | | ie | uei(ui) | | |
| | | in | uen(un) | | |
| | | ing | ueng | | |
| | | iong | uo | | |
| | | iou(iu) | | | |

**c) The combination of Initials and Finals - Pinyin**

**UNIT III**

**Introduction of Syllables and tones**

a) syllable=initial+final+tone

b) There are four tones in Chinese: the high-and-level tone, the rising tone, the falling-and-rising tone, and the falling tone. And the markers of the different tones.

**UNIT IV**

**A. Tones practice**

**B. the Strokes of Characters**

1. Introduction of Chinese Characters
2. The eight basic strokes of characters

**UNIT V**

1. **Learn to read and write the Characters:**
   八(eight) 不(not) 马(horse) 米(rice) 木(wood ).
2. **classes are organized according to several Mini-dialogues.**

**TEXT BOOK**

1. A New Chinese Course 1- Beijing Language and Culture University Press.

**REFERENCES**

1. New Practical Chinese Reader Textbook (1) – Beijing Language and Culture University Press.
2. 40 Lessons For Basic Chinese Course I – Shanghai Translation Press.
3. My Chinese Classroom - East China Normal University Press.

| LE1007CHINESE LANGUAGE PHASE I | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course Designed by | | Department of English and Foreign Languages | | | | | | | | | | |
| 1. | Student Outcomes | a | b | c | d | e | f | g | h | i | j | k |
| | | | | | | | | x | | | | |
| 2. | Mapping of instructional objectives with student outcome | | | | | | | 1-4 | | | | |
| 3. | Category | General (G) | | Basic Sciences(B) | | Engineering Sciences and Technical Arts(E) | | | | Professional Subjects(P) | | |
| | | X | | -- | | - | | | | - | | |
| 4. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

| PD1003 | APTITUDE-I | L | T | P | C |
|---|---|---|---|---|---|
| | Total Contact Hours – 30 | 1 | 0 | 1 | 1 |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

To enhance holistic development of students and improve their employability skills.

**INSTRUCTIONAL OBJECTIVES**

| | |
|---|---|
| 1. | To improve aptitude, problem solving skills and reasoning ability of the student. |
| 2. | To collectively solve problems in teams & group. |

**UNIT I -NUMBERS** **(6 hours)**

Types and Properties of Numbers, LCM, GCD, Fractions and decimals, Surds

**UNIT II - ARITHMETIC – I** **(6 hours)**

Percentages, Profit & Loss, Simple Interest & Compound Interest, Clocks & calendars

**UNIT III - ALGEBRA - I** **(6 hours)**

Logarithms, Problems on ages

**UNIT IV - MODERN MATHEMATICS - I** **(6 hours)**

Permutations, Combinations, Probability

**UNIT V - REASONING** **(6 hours)**

Logical Reasoning, Analytical Reasoning

**ASSESSMENT**

1. Objective type – Paper based / Online – Time based test

**REFERENCE**


1. Agarwal.R.S – *Quantitative Aptitude for Competitive Examinations",* S.Chand Limited 2011
2. Abhijit Guha*, "Quantitative Aptitude for Competitive Examinations",*Tata McGraw Hill, 3rd Edition*,* 2011
3. Edgar Thrope,*"Test Of Reasoning for Competitive Examinations",* Tata McGraw Hill, 4th Edition, 2012
4. *"Other material related to quantitative aptitude"*


| PD1003 – APTITUDE-I | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course Designed by | | Career Development centre | | | | | | | | | | |
| 1. | Student Outcomes | a | b | c | d | e | f | g | h | i | j | k |
| | | x | | | x | | | | | | | |
| 2. | Mapping of instructional objectives with student outcome | 1 | | | 2 | | | | | | | |
| 3. | Category | General (G) | | Basic Sciences(B) | | Engineering Sciences and Technical Arts(E) | | | | Professional Subjects(P) | | |
| | | X | | -- | | - | | | | - | | |
| 4. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

| | FOURIER SERIES, PARTIAL DIFFERENTIAL EQUATIONS & ITS APPLICATIONS | L | T | P | C |
|---|---|---|---|---|---|
| | Total Contact Hours = 60 | 4 | 0 | 0 | 4 |
| MA 1013 | (Common to Auto, Aero, Mech, Nano, Civil & Chemical) | | | | |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

To inculcate the problem solving ability in the minds of students so as to apply the theoretical knowledge to the respective branches of Engineering.

**INSTRUCTIONAL OBJECTIVES**

| | |
|---|---|
| 1. | To know to formulate and solve partial differential equations |
| 2. | To have thorough knowledge in Fourier series |
| 3. | To learn to solve boundary value problems |
| 4. | To be familiar with applications of PDE in two dimensional heat equation |
| 5. | To gain good knowledge in the application of Fourier transform |

**UNIT I-PARTIAL DIFFERENTIAL EQUATIONS (12 hours)**

Formation - Solution of standard types of first order equations - Lagrange's equation - Linear Homogeneous partial differential equations of second and higher order with constant coefficients.

**UNIT II-FOURIER SERIES (12 hours)**

Dirichlet's conditions - General Fourier series - Half range sine and cosine series- Parseval's identity - Harmonic analysis.

**UNIT III-BOUNDARY VALUE PROBLEMS (12 hours)**

Classification of second order linear partial differential equations - Solutions of one-dimensional wave equation - one-dimensional heat equation

**UNIT IV-TWO DIMENSIONAL HEAT EQUATION (12 hours)**

Steady state solution of two-dimensional heat equation - Fourier series solutions in Cartesian coordinates & Polar coordinates.

**UNIT V-FOURIER TRANSFORMS** **(12 hours)**

Statement of Fourier integral theorem (without proof) - Fourier transform pairs - Fourier Sine and Cosine transforms - Properties - Transforms of simple functions - Convolution theorem - Parseval's identity.

**TEXT BOOKS**


1. Kreyszig.E, "*Advanced Engineering Mathematics"*, 10th edition, John Wiley & Sons. Singapore,2012.
2. Grewal, B, S., "*Higher Engineering Mathematics"*, 42nd edition, Khanna Publishers, New Delhi, 2012.


**REFERENCES**


1. Sivaramakrishna Das P. and Vijayakumari.C, "*A text book of Engineering Mathematics-III"*,Viji's Academy,2010.
2. Kandasamy, P., etal.,"*Engineering Mathematics, Vol. II & Vol. III (4th revised edition*")", S.Chand & Co., New Delhi, 2000.
3. Narayanan, S., Manickavachagom Pillay, T., and Ramanaiah,G., "*Advanced Mathematics for Engineering students"*, Volume II & III (2nd edition), S,Viswanathan Printers and Publishers, 1992.
4. Venkataraman, M, K., "*Engineering Mathematics - Vol.III - A & B (13th edition")"*, National Publishing Co., Chennai, 1998.
5. Sankara Rao, "*Introduction to Partial Differential Equations*", 2nd Edition, PHI Learning Pvt. Ltd., 2006.


| **MA 1013 - FOURIER SERIES, PARTIAL DIFFERENTIAL EQUATIONS & ITS APPLICATIONS** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Designed by** | | **Department of Mathematics** | | | | | | | | | | |
| 1. | Student Outcomes | a | b | c | d | e | f | g | h | i | j | k |
| | | X | | | | X | | | | | | |
| 2. | Mapping of instructional objectives with student outcome | 1-5 | | | | 1-5 | | | | | | |
| 3. | Category | General (G) | | Basic Sciences(B) | | Engineering Sciences and Technical Arts(E) | | | | Professional Subjects(P) | | |
| | | -- | | X | | - | | | | - | | |
| 4. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

| | APPLIED MECHANICS AND STRENGTH OF MATERIALS | L | T | P | C |
|---|---|---|---|---|---|
| CE1051 | Total Contact Hours - 45 | 3 | 0 | 0 | 3 |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

To bring about an understanding of behaviour of materials under the action of applied forces and create an insight into the design of structures using the materials.

**INSTRUCTIONAL OBJECTIVES**

| | |
|---|---|
| 1. | To introduce the basic concepts of stress and strain caused by applied forces. |
| 2. | To create an awareness of the properties of sections and their relevance to applied mechanics. |
| 3. | To bring about an understanding of deformation of simple structures under the action of loads. |
| 4. | To create a confidence in analyzing simple structural components. |

**UNIT I-ELASTICITY OF MATERIALS (9 hours)**

Stress and Strain – Compression, Tensile, Shear, Bending and Bearing stresses– Stress –Strain Diagram-Hooks Law-Modulus of Elasticity, Modulus of Rigidity, Bulk Modulus and Poisson's Ratio- Relationship between elastic constants. Temperature stresses- composite bars Dead, Live, Erection and Impact loads permissible stresses- factors of safety.

**UNIT II-THIN AND THICK CYLINDERS (9 hours)**

Thin cylindrical shells subjected to fluid pressure, seamless and jointed shells. Thin spherical shells subjected to fluid pressure. Thick cylindrical shells- Lame's equation- Shrink-fit -Compound cylinders

**UNIT III-PROPERTIES OF SECTIONS (9 hours)**

Calculation of centroid, neutral axis and moment of Inertia-Modulus of section – radius of gyration Standard Structural steel sections- built up sections.

**UNIT IV-BEAMS AND SUPPORT SYSTEMS (12 hours)**

Simply supported and cantilever beams-Bending and Shear force diagrams. Simple theory of bending and bending stresses in beams- Qualitative treatment of deflection in beams (concepts and deflection profiles only)

Saddle and skirt supports, Welded joints and wall brackets – qualitative treatment

**UNIT V-COLUMNS AND MATERIAL TESTING (6 hours)**

Combined direct and bending stress in columns and struts- Long and short columns, effect of end conditions, equivalent length, slenderness ratio. Euler's theory of columns, Rankine's formula for axial and eccentric loading.

**TEXT BOOKS**


1. Ramamrutham S., Narayanan R., "*Strength of Material*", Dhanpat Rai Publications, New Delhi, 2001.
2. Khurmi R.S, "*A Text book of Engineering Mechanics*", S.Chand & Co, New Delhi, 2000.


**REFERENCES**


1. Egor P. Popov, "*Introduction to Mechanics of Solids*", Prentice Hall of India, New Delhi,1991.
2. Junarkar S.B., "*Mechanics of Structures*", Vol. I 21st Edn., Charotar Publishing house, Anand, India,2001.
3. http://www.coade.com/FAQ/151


| **CE1051 - APPLIED MECHANICS AND STRENGTH OF MATERIALS** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Designed by** | | **Department of Civil Engineering** | | | | | | | | | | |
| 1. | Student Outcomes | a | b | c | d | e | f | g | h | i | j | k |
| | | X | | | | x | | | | | | |
| 2. | Mapping of instructional objectives with student outcome | 1-4 | | | | 1-4 | | | | | | |
| 3. | Category | General (G) | | Basic Sciences(B) | | Engineering Sciences and Technical Arts(E) | | | | Professional Subjects(P) | | |
| | | -- | | -- | | x | | | | -- | | |
| 4. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| **CH1040** | **TRANSPORT PROCESSES IN FOOD ENGINEERING** | **L** | **T** | **P** | **C** |
| | Total Contact Hours - 45 | **3** | **0** | **0** | **3** |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

This course deals with various modes of heat transfer, heat exchangers, and mechanism of mass transfer and momentum transfer and their respective applications in the food industry

**INSTRUCTIONAL OBJECTIVES**

To familiarize the students with:

| | |
|---|---|
| 1. | Modes of heat transfer – Conduction, convection and radiation |
| 2. | The important heat exchange equipments used in the food industry |
| 3. | Mechanism of mass transfer operations |
| 4. | The basic concepts and fluid-flow phenomena and the kinematics of flow |

**UNIT I-HEAT TRANSFER (11 hours)**

Mechanism of heat transfer by Conduction, convection and radiation, Fourier's law of heat conduction, steady-state and unsteady state conduction, concept of overall and individual heat transfer coefficients, heat transfer to fluids without phase change: heat transfer coefficient calculation for natural and forced convection, heat transfer to fluids with phase change: boiling, heat transfer from condensing vapours, dropwise and film-type condensation

**UNIT II-HEAT-EXCHANGE EQUIPMENTS (8 hours)**

Parallel and counter flow heat exchangers - Log mean temperature difference - Single pass and multi pass heat exchangers; plate heat exchangers- application in milk processing; double pipe heat exchangers, shell and tube heat exchanger, heat exchangers effectiveness; Fouling factors.

**UNIT III-MASS TRANSFER OPERATIONS (11 hours)**

Molecular diffusion in fluids and solids, Effect of temperature and pressure on diffusivity, Interphase mass transfer and mass transfer coefficients, Single and multi component absorption, Absorption with chemical reaction, HTU and NTU concepts, Vapour-liquid equilibria, Simple, steam and flash distillation, Continuous distillation, McCABE – THIELE Principles.

**UNIT IV-FLUID FLOW PHENOMENA (9 hours)**

Nature of fluid flow – overall momentum balance – design equations for laminar and turbulent flow in pipes, friction factor, Darcy-Weisbach relation.compressible flow of gases – Differential equations of momentum transfer – Euler equation – Dimensional analysis in momentum transfer – Applications specific to food systems – Flow behaviour of ketchup, syrups, beverages, batter.

**UNIT V-KINEMATICS OF FLOW (6 hours)**

Bernoulli's equation, Boundary layer phenomenon and turbulence - Flow of incompressible fluids in conduits and thin layers average velocity for laminar flow of Newtonian fluids, Hagen-Poiseuille equation.

**TEXT BOOKS**


1. Geankoplis C.J., 2003. "*Transport Processes and UNIT Operations*", 3rd edition, Printice Hall of India.


**REFERENCES**


1. Warren L. Mccabe, Julian C. Smith and peter Harriott, 2001."*UNIT Operations of Chemical Engineering*", 6th Edn., McGraw Hill International Edition, NewYork.
2. Robert E. Treybal, 1980."*Mass-Transfer Operations*", 3rd Edn., McGraw Hill International Edition, Singapore.
3. Coulson J.M., Richardson J.F., Backhurst J.R. and Harker J.M., Coulson & Richardson's 1999. "*Chemical Engineering*", Vol. I & II Edn., Butter worth Heinemann, Oxford,
4. Noel de Nevers, 1991. "*Fluid Mechanical for chemical Engineers*", 2nd Edn., McGraw Hill International Editions.


| CH1040TRANSPORT PROCESSES IN FOOD ENGINEERING | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course Designed by | | Department of Chemical Engineering | | | | | | | | | | |
| 1. | Student Outcomes | a | b | c | d | e | f | g | h | i | j | k |
| | | X | | | | | | | | | | |
| 2. | Mapping of instructional objectives with student outcome | 1-2 | | | | | | | | | | |
| 3. | Category | General (G) | | Basic Sciences(B) | | Engineering Sciences and Technical Arts(E) | | | | Professional Subjects(P) | | |
| | | -- | | -- | | -- | | | | x | | |
| 4. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

| ME1055 | KINEMATICS OF MACHINERY | L | T | P | C |
|---|---|---|---|---|---|
| | Total Contact Hours - 45 | 3 | 0 | 0 | 3 |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

To help the students to understand the machines and their components so as to enable them manage the machineries in the food industries.

**INSTRUCTIONAL OBJECTIVES**

| | |
|---|---|
| 1. | To understand the basic mechanisms involved in machines |
| 2. | To know about the various drives the actuation, control and conversion from one form to another. |

**(Elementary Treatment only. Only simple problems to be solved)**

**UNIT I-MECHANISMS (9 hours)**

Basic concept of machines-Kinematics-links-pairs-chain-machines and mechanisms-Different mechanisms and uses-Inversion of mechanisms-Four bar linkage-its inversions.

**UNIT II-FRICTION (9 hours)**

Friction-pivot and collar friction-bearing-types-loss of power due to friction in bearings-Basic theory of lubrication-viscosity ratings-Antifriction bearings-types-brakes band-shoe-clutches types-single and multiple disc cone and their applications.

**UNIT III-POWER DRIVES (9 hours)**

Power Drives – belt-flat and V belts-Tension ratio-centrifugal tension-creep-chain Drives-Gears-classification-terminology-profile-law of gearing-minimum number of teeth-interference between rack and pinion-efficiency-gear trains-simple-compound-reverted.

**UNIT IV-GOVERNORS AND FLYWHEELS (9 hours)**

Governor-watt and porter governor-sensitivity and hunting, flywheel-function-fluctuation of speed and energy.

**UNIT V-CAM (9 hours)**

Cam and follower-types-application-profiles for uniform velocity and acceleration-simple harmonic and cycloidal motion – uniform angular velocity.

**TEXT BOOKS**

1. Shigley.J.E. & Nicker.J.J., 1995. "*Theory of Machines and Mechanisms*" end Edition, McGrawHill Inc.
2. Ghosh A & Malik A.K., 1988. "*Theory of Mechanisms and Machines*", Affiliated East West Press (P) Ltd.

**REFERENCES**


1. Ballaney, P.L., 1994. "*Theory of Machines*", Khanna Publishers, New Delhi.
2. Rattan, S.S. "*Theory of Machines*", Tata McGrawHill Publishing Company Ltd., New Delhi.
3. Khurni, R.S. and Gupta, J.K. 1994. "*Theory of Machines*", Eurasia Publishing House, Calcutta.


| Department of Food Process Engineering | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course Designed by | | Department of Chemical Engineering | | | | | | | | | | |
| 1. | Student Outcomes | a | b | c | d | e | f | g | h | i | j | k |
| | | X | | | | | | | | | | |
| 2. | Mapping of instructional objectives with student outcome | 1-2 | | | | | | | | | | |
| 3. | Category | General (G) | | Basic Sciences(B) | | Engineering Sciences and Technical Arts(E) | | | | Professional Subjects(P) | | |
| | | -- | | -- | | -- | | | | x | | |
| 4. | Broad area | Basic Bio Sciences | | Food Engineering | | Product Development | | Industrial Application & Allied Engineering Subject | | | | |
| | | -- | | -- | | -- | | x | | | | |
| 5. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

| FP1003 | FOOD MICROBIOLOGY | L | T | P | C |
|---|---|---|---|---|---|
| | Total Contact Hours - 45 | 3 | 0 | 0 | 3 |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

To make the student to understand the causes of food spoilage and predict the micro organism that can spoil a given food, when prepared, processed and stored under given condition and take corrective measures to control the spoilage and pathogenic micro organism in food.To help the students to understand the

| | |
|---|---|
| machines and their components so as to enable them manage the machineries in the food industries | |
| **INSTRUCTIONAL OBJECTIVES** | |
| 1. | To understand the role of beneficial micro organisms in food processing and preservation |
| 2. | To list the major food spoilage microorganisms |
| 3. | To analyze methods used to control or destroy micro organism commonly found in food. |

**UNIT I-INTRODUCTION (9 hours)**

Development and scope of Microbiology - classification and Identification of Microorganisms –Bacteria, fungi, viruses, protozoa and bacteriophage - Morphology, cultivation- Growth curve – microscopy – types- importance of micro organisms in food.

**UNIT II-ISOLATIONOF MICROORGANISMS (9 hours)**

Methods of isolation and purification – preparation of media – types of nutritional media – staining techniques – Simple, differential and structural staining – preservation of the microbial culture- primary sources of micro organisms in food-. Parameters affecting the growth of microorganisms

**UNIT III-MICROBIALSPOILAGE IN FOODS (9 hours)**

Types of micro organisms in food via meat, poultry, sea foods, vegetables, dairy products, fruits and vegetables. Assessing microbial population in food- meat, poultry, fish and dairy products- microbial spoilage of fruits, vegetables, cereal and bakery products, meat products and egg.

**UNIT IV-FOODPRESERVATION (9 hours)**

Preservation by Moist Heat-Heat Resistance of microorganisms and spores. Decimal reduction time (Dvalues), 12D concept, Thermal Death Time curves. UNIT of lethality, determination of process lethality requirements, effective F values.Preservation by low temperature.The behaviour of microorganisms under freezing and refrigeration environment.Growth and lethal effects of low temperature treatments on microorganisms in raw and processed foods.Chemical preservation

**UNIT V-HARMFULMICRO ORGANISM AND BENEFICIAL MICRO ORGANISM**

**(9 hours)**

Food borne diseases – food infection and food intoxication, toxins – symptoms, causes and control measures. Micro organisms as food- Single Cell Protein - Fermented food- pickles, sauerkraut,- vinegar and lactic acid.

**TEXT BOOKS**


1. Pelczar,M.J., E.C.S. Chan and N.R. Krieg. "*Microbiology*". McGraw-Hill New York 1993.
2. Frazier, W.C. and Westhoff, D.C."*Food Microbiology*". Fourth Edition. Tata McGraw Hill Publishing Co. Ltd., New Delhi 2008.


**REFERENCES**


1. Banwart, G.J, "*Basic Food Microbiology*" Van No Strand Reinhold Publishers, New York 1989.
2. Jay, J.M., "*Modern Food Microbiology*". CBS Publishers& Distributors, New Delhi 2000.


<table>
<tr><th colspan="14">FP1003FOOD MICROBIOLOGY</th></tr>
<tr><td colspan="2">Course Designed by</td><td colspan="12">Department of Food Process Engineering</td></tr>
<tr><td rowspan="2">1.</td><td rowspan="2">Student Outcomes</td><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td><td>f</td><td>g</td><td>h</td><td>i</td><td>j</td><td>k</td></tr>
<tr><td>X</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2.</td><td>Mapping of instructional objectives with student outcome</td><td>1-2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">3.</td><td rowspan="2">Category</td><td colspan="2">General (G)</td><td colspan="2">Basic Sciences(B)</td><td colspan="4">Engineering Sciences and Technical Arts(E)</td><td colspan="3">Professional Subjects(P)</td></tr>
<tr><td colspan="2">--</td><td colspan="2">--</td><td colspan="4">--</td><td colspan="3">x</td></tr>
<tr><td rowspan="2">4.</td><td rowspan="2">Broad area</td><td colspan="2">Basic Bio Sciences</td><td colspan="2">Food Engineering</td><td colspan="3">Product Development</td><td colspan="4">Industrial Application & Allied Engineering Subject</td></tr>
<tr><td colspan="2">--</td><td colspan="2">--</td><td colspan="3">--</td><td colspan="4">x</td></tr>
<tr><td>5.</td><td>Approval</td><td colspan="12">23rd Meeting of Academic Council, May 2013</td></tr>
</table>

**SEMESTER - IV**

| | | | | | |
|---|---|---|---|---|---|
| **LE1008** | **GERMAN LANGUAGE PHASE II** | **L** | **T** | **P** | **C** |
| | Total Contact Hours- 30 | **2** | **0** | **0** | **2** |
| | Prerequisite | | | | |
| | LE1003-German Language Phase I | | | | |

**PURPOSE**

Familiarity in German language will be helpful for the students in preparing their resumes in German. Proficiency in the language will be an added asset for the students to have an edge in the present day highly competitive and global job market.

**INSTRUCTIONAL OBJECTIVES**

| | |
|---|---|
| 1. | To enable the students to speak and understand about most of the activities in the day to day life. |
| 2. | The students will be able to narrate their experiences in Past Tense. |
| 3. | The students will be able to understand and communicate even with German Nationals. |
| 4. | By the end of Phase – II the students will have a reasonable level of conversational skills. |

**UNIT I** **(6 hours)**

Wichtige Sprachhandlungen: Zimmersuche, Möbel

**Grammatik**: Verben mit trennbaren Vorsilben im Präsens und Perfekt. Verben mit trennbaren Vorsilben und Modalverben imPräsens.Verben mit untrennbaren Vorsilben im Perfekt.Unregelmäßige und gemischte Verben im Perfekt.

**UNIT II** **(6 hours)**

Wichtige Sprachhandlungen: Kleidung ,Farben , Materialien.

**Grammatik :** formelle Imperativsätze mit “Sie” informelle Imperativsätze Vorschläge mit “wir” – “sollen/wollen wir”—Soll ich? Modalpartikeln “doch” “mal” “doch mal.

**UNIT III** **(6 hours)**

Wichtige Sprachhandlungen : Sehenswürdigkeite (Prater, Brandenburger Tör,Kolossium, Eifeltürm)

Grammatik : Ortsangaben mit Akk. und Dativ “alle”,”man” Indefinitepronomen “etwas”, “nichts”,

**UNIT IV** **(6 hours)**

Wichtige Sprachhandlungen : Wegbeschreibung/ Einladung interkulturelle Erfahrung.

Grammatik :Verwendung von Präsens für zukünftigen Zeitpunkt.

**UNIT V** **(6 hours)**

Wichtige Sprachhandlungen: Essen und Trinken im Restaurant , Partyvorbereitung und Feier

**Grammatik:**Nomen aus Adjektiven nach "etwas"und "nichts" Nomen aus dem Infinitiv von Verben, zusammegesetzte Nomen und ihre Artikel. Adjektive im Nom. und Akk. nach unbestimmten Artikel, Negativartikel und Possessivartikel.

**TEXT BOOK**

1. Studio d A1. Deutsch als Fremdsprache with CD.(Kursbuch und Sprachtraining).

**REFERENCES**

1. German for Dummies
2. Schulz Griesbach

| **LE01008 GERMAN LANGUAGE PHASE II** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Designed by** | | **Department of English and Foreign Languages** | | | | | | | | | | |
| 1. | Student Outcomes | a | b | c | d | e | f | g | h | i | j | k |
| | | | | | | | | x | | | | |
| 2. | Mapping of instructional objectives with student outcome | | | | | | | 1-4 | | | | |
| 3. | Category | General (G) | | Basic Sciences(B) | | Engineering Sciences and Technical Arts(E) | | | | Professional Subjects(P) | | |
| | | X | | -- | | -- | | | | -- | | |
| 4. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

| **LE1009** | **FRENCH LANGUAGE PHASE II** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | Total Contact Hours- 30 | **2** | **0** | **0** | **2** |
| | Prerequisite | | | | |
| | LE1004- French Language Phase I | | | | |
| **PURPOSE** | | | | | |
| To enable the students communicate effectively with any French speaker and have a competitive edge in the international market. | | | | | |

| INSTRUCTIONAL OBJECTIVES | |
|---|---|
| 1. | To enable students access information on the internet |
| 2. | To receive and send e mails |
| 3 | To assist students in gaining a certain level of proficiency to enable them to give the level 1 exam conducted by Alliance Française de Madras. |
| 4. | To enhance their lexical and technical competence. |

**UNIT I** **(6 hours)**

1. Grammar and Vocabulary: The second group verbs: Finir, rougir, grossir, grandir . "Les preposition de temps": à, en, le, de 7h à 8h, jusqu' à, vers.
2. Listening and Speaking – the semi- vowels: Voilà, pollutant. Writing –the days of the week. Months, technical subjects, time, "les spécialités scientifiques et l' année universitaire, paragraph writing about time table.
3. Reading -- Reading of the text and comprehension – answering questions

**UNIT II** **(6 hours)**

Grammar and Vocabulary – The adjectives, the nationality, feminine & masculine noun forms "les métiers scientifiques".
Listening and Speaking – Vowels: soirée, année, près de, très.
Writing – Countries name, nationality, "les métiers scientifiques", numbers from: 69 to infitive and some measures of unit.
Reading Comprehension – reading a text.

**UNIT III** **(6 hours)**

Grammar and Vocabulary – near future, The demonstrative adjectives, Express the aim by using the verb, Listening and Speaking –"La liaison interdite – en haut". Writing – some scientific terms, French expressions to accept an invitation. Sentence framing. Reading Comprehension – reading a text.

**UNIT IV** **(6 hours)**

Grammar and Vocabulary –the verbs: manger, boire , the partitive articles
Listening and Speaking – "le 'e' caduc Writing- the food, the ingredients, fruits, vegetables, expression of quantity, paragraph writing about food habits. Reading – reading a text.

**UNIT V** **(6 hours)**

Grammar and Vocabulary – " les prepositions de lieu": au à la, à l', chez, the reflexives verbs, verbs to nouns. Listening and Speaking – "le 'e' sans accents ne se prononce pas. C'est un "e" caduc. Ex: quatre, octobre. " les sons (s) et (z)-

salut , besoin. Writing –paragraph writing about one's everyday life, French culture. Reading Comprehension -- reading a text or a song.....

**TEXT BOOK**

1. Tech French

**REFERENCES**

1. French for Dummies
2. French made easy: Goyal publishers
3. Panorama

| LE1009 FRENCH LANGUAGE PHASE II | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course Designed by | | Department of English and Foreign Languages | | | | | | | | | | |
| 1. | Student Outcomes | a | b | c | d | e | f | g | h | i | j | k |
| | | | | | | | | x | | | | |
| 2. | Mapping of instructional objectives with student outcome | | | | | | | 1-4 | | | | |
| 3. | Category | General (G) | | Basic Sciences(B) | | Engineering Sciences and Technical Arts(E) | | | | Professional Subjects(P) | | |
| | | X | | -- | | -- | | | | -- | | |
| 4. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

| LE 1010 | JAPANESE LANGUAGE PHASE II | L | T | P | C |
|---|---|---|---|---|---|
| | Total Contact Hours- 30 | 2 | 0 | 0 | 2 |
| | Prerequisite | | | | |
| | LE1005- Japanese Language Phase I | | | | |

**PURPOSE**

To enable students to learn a little advanced grammar in order to improve their conversational ability in Japanese.

**INSTRUCTIONAL OBJECTIVES**

| | |
|---|---|
| 1. | To help students learn Katakana script (used to write foreign words) |
| 2. | To improve their conversational skill. |
| 3 | To enable students to know about Japan and Japanese culture. |
| 4. | To improve their employability by companies who are associated with Japan. |

**UNIT I** **(8 hours)**

Introduction to Verbs; Ikimasu, okimasu, nemasu, tabemasu etc.
Grammar – usage of particles de, o, to, ga(but) and exercises
Common daily expressions and profession.
Katakana script and related vocabulary.
Religious beliefs, Japanese housing and living style.
Conversation – audio

**UNIT II** **(8 hours)**

Grammar :Verbs –Past tense, negative - ~mashita, ~masen deshita..
i-ending and na-ending adjectives - introduction
Food and transport (vocabulary)
Japanese food, transport and Japanese tea ceremony.
Kanji Seven elements of nature (Days of the week)
Conversation – audio

**UNIT III** **(6 hours)**

Grammar - ~masen ka, mashou
Adjectives (present/past – affirmative and negative)
Conversation – audio

**UNIT IV** **(4 hours)**

Grammar – ~te form
Kanji – 4 directions
Parts of the body
Japanese political system and economy
Conversation – audio

**UNIT V** **(4 hours)**

Stationery, fruits and vegetables
Counters – general, people, floor and pairs

**TEXT BOOK**

1. First lessons in Japanese, ALC Japan

**REFERENCES**

1. Japanese for dummies. Wiley publishing co. Inc., USA.
2. Kana workbook, Japan foundation

| LE1010 JAPANESE LANGUAGE PHASE II | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Designed by** | | **Department of English and Foreign Languages** | | | | | | | | | | |
| 1. | Student Outcomes | a | b | c | d | e | f | g | h | i | j | k |
| | | | | | | | | x | | | | |
| 2. | Mapping of instructional objectives with student outcome | | | | | | | 1-4 | | | | |
| 3. | Category | General (G) | | Basic Sciences(B) | | Engineering Sciences and Technical Arts(E) | | | | Professional Subjects(P) | | |
| | | X | | -- | | -- | | | | -- | | |
| 4. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

| LE1011 | KOREAN LANGUAGE PHASE II | L | T | P | C |
|---|---|---|---|---|---|
| | Total Contact Hours-30 | 2 | 0 | 0 | 2 |
| | Prerequisite | | | | |
| | LE1006-Korean Language Phase I | | | | |

**PURPOSE**

To enable students achieve a basic exposure on Korea, Korean language and culture. To acquire basic conversational skill in the language.

**INSTRUCTIONAL OBJECTIVES**

| | |
|---|---|
| 1. | To help students learn the scripts. |
| 2. | To make the students acquire basic conversational skill. |
| 3 | To enable students to know about Korean culture. |
| 4. | To create an advantageous situation for the students to have better opportunity for employability by companies who have association with Korea. |

**UNIT I** (**9 hours)**

Lesson 1 <Review of Vowels and Consonants>, Lesson2 < Various Usages of "To be">, Lesson3 < Informal form of "to be"><Basic Conversation, Vocabularies and Listening>

**UNIT II** (**9 hours)**

Lesson 4< Informal interrogative form of "to be">, Lesson 5 < To be, to have, to stay>, Lesson 5 < Advanced Interrogative practice>, Lesson 6 < Types of Negation>, <Basic Conversation, Vocabularies and Listening>

**UNIT III** (**9 hours**)

Lesson 7 < Honorific forms of noun and verb2>, Lesson8 < Formal Declarative2>, Lesson 9 < Korean Business Etiquette>, <Basic Conversation, Vocabularies and Listening>

**UNIT IV** (**3 hours**)

Lesson 10 <Field Korean as an Engineer1>, <Field Korean as an Engineer2><Basic Conversation, Vocabularies and Listening>

**TEXT BOOK**

1. Korean through English 2(Basic Korean Grammar and Conversation)

**REFERENCES**

1. Bharati Korean (Intermediate Korean Grammar)
2. Hand-outs
3. Various visual media such Movie CD, Audio CD, and music
4. Collection of vocabularies for engineering field.

| **LE1011KOREAN LANGUAGE PHASE II** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Designed by** | | **Department of English and Foreign Languages** | | | | | | | | | | |
| 1. | Student Outcomes | a | b | c | d | e | f | g | h | i | j | k |
| | | | | | | | | x | | | | |
| 2. | Mapping of instructional objectives with student outcome | | | | | | | 1-4 | | | | |
| 3. | Category | General (G) | | Basic Sciences(B) | | Engineering Sciences and Technical Arts(E) | | | | Professional Subjects(P) | | |
| | | X | | -- | | -- | | | | -- | | |
| 4. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

| **LE1012** | **CHINESE LANGUAGE PHASE II** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | Total Contact Hours-30 | **2** | **0** | **0** | **2** |
| | Prerequisite | | | | |
| | LE1007-Chinese Language Phase I | | | | |

**PURPOSE**

To enable students achieve a basic exposure on China, Chinese language and culture. To acquire basic conversational skill in the language.

**INSTRUCTIONAL OBJECTIVES**

1. To help students learn the Chinese scripts.

| | |
|---|---|
| 2. | To make the students acquire basic conversational skill. |
| 3 | To enable students to know about China and Chinese culture. |
| 4. | To create an advantageous situation for the students to have better opportunity for employability by companies who have association with china. |

**UNIT I**

**A)** Greetings
Questions and answers about names
Introducing oneself
Receiving a guest
Making corrections

**New words:** 你ˆyou˘好ˆgood 'well˘工作ˆwork 'job˘人员ˆpersonnel 'staff member˘请问ˆMay I ask…˘贵ˆexpensive 'valuable˘姓ˆone's family name is ˘

**B)** Questions and answers about the number of people in a family
Expressing affirmation/negation
Questions and answers about the identity of a person same or not.

**New words:** 家ˆfamily 'home˘有ˆhave˘几ˆseveral˘
爸爸 (father˘妈妈 (mother) 哥哥 (elderly brother˘

**UNIT II**

A. About places
B. About numbers
C. if one knows a certain person
D. Expressing apology
E. Expressing affirmation/negation
F. Expressing thanks.

**New Words:**
客人ˆguest,visitor˘这儿ˆhere˘中文ˆChinese˘对ˆright, correct˘学生ˆstudent˘多ˆmany, a lot˘
**Grammar:** Sentences with a verbal predicate

**UNIT III**

Introducing people to each other
A. Exchanging amenities

B. Making/Negating conjectures
C. Questions and answers about nationality

**Grammar**: Sentences with an adjectival predicate

**UNIT IV**

A) About places to go
Indicating where to go and what to do
Referring to hearsay.
Saying good-bye

B) Making a request
Questions and answers about postcodes and telephone numbers
Reading dates postcodes and telephone numbers
Counting Renmibi

**Grammar:** Sentences with a subject-verb construction as its predicate
Sentences with a nominal predicate

**UNIT V**

A. Asking and answering if someone is free at a particular time
B. Making proposals
C. Questions about answers about time
D. Making an appointment
E. Telling the time
F. Making estimations

**TEXT BOOK**

1. A New Chinese Course 1- Beijing Language and Culture University Press

**REFERENCES**

1. New Practical Chinese Reader Textbook (1) – Beijing Language and Culture University Press
2. 40 Lessons For Basic Chinese Course I – Shanghai Translation Press
3. My Chinese Classroom - East China Normal University Press

| LE1012CHINESE LANGUAGE PHASE II | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course Designed by | | Department of English and Foreign Languages | | | | | | | | | | |
| 1. | Student Outcomes | a | b | c | d | e | f | g | h | i | j | k |
| | | | | | | | | x | | | | |
| 2. | Mapping of instructional objectives with student outcome | | | | | | | 1-4 | | | | |

| 3. | Category | General (G) | Basic Sciences(B) | Engineering Sciences and Technical Arts(E) | Professional Subjects(P) |
|---|---|---|---|---|---|
| | | X | -- | -- | -- |
| 4. | Approval | 23rd Meeting of Academic Council, May 2013 | | | |

| PD1004 | APTITUDE-II | L | T | P | C |
|---|---|---|---|---|---|
| | Total Contact Hours - 30 | 1 | 0 | 1 | 1 |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

To enhance holistic development of students and improve their employability skills.

**INSTRUCTIONAL OBJECTIVE**

| | |
|---|---|
| 1. | To improve verbal aptitude, vocabulary enhancement and reasoning ability of the student. |

**UNITI** **(6 hours)**

Critical Reasoning – Essay Writing

**UNIT II** **(6 hours)**

Synonyms – Antonyms - Odd Word - Idioms & Phrases

**UNIT III** **(6 hours)**

Word Analogy - Sentence Completion

**UNIT IV** **(6 hours)**

Spotting Errors - Error Correction - Sentence Correction

**UNIT V** **(6 hours)**

Sentence Anagram - Paragraph Anagram - Reading Comprehension

**ASSESSMENT**

1. Objective type – Paper based /Online – Time based test

**TEXT BOOK**

1. Personality Development -Verbal Work Book, "*Career Development Centre"*,SRM Publications

**REFERENCES**


1. Green Sharon Weiner M.A & Wolf Ira K. ''*Barron's New GRE*, *19th Edition*" Barron's Educational Series, Inc, 2011.
2. Lewis Norman, ''*Word Power Made Easy''*, Published by W.R.Goyal Pub, 2011.
3. Thorpe Edgar and Thorpe Showich, ''*Objective English''.* Pearson Education 2012.
4. Murphy Raymond, ''*Intermediate English Grammar''*, (Second Edition), Cambridge University Press, 2012.


| PD1004 - APTITUDE-II | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Designed by** | | **Career Development Centre** | | | | | | | | | | |
| 1. | Student Outcomes | a | b | c | d | e | f | g | h | i | j | k |
| | | | | | | | | x | | | | |
| 2. | Mapping of instructional objectives with student outcome | | | | | | | 1 | | | | |
| 3. | Category | General (G) | | Basic Sciences(B) | | Engineering Sciences and Technical Arts(E) | | | | Professional Subjects(P) | | |
| | | X | | -- | | -- | | | | -- | | |
| 4. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

| CH1039 | STOICHIOMETRY AND ENGINEERING THERMODYNAMICS | L | T | P | C |
|---|---|---|---|---|---|
| | Total Contact Hours - 45 | **3** | **0** | **0** | **3** |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

This course deals with (i) formulation and solution of material balances on chemical process systems, and (ii) the transformation of energy from one form to another.

**INSTRUCTIONAL OBJECTIVES**

To familiarize the students with:

| | |
|---|---|
| 1. | Basic principles of process calculations |
| 2. | Material balance calculations |
| 3. | Basic concepts and laws of thermodynamics |
| 4. | Volumetric properties of pure fluids |

**UNIT I-INTRODUCTION (9 hours)**

UNITs and dimensions, the mole UNIT, mole fraction (or percent) and mass fraction (or percent), analyses of a mixture, concentrations, basis of calculations, predicting P-V-T properties of gases using the following equations of state: ideal gas law, Van der Waals equation, Redlich-Kwong equation, calculation of density.

**UNIT II-CHEMICAL EQUATION AND MATERIAL BALANCES (9 hours)**

Basics of chemical equation and stoichiometry, limiting reactant, excess reactant, conversion, selectivity, yield. Basic concepts involved in material balance calculations, material balance problems without chemical reactions: membrane separation, mixing, drying, crystallization. Basic concepts of recycle, bypass and purge streams.

**UNIT III-BASIC CONCEPTS AND FIRST LAW OF THERMODYNAMICS (9 hours)**

Fundamental concepts of thermodynamics – systems, properties, process, functions, UNITs, energy, heat and work – Zeroth law. First law, internal energy, enthalpy, heat capacities $C_V$ and $C_P$ – steady flow processes with reference to various thermal equipments - nozzle, throat, throttling process and compressors.

**UNIT IV-VOLUMETRICPROPERTIES OF PURE FLUIDS (9 hours)**

PVT behavior of pure substances, virial equations of state, the ideal gas, equations for process calculations(for an ideal gas in any mechanically reversible closed-system process): isothermal process, isobaric process, isochoric process, adiabatic process, and polytropic process. Application of the virial equations, introduction to cubic equations of state: van der Waals equation, Redlich/Kwong equation, theorem of corresponding states; acentric factor.

**UNIT V-SECOND LAW OF THERMODYNAMICS (9 hours)**

Statements, heat engines, Carnot's theorem, ideal-gas temperature scale; Carnot's equations, concept of entropy, entropy changes of an ideal gas undergoing a mechanically reversible process in a closed system, mathematical statement of the second law, entropy balance for open systems, statement of the third

**TEXT BOOKS**


1. David M. Himmelblau, 1998. "*Basic Principles and Calculations in Chemical Engineering"*, 6$^{th}$Edn., Prentice-Hall of India, New Delhi.
2. Smith, J.M., Van Ness, H.C., and Abbott, M.M., 2001. *"Introduction to Chemical Engineering Thermodynamics"*, 6$^{th}$Edn., McGraw Hill International Edition, Singapore.

**REFERENCES**


1. Bhatt B.I. and Vora S.M., 1996. "*Stoichiometry"*, 3rdEdn., Tata McGraw-Hill Publishing Company, New Delhi.
2. Rao Y.V.C, 1997. "*Chemical Engineering Thermodynamics*", University Press (I) Ltd., Hyderabad,


| CH1039 STOICHIOMETRY AND ENGINEERING THERMODYNAMICS | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Designed by** | | **Department of chemical Engineering** | | | | | | | | | | |
| 1. | Student Outcomes | a | b | c | d | e | f | G | h | i | j | k |
| | | x | | | | | | | | | | |
| 2. | Mapping of instructional objectives with student outcome | 1 - 2 | | | | | | | | | | |
| 3. | Category | General (G) | | Basic Sciences(B) | | Engineering Sciences and Technical Arts(E) | | | | Professional Subjects(P) | | |
| | | -- | | -- | | -- | | | | x | | |
| 4. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

| FP1004 | FOOD CHEMISTRY | L | T | P | C |
|---|---|---|---|---|---|
| | Total Contact hours - 90 | **3** | **0** | **3** | **5** |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

This is a introductory course which gives the necessary details and informations to get acquainted with the properties and composition of food.

**INSTRUCTIONAL OBJECTIVES**

At the end of this course, the student will have an idea about the various constituents of foods, sources, energy and nutritional requirements and their functions.

**UNITI-FOOD SCIENCE** **(7hours)**

Food requirements - Consumer safety – Objectives of food science – Constituents of food – Food as a source of energy – Energy requirement in human body – Food health and disease. Water – Role of water – Dietary requirements and sources – Important physical properties of water – concept of water activity – Water binding in foods – water activity and activity of microorganisms – Controlling of water activity in foods – Experimental determination of water activity in foods.

**UNITII-CARBOHYDRATES (10hours)**

Chemistry of carbohydrates – composition and structure- Definition, classification, importance, monosaaccharides-structure and properties-disarcharides-maltose, lactose, sucrose.Oligo saccharides-raffinose.Polysaccharides-starch, cellulose, pectins, seed gum, sea weed and algal polysaccharides (application only). Dietary sources – Functional properties of dietary carbohydrates- Biological role of Dietary fibre– Nutrition - Flavor and colour development Sweetness – Texturing characteristics of carbohydrates – Plasticizing action and Humectancy of carbohydrates.

**UNIT III-FATSAND OILS (9hours)**

Definition and classification –biological role and uses of lipids proximate composition of cereals, pulses, tubers, oil seeds, fruits and vegetables – Fat group classification – Dietary sources – Fatty acids in foods nomenclature – Triglycerides – composition and structure – Physical properties of triglycerides – Polymorphism of triglycerides – Plasticizing properties of fats – Enrobing fats – Emulsifying properties of fats – Rancidity and reversion of fats.

**UNIT IV-PROTEINSAND ENZYMES (10hours)**

Classification, structure and functions – Role of proteins and requirements – Aminoacids-Definition, classification, properties Functions of proteins in foods – physical and chemical properties of proteins, Important protein sources– Milk, Meat, Fish, Egg and Cereal proteins – Enzymes – Endogenous enzymes in foods and their activity – Enzymes as food processing aids.

**UNIT V-VITAMINSAND MINERALS (9hours)**

Definition –Classification, general sources, structure, properties, functions and dietary requirements – deficiency symptoms of vitamins A,D,E,K,C thiamins, riboflavin, niacin and biotin- role of minerals – Food colours and flavors – Food additives – classification and purpose – Role of thickeners, sweeteners, stabilizers, emulsifiers, leaveners, colours, flavoring agents, preservatives – examples.

**TEXT BOOKS**


1. Sivasankar, B, "*Food processing and preservation*" Prentice – Hall of India Pvt. Ltd. New Delhi 2002.
2. Srinivasan Damodaran, Kirk L. Parkin, and O.R. Fennema, E, "*Food Chemistry*" 4th Edition, CRC Press, New York2007.
3. Fox, B. A. and Cameron, A.G., "*Food Science, Nutrition and Health*", 5th Edition, Edward Arnold, London 2005.

4. Potter, N. N. and Joseph, H. Hotchkiss, "*Food Science*" CBS Publishers and distributors, New Delhi 1996.

**REFERENCES**


1. Charley, H, "*Food Science*" John Wiley and Sons Inc., New York 1982.
2. Birch, G.G., Brennan, J. G. and Parker, K. J, "*The Sensory Properties of Foods*" Applied Science Publication, London 1977.
3. Robinson, D. S, "*Food – Biochemistry and Nutritional Value*" Longman Scientific and Technical, London 1987.


**LIST OF EXPERIMENTS**

1. Preparation of solutions - normal, molar and per cent solutions and preparation of buffers
2. Qualitative tests for carbohydrates
3. Estimation of starch (Anthrone reagent method)
4. Estimation of reducing sugar (Dinitrosalicylic acid method)
5. Estimation of protein (Lowry's method)
6. Estimation of total nitrogen (Kjeldhal method)
7. Estimation total free amino acids (Ninhydrin method)
8. Extraction and estimation of oil content
9. Chromatographic separation of amino acids and sugars
10. Estimation of flavanoids
11. Extraction and estimation of phenols
12. Extraction and estimation of tannins

**REFERENCE**


1. Laboratory Manual


| **FP1004FOOD CHEMISTRY** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Designed by** | | **Department of Food Process Engineering** | | | | | | | | | | |
| 1. | Student Outcomes | a | b | c | d | e | f | g | h | i | j | k |
| | | x | | | | | | | | | | |
| 2. | Mapping of instructional objectives with student outcome | 1 | | | | | | | | | | |
| 3. | Category | General (G) | | Basic Sciences(B) | | Engineering Sciences and Technical Arts(E) | | | | Professional Subjects(P) | | |
| | | -- | | -- | | -- | | | | x | | |

| | | | | | |
|---|---|---|---|---|---|
| 4. | Broad area | Basic Bio Sciences | Food Engineering | Product Development | Industrial Application |
| | | x | -- | -- | -- |
| 5. | Approval | 23rd Meeting of Academic Council, May 2013 | | | |

| | UNIT OPERATIONS IN FOOD PROCESSING | L | T | P | C |
|---|---|---|---|---|---|
| **FP1005** | Total Contact Hours - 90 | **3** | **0** | **3** | **5** |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

The students are exposed to different UNIT operations performed in various food processing industries so as to enable them to understand the basic processes.

**INSTRUCTIONAL OBJECTIVES**

The student should be able to understand thoroughly the food processing UNIT operations, the equipments used to carry out the processes and also the calculations wherever necessary.

**UNIT I-INTRODUCTION (9 hours)**

Basic Principles of food processing, Dimensions and UNITs, Dimensional Consistency, Conservation of mass and energy.

**UNIT II-EVAPORATION (9 hours)**

Basic principle, need for evaporation, single effect, multiple effect, heat economy, vapour recompression, boiling point elevation, types of evaporator.

**UNIT III-DISTILLATION (9 hours)**

Liquid vapour equilibrium, distillation of binary mixtures, simple distillation, flash distillation, steam distillation. Crystallization-rate of crystallization, crystallization equilibrium

**UNIT IV-CONTACT EQUILIBRIUM SEPARATION PROCESS (9 hours)**

Concentration, Gas – Liquid equilibria, Solid – Liquid equilibria, Extraction-Solid Liquid extraction, Liquid-Liquid extraction, stage equilibrium extraction. Super critical fluid extraction, Application-extraction of fatty acid, Essential oils.

**UNIT V-MECHANICAL SEPARATION AND MATERIAL HANDLING (9 hours)**

Sedimentation, Floatation, Centrifugal separation, filtration, Mixing, Material handling-Belt conveyor, Screw Conveyor, bucket elevator and pneumatic conveyor.

**TEXT BOOKS**

1. Paul Singh and Dennis R Heldman., "*Introduction to Food Engineering".* Third Earle R.L., "*UNIT operations in Food Processing*", Pergamon Press.
2. R. edition. "*Academic press"*, London 2004.

**REFERENCES**

1. McCabe, W.L. and Smith.J.C, "*Unit Operations of Chemical Engineering*", McGraw-Hill 1976.
2. Geankoplis C.J, "*Transport Processes and Unit Operations*", 3rd edition, Printice Hall of India 2003.

**LIST OF EXPERIMENTS**

1. Experiments on evaporation
2. Experiments on size reduction of burr mill
3. Experiments on size reduction by mini dhal mill
4. Experiments on oil extraction by soxhlet apparatus
5. Experiments on super critical fluid extraction
6. Experiments in rotary flash evaporator
7. Experiments of mixing solid with solid
8. Experiments on inclined belt separator
9. Experiments on batch distillation process
10. Performance evaluation of screw conveyor
11. Performance evaluation of bucket elevator
12. Study of drying characteristics of the given material by fludisied bed drying

| **FP1005UNIT OPERATIONS IN FOOD PROCESSING** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Designed by** | | **Department of Food Process Engineering** | | | | | | | | | | |
| 1. | Student Outcomes | a | b | c | d | e | F | g | h | i | j | k |
| | | x | | | | | | | | | | |
| 2. | Mapping of instructional objectives with student outcome | 1 | | | | | | | | | | |
| 3. | Category | General (G) | | Basic Sciences(B) | | Engineering Sciences and Technical Arts(E) | | | | Professional Subjects(P) | | |

| | | | | | |
|---|---|---|---|---|---|
| | | -- | -- | -- | x |
| 4. | Broad area | Basic Bio Sciences | Food Engineering | Product Development | Industrial Application |
| | | -- | x | -- | -- |
| 5. | Approval | 23rd Meeting of Academic Council, May 2013 | | | |

| FP1006 | POST HARVEST TECHNOLOGY OF FRUITS AND VEGETABLES | L | T | P | C |
|---|---|---|---|---|---|
| | Total Contact Hours - 90 | 3 | 0 | 3 | 5 |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

This course enables the students to gain a sound knowledge about the processing and preservation technologies of fruits and vegetables.

**INSTRUCTIONAL OBJECTIVES**

At the end of this course the students get a detailed background about

| | |
|---|---|
| 1. | Various methods used for preserving fruits and vegetables. |
| 2. | Different operations involved in processing fruits and vegetables |
| 3. | Technology behind intermediate moisture and minimally processed fruit and vegetable. |

**UNIT I-INTRODUCTION AND IMPORTANCE OF FRUITS AND VEGETABLES (9hours)**

Fruit and vegetable processing - Post harvest technology- concept, importance and role. Present status of fruits and vegetables industry in India.

**UNIT II-STRUCTURALFEATURES (9hours)**

Structural components- basis of derivation from plant tissue.Cellular components-cell wall, protoplast, components and function.Biochemical constituents of important fruit and vegetables. Physiological development- stages of development.

**UNIT III-HARVESTINGAND POST HARVEST HANDLING (9hours)**

Harvesting methods- Maturity- Maturity indices for fruit and vegetable, methods of measurement. Post harvest handling operations- Pre processing operations, precooling, curing, waxing. Respiration - physiology, biochemistry of respiration, EMP & TCA cycle, Respiration quotient, methods of measuring respiration.

**UNIT IV-PRESERVATIONMETHODS FOR FRUITS AND VEGETABLES (9 hours)**

Preservation by reduction of water content: drying / dehydration and concentration, drying mechanisms – equipments- tray, tunnel, fluidized bed, belt, drum, freeze, foam mat drier. Chemical preservation - preservation of vegetables by acidification, preservation with sugar.

**UNIT V-PROCESSINGTECHNIQUES FOR FRUIT AND VEGETABLE (9 hours)**

Dehydrated product technology- Semi-processed fruit products technology- Fruit sugar preserves technology- Fruit beverage technology- fresh cut fruit and vegetable technology- sensory evaluation methods.

**TEXT BOOKS**


1. Wills, R.B.H., LeeT.H., GrahamD., W.B. McGlasson and HallE.G., "*Post Harvest: An introduction to physiology and handling of fruits and vegetables"* AVI Publishing Co., Inc., Westport, Conneticut 1981.
2. Verma L.R.and JoshiV.K., "*Post Harvest technology of fruits and vegetables handling, processing, fermentation and waste management. General concepts and principles".* Volume 1, Indus Publishing Company, New Delhi 2000.


**REFERENCES**


1. Mircea Enachescu Dauthy, "*Fruit and Vegetable Processing*" FAO Agricultural Services Bulletin No.119, Publication Division, Food and Agriculture Organization of the UNITed Nations,Rome1995.
2. Chenna Kesava S.Reddy and Preethi SagarR.. E book. "*Fruit and Vegetable Processing*" URL: http://www.angrau.ac.in/media/10841/fdst215.pdf


**LIST OF EXPERIMENTS**

1. Experiment on preparation of osmotic dehydrated products.
2. Experiment on preparation of jam.
3. Experiment on quality evaluation of jam.
4. Experiment on preparation of fruit bar.
5. Experiment of quality evaluation of fruit bar.
6. Experiment on preparation of Ready to serve beverages.
7. Experiment on preparation of squash.
8. Experiment on preparation of sauce
9. Experiment on quality evaluation of fruit beverages.
10. Experiment on fermented fruit and vegetable preparation.
11. Experiment on quality evaluation of fermented fruit and vegetable products.
12. Experiment on sensory evaluation of food products.

| FP1006 POST HARVEST TECHNOLOGY OF FRUITS AND VEGETABLES | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Designed by** | | **Department of Food Process Engineering** | | | | | | | | | | |
| 1. | Student Outcomes | a | b | c | d | e | f | g | h | i | j | k |
| | | x | | | | | | | | | | |
| 2. | Mapping of instructional objectives with student outcome | 1-3 | | | | | | | | | | |
| 3. | Category | General (G) | | Basic Sciences(B) | | Engineering Sciences and Technical Arts(E) | | | | Professional Subjects(P) | | |
| | | -- | | -- | | -- | | | | x | | |
| 4. | Broad area | Basic Bio Sciences | | Food Engineering | | Product Development | | | | Industrial Application | | |
| | | -- | | x | | -- | | | | -- | | |
| 5. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

**SEMESTER - V**

| | | | | | |
|---|---|---|---|---|---|
| **PD1005** | **APTITUDE-III** | **L** | **T** | **P** | **C** |
| | Total Contact Hours - 30 | **1** | **0** | **1** | **1** |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

To enhance holistic development of students and improve their employability skills.

**INSTRUCTIONAL OBJECTIVES**

| | |
|---|---|
| 1. | Understand the importance of effective communication in the workplace. |
| 2. | Enhance presentation skills – Technical or general in nature. |
| 3. | Improve employability scope through Mock GD, Interview |

**UNIT I** **(6 hours)**

Video Profile

**UNIT II** **(6 hours)**

Tech Talk / Area of Interest / Extempore / Company Profile

**UNIT III** **(6 hours)**

Curriculum Vitae

**UNIT-IV** **(6 hours)**

Mock Interview

**UNIT- V** **(6 hours)**

Group Discussion / Case Study

**ASSESSMENT**

1. Objective type – Paper based / Online – Time based test
2. 50% marks based on test, 50 % based on Continuous Communication assessment

**REFERENCE**

1. Bovee Courtland and Throill John, "*Business Communication Essentials: A skills-Based Approach to Vital Business English*" Pearson Education Inc., 2011.

2. Dhanavel, S.P., "*English & Communication Skills for Students of Science and Engineering*."Orient Black Swan, 2009.
3. Rizvi M. Ashraf "*Effective Technical Communication"*, Tata McGraw-Hill Publishing Company Limited, 2006.

| PD1005–APTITUDE-III | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Designed by** | | **Career Development Centre** | | | | | | | | | | |
| 1. | Student Outcomes | a | b | c | d | e | f | g | h | i | j | k |
| | | x | | | | | | | | | | |
| 2. | Mapping of instructional objectives with student outcome | | | | | | | 1,2,3 | | 1,2 | | 2,3 |
| 3. | Category | General (G) | | Basic Sciences(B) | | Engineering Sciences and Technical Arts(E) | | | | Professional Subjects(P) | | |
| | | x | | -- | | -- | | | | -- | | |
| 4. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

| **FP1007** | **GRAIN PROCESSING** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | Total Contact Hours - 45 | **3** | **0** | **0** | **3** |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

This course covers fundamentals of cereals and pulses processing, equipments, products and storage requirements

**INSTRUCTIONAL OBJECTIVES**

| | |
|---|---|
| 1. | To learn about the processing of major cereals and pulses. |
| 2. | To gain knowledge about grain storage structure and handling devices. |

**UNIT I-PADDY PROCESSING (9 hours)**

Paddy -structure, composition. Parboiling Processes- drying- LSU Dryer. Milling operations-flow chart- pre cleaners, shellers and hullers, separators, polishers.Rice Mill yields and loss at different stages of milling.Production of Flattened Rice and Puffed Rice from Paddy.

**UNIT II-WHEAT PROCESSING (9 hours)**

Wheat varieties, structure, composition and quality characteristics.Wheat milling process.Equipments in wheat milling.Extruded wheat products.

**UNIT III-MILLING OF PULSES (9 hours)**

Pulse milling status- Traditional and modern milling process - Machinery and equipments, working principle – Products from pulses.

**UNIT IV-MAIZE PROCESSING (9 hours)**

Dry and wet milling process of maize- Machinery and equipments- Acid Hydrolysis, Enzyme Hydrolysis- Processing for value added products -dextrose, malto dextrin and other products.

**UNIT V-STORAGE AND HANDLING OF GRAIN (9 hours)**

Storage structure- Bag storage,Cover and plinth,CAP storage (Ceiling and Plinth Storage), Silos and large bins -Design of storage structures- Silos flow pattern and problem- Fumigation Processes- Feeding and discharging of silos- conveyors and elevators for grain handling.

**TEXT BOOKS**


1. Chakraverty, A. "*Post Harvest Technology of Cereals, Pulses and Oilseeds"*. Oxford and IBH Publishing Co, Calcutta 1995.
2. Samuel Matz, "*The Chemistry and Technology of Cereals as Food and Feed"*, Chapman & Hall 1992.
3. Kent N.L.and A.D.Evans, "*Technology of Cereals"* 4th Edition, Elsevier Science (Pergaman), Oxford, UK 1994.
4. George E Inglett,, "*Maize-Recent Progress in Chemistry and Technology*" Academic Press, London 1982.
5. Ruth H. Matthews, "*Pulses – Chemistry, Technology and Nutrition*" Mercel Dekker Inc. USA 1989.


**REFERENCES**


1. Smartt, J, "*Tropical Pulses*" Longman Group Ltd. London 1980.
2. Pomeranz, Y, "*Modern Cereal Science and Technology*" VCH Publishing Inc. New York 1987.
3. Cryde M, "*Storage of Cereal Grains and their Products*" American Association of Cereal Chemists inc., St. Paul, USA 1982.
4. Bernard Godon and Claude Willm, "*Primary Processing of Cereals*" Berns and Noble Publishers 1994.
5. Karel Kulp and Joseph P Pante, "*Hand Book Of Cereal Science and Technology*" Mercel Dekkar USA 2000.

| FP1007GRAIN PROCESSING | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course Designed by | | Department of Food Process Engineering | | | | | | | | | | |
| 1. | Student Outcomes | a | b | c | d | e | f | g | h | i | j | k |
| | | x | | | | | | | | | | |
| 2. | Mapping of instructional objectives with student outcome | 1-2 | | | | | | | | | | |
| 3. | Category | General (G) | | Basic Sciences(B) | | Engineering Sciences and Technical Arts(E) | | | | Professional Subjects(P) | | |
| | | -- | | -- | | -- | | | | x | | |
| 4. | Broad area | Basic Bio Sciences | | Food Engineering | | Product Development | | | | Industrial Application | | |
| | | -- | | x | | -- | | | | -- | | |
| 5. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

| FP1008 | DAIRY PLANT ENGINEERING | L | T | P | C |
|---|---|---|---|---|---|
| | Total Contact Hours - 90 | 3 | 0 | 3 | 5 |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

This course helps the students to gain a good knowledge on the various processes and equipments used in the processing of milk and milk products.

**INSTRUCTIONAL OBJECTIVES**

| | |
|---|---|
| 1. | To make the student familiarize with |
| 2. | The UNIT operations involved in the processing of milk and its products |
| 3. | The different equipments and technologies applied in a dairy plant from the point of reception of milk till it is packed and stored. |

**UNIT I-PASTEURIZATION (9 hours)**

Milk-physical, chemical and functional properties-composition -reception and storage-testing—milk grading and defects-cooling of milk –Pasteurization – principles, objectives and methods.LTLT/holding pasteurization-types, advantages and disadvantages. HTST pasteurization- functions of HTST pasteurizer, advantages and disadvantages –milk flow diagram-.vacreation.

**UNIT II-STERILIZATION AND HOMOGENIZATION (9 hours)**

Sterilization-Inbottle sterilization, UHT processing-advantages-difficulties, Indirect heating systems using plate heat exchangers, Direct heating-Fouling of heat

exchangers. Packaging for asceptic processing-Homogenization theory, mechanism-merits and demerits –factors influencing homogenization

**UNIT III-CENTRIFUGATION, BACTOFUGATION AND MEMBRANE SEPARATION (9 hours)**

Principles of Centrifugation-clarification-separatoion-standardisation-clarifiers and cream separators - components -factors affecting fat percentage in cream-fat loss in skim milk. Membrane processing-principles of -Reverse osmosis - Ultra filtration and Electro dialysis. Bactofuge treatment- Factors affecting bactofugation-Application

**UNIT IV-CLEANING AND PACKAGING (9 hours)**

Principles of Cleaning- -can washing- - Cleaning Cycle, Washing Methods-Types of Can washers cleaning-in-place- Cleaning procedures, -Centralized and De-centralized CIP systems –-corrosion control.

**UNIT V-MANUFACTURE OF DAIRY PRODUCTS (9 hours)**

Milk powder - spray drying- construction, powder recovery system, - Butter, cheese, Ice cream, Paneer, Khoa, Rabari, Basundi, Rasmalai, condensed milk – manufacturing methods-defects- standards- packaging.

**TEXT BOOKS**


1. Tufail Ahmed, "*Dairy Plant Engineering and Management*", CBS Publishers and Distributors, New Delhi 2001.
2. De Sukumar, "*Outlines of Dairy Technology*", Oxford University Press, New Delhi 1999.
3. R.K. Robinson, "*Modern Dairy Technology I: Advances in Milk Processing*". Elsevier Applied Science Publishers, Ltd., London, UK 1986.
4. R.K. Robinson, "*Modern Dairy Technology II Advances in Milk Products*". (Ed.). Elsevier Applied Science Publishers, Ltd., London, UK 1986.


**REFERENCES**


1. Ananthakrishnan. C.P. and M.N.Sinha, "*Technology and Engineering of Dairy Plant Operations*", Laxmi Publications, New Delhi 1997.
2. Farrall.A.W., "*Engineering for Dairy and Food Products*", John Wiley and Sons, New York 1995.
3. Robinson .R.K., "Modern Dairy Technology Vol.1 "*Advances in Milk Processing"*, Elsevier Applied Science Publishers, London 1996.

4. Dairy Science and Technology: Principles and Applications. La Fondation de Technologie Laitiere du Quebec, Inc (Ed.), Les Presses de 'Universite Laval, Quebec, Canada 1985.
5. Kessler. H.G, "*Food Engineering and Dairy Technology*". Verlag Kessler, Germany 1981.

**LIST OF EXPERIMENTS**

1. Experiment on Platform test
2. Experiment on Quality control test
3. Experiment on Homogenization
4. Experiment on Pasteurization
5. Experiment on Cream separation
6. Experiment on Spray dying
7. Development of Frozen desserts
8. Development of Flavored drinks
9. Development of heat and acid coagulated Product
10. Development of heat desiccated product
11. Development of Fermented products
12. Development of misti dahi
13. Preparation of Chhana podo
14. Visit to dairy industry
15. Reference
16. Laboratory Manual

| **FP1008DAIRY PLANT ENGINEERING** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Designed by** | | **Department of Food Process Engineering** | | | | | | | | | | |
| 1. | Student Outcomes | a | b | c | d | e | f | g | h | i | j | k |
| | | x | | | | | | | | | | |
| 2. | Mapping of instructional objectives with student outcome | 1-3 | | | | | | | | | | |
| 3. | Category | General (G) | | Basic Sciences(B) | | Engineering Sciences and Technical Arts(E) | | | | Professional Subjects(P) | | |
| | | -- | | -- | | -- | | | | x | | |
| 4. | Broad area | Basic Bio Sciences | | Food Engineering | | Product Development | | | | Industrial Application | | |
| | | -- | | x | | -- | | | | -- | | |
| 5. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

| FP1009 | ENGINEERING PROPERTIES OF FOODS | L | T | P | C |
|---|---|---|---|---|---|
| | Total Contact Hours - 90 | 2 | 1 | 3 | 4 |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

This course will provide the knowledge on measuring the various engineering properties of food material.

**INSTRUCTIONAL OBJECTIVES**

1. To enable students to understand the different engineering properties of food materials.
2. To make the students to acquire knowledge of engineering properties in the designing of food processing systems.

**UNIT I-PHYSICAL PROPERTIES (9 hours)**

Engineering properties - importance and applications in the crop process equipment design. Physical characteristics – shape, size, volume, bulk density, particle density, porosity, Surface area. Frictional characteristics- angle of repose, co-efficient of friction - determination.

**UNIT II-RHEOLOGICAL PROPERTIES (9 hours)**

Rheology - definition - various types of materials - Hook's law – classic ideal material. Stress – strain - density relationship. Rheological models - Maxwell model, Kelvin model, Four elements Burger's model. Viscometry - Newtonian and Non-Newtonian fluids - flow behaviour equations – mechanics of flow in rotational and capillary viscometers. Yield stress and power law equations for Newtonian and Non-Newtonian fluids.

**UNIT III-TEXTURAL PROPERTIES (9 hours)**

Texture of food materials - subjective and objective methods - initiative and empirical tests - dynamic test.Firmness and Hardness - different methods of measurements on various produce and foods - dynamic hardness. Mechanical damage on food - causes - biological and chemical reactions following mechanical damage - Detection and evaluation - static and dynamic resistance to mechanical damage – comparison. Impact damage - damage under dead load.Vibration damage - stress cracking.

**UNIT IV-THERMAL PROPERTIES (9 hours)**

Thermal properties - specific heat - determination - methods for solids and powders.Determination of thermal conductivity - steady state and unsteady state methods.Thermal diffusivity - determination - relationship among specific heat, thermal conductivity, bulk density and thermal diffusivity - effect of moisture content on thermal properties.

**UNIT V-ELECTRICAL AND AERODYNAMIC PROPERTIES (9 hours)**

Electrical properties - resistance, capacitance - uses - Dielectric loss factor - method of determination. A.C. conductivity and dielectric constant - determination - Q meter. Effect of moisture content on electrical properties - energy absorption from high frequency electric field. Aerodynamic properties - lift and drag - drag coefficient - friction drag - pressure drag – terminalvelocity - importance - spherical bodies and non-spherical bodies - drag coefficient - Reynold's number relationship - separation of foreign materials - pneumatic handling and transportation - applications.

**TEXT BOOKS**


1. Mohesenin. N.N, "*Thermal properties of Foods and Agricultural Materials*". Gordon and Breach Science Publishers, New York 1980.
2. Mohesenin. N.N, "*Physical properties of Plant and Animal Materials*". Gordon and Breach Science Publishers, New York 1980.
3. Rao, M.A and S.S.H.Rizvi (Eds) "*Engineering Properties of Foods*". Marcel Dekker Inc. New York 1986.


**REFERENCES**


1. Singhal,O.P. and Samuel,D.V.K, "*Engineering Properties of Biological Materials"*. Saroj Prakasan, Allahabad 2003.
2. Peleg, M.and BagelayE.B., "*Physical properties of foods*". AVI publishing Co. USA 1983.


**LIST OF EXPERIMENTS**

1. Experiment on determination of physical properties
2. Establishing the relationship between surface area and true volume
3. Experiment on determination of porosity of food grains
4. Experiment on determination of viscosity
5. Experiment on Filling and emptying Angle of repose
6. Experiment on determination of co efficient of friction
7. Experiment on determination of firmness
8. Experiment on determination of thermal conductivity

9. Experiment on determination of terminal velocity
10. Experiment on determination of specific heat of foods
11. Determination of texture properties of foods
12. Determination of thermal conductivity of foods
13. Determination of electrical properties of foods

**REFERENCE**

1. Laboratory manual

| FP1009ENGINEERING PROPERTIES OF FOODS | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Designed by** | | **Department of Food Process Engineering** | | | | | | | | | | |
| 1. | Student Outcomes | a | b | c | d | e | f | g | h | i | j | k |
| | | x | | | | | | | | | | |
| 2. | Mapping of instructional objectives with student outcome | 1-2 | | | | | | | | | | |
| 3. | Category | General (G) | | Basic Sciences(B) | | Engineering Sciences and Technical Arts(E) | | | | Professional Subjects(P) | | |
| | | -- | | -- | | -- | | | | x | | |
| 4. | Broad area | Basic Bio Sciences | | Food Engineering | | Product Development | | | | Industrial Application | | |
| | | -- | | x | | -- | | | | -- | | |
| 5. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

| **FP1010** | **FOOD ANALYSIS LABORATORY** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | Total Contact Hours - 60 | **0** | **0** | **4** | **2** |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

The goal of this course is to teach the laboratory skills that will give the students confidence in analyzing various constituents of food substances.

**INSTRUCTIONAL OBJECTIVES**

Identifying and determining the relative amounts of components in a sample of matter

**LIST OF EXPERIMENTS**

1. Determination of total soluble solids, titratable acidity and pH of fruit juice
2. Determination of ash and acid insoluble ash

3. Determine salt content in processed products.
4. Quality analysis of milk
5. Quality analysis of water
6. Determination of beta carotene
7. Determination of reducing sugar and total sugar
8. Determination of gluten content
9. Determination of protein content
10. Experiments on fat tests.
11. Estimation of salt (sodium and potassium) present in a fruit sample by flame photometer
12. Determination of ascorbic acid.
13. Determination of crude fiber in foods
14. Separation and identification of amino acids by paper chromatography
15. To detect and qualify sulphur dioxide added in the form of potassium metabisulphate
16. To detect, identify and qualify artificial colouring matter added to food products.

**REFERENCE**

1. Laboratory Manual

<table>
<tr><th colspan="13">FP1010FOOD ANALYSIS LABORATORY</th></tr>
<tr><th colspan="2">Course Designed by</th><th colspan="11">Department of Food Process Engineering</th></tr>
<tr><td rowspan="2">1.</td><td rowspan="2">Student Outcomes</td><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td><td>f</td><td>g</td><td>h</td><td>i</td><td>j</td><td>k</td></tr>
<tr><td></td><td>X</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2.</td><td>Mapping of instructional objectives with student outcome</td><td></td><td>1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">3.</td><td rowspan="2">Category</td><td colspan="2">General (G)</td><td colspan="2">Basic Sciences(B)</td><td colspan="4">Engineering Sciences and Technical Arts(E)</td><td colspan="3">Professional Subjects(P)</td></tr>
<tr><td colspan="2">--</td><td colspan="2">--</td><td colspan="4">--</td><td colspan="3">x</td></tr>
<tr><td rowspan="2">4.</td><td rowspan="2">Broad area</td><td colspan="2">Basic Bio Sciences</td><td colspan="2">Food Engineering</td><td colspan="4">Product Development</td><td colspan="3">Industrial Application</td></tr>
<tr><td colspan="2">x</td><td colspan="2">--</td><td colspan="4">--</td><td colspan="3">--</td></tr>
<tr><td>5.</td><td>Approval</td><td colspan="11">23rd Meeting of Academic Council, May 2013</td></tr>
</table>

| FP1047 | INDUSTRIAL TRAINING I (Training to be undergone after IV semester) | L | T | P | C |
|---|---|---|---|---|---|
| | 2 week practical training in industry | 0 | 0 | 1 | 1 |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

To provide hands-on experience at site / planning or design office where food process engineering projects are carried out

**INSTRUCTIONAL OBJECTIVES**

1. Students have to undergo two – week practical training in Food Process Engineering related project site or design / planning office so that they become aware of the practical application of theoretical concepts studied in the class rooms.

Students have to undergo two-week practical training in Food Process Engineering related project site or design / planning office of their choice but with the approval of the department. At the end of the training student will submit a report as per the prescribed format to the department.

**Assessment process**

This course is mandatory and the student has to pass the course to become eligible for the award of degree. The student shall make a presentation before a committee constituted by the department which will assess the student based on the report submitted and the presentation made. Marks will be awarded out of 100 and appropriate grades assigned as per the regulations.

| FP1047 INDUSTRIAL TRAINING I | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course Designed by | | Department of Food Process Engineering | | | | | | | | | | |
| 1. | Student Outcomes | a | b | c | d | e | f | g | h | i | j | k |
| | | | | | X | x | X | X | X | X | X | |
| 2. | Mapping of instructional objectives with student outcome | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| 3. | Category | General (G) | | Basic Sciences(B) | | Engineering Sciences and Technical Arts(E) | | | | Professional Subjects(P) | | |
| | | -- | | -- | | -- | | | | x | | |
| 4. | Broad area | Basic Bio Sciences | | Food Engineering | | Product Development | | | | Industrial Application | | |
| | | -- | | -- | | -- | | | | x | | |
| 5. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

**SEMESTER - VI**

| | | | | | |
|---|---|---|---|---|---|
| **PD1006** | **APTITUDE-IV** | **L** | **T** | **P** | **C** |
| | Total Contact Hours – 30 | **1** | **0** | **1** | **1** |
| | Prerequisite | | | | |
| | Nil | | | | |

| | |
|---|---|
| **PURPOSE** | |
| To enhance holistic development of students and improve their employability skills. | |
| **INSTRUCTIONAL OBJECTIVES** | |
| 1. | To improve aptitude, problem solving skills and reasoning ability of the student. |
| 2. | To collectively solve problems in teams & group. |

**UNIT I - ARITHMETIC - II** **(6 hours)**

Ratios & Proportions, Averages, Mixtures & Solutions

**UNIT II - ARITHMETIC – III** **(6 hours)**

Time, Speed & Distance, Time & Work

**UNIT III - ALGEBRA – II** **(6 hours)**

Quadratic Equations, Linear equations & inequalities

**UNIT IV- GEOMETRY** **(6 hours)**

2D Geometry, Trigonometry, Mensuration

**UNIT V – MODERN MATHEMATICS – II** **(6 hours)**

Sets & Functions, Sequences & Series, Data Interpretation, Data Sufficiency

**ASSESSMENT**

1. Objective type – Paper based / Online – Time based test

**REFERENCES**


1. Agarwal.R.S – *"Quantitative Aptitude for Competitive Examinations"*S Chand Limited 2011.
2. Abhijit Guha*, "Quantitative Aptitude for Competitive Examinations",*Tata Mcgraw Hill, 3rd Edition.

3. Edgar Thrope, *"Test Of Reasoning For Competitive Examinations",* Tata Mcgraw Hill, 4th Edition.
4. "*Other material related to quantitative aptitude"*

| PD1006 - APTITUDE-IV | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Designed by** | | **Career Development Centre** | | | | | | | | | | |
| 1. | Student Outcomes | a | b | c | d | e | f | g | h | i | j | k |
| | | X | | | X | | | | | | | |
| 2. | Mapping of instructional objectives with student outcome | 1 | | | 2 | | | | | | | |
| 3. | Category | General (G) | | Basic Sciences(B) | | Engineering Sciences and Technical Arts(E) | | | | Professional Subjects(P) | | |
| | | -- | | -- | | -- | | | | x | | |
| 4. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

| **ME1056** | **REFRIGERATION AND COLD CHAIN** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | Total Contact Hours - 45 | **3** | **0** | **0** | **3** |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

This course provides the knowledge about refrigeration and cold chain systems and their importance from the food engineering point of view.

**INSTRUCTIONAL OBJECTIVES**

To introduce the students to:

| | |
|---|---|
| 1. | Vapour compression and vapour absorption cycles |
| 2. | The importance of refrigeration and cold chain in the processing and preservation of foods |
| 3. | The utilization of cold storage rooms for food storage, thereby improving the shelf life of foods |
| 4. | The equipments used for chilling and freezing foods |
| 5. | The importance of cold storage – about the microorganisms involved in contamination of chilled foods and their prevention methods |
| 6. | Finally, the optimum conditions for storing the foods under low temperatures |

**UNIT I-PRINCIPLES OF REFRIGERATION AND COLD STORAGE (9 hours)**

Refrigeration cycles, Vapour Compression and Vapour Absorption cycles, Refrigerants, characteristics of different refrigerants, Components of a Refrigeration system: Compressor, condenser, Evaporator, Expansion valves piping and different controls. Low temperature methods of storage, Microbial activity at low temperature, factors affecting cold storage, importance of refrigerated storage, Optimum temperatures of storage for different food materials-meat and poultry products, marine products, fruits and vegetables, spices and food grains,

**UNIT II-CHILLING OF FOODS (9 hours)**

Chilling equipment for liquid foods. Secondary refrigerants and direct expansion techniques in chilling. Chilled foods transport and display cabinets - Basics of Chilled foods microbiology, Packaging of Chilled foods - Hygienic design considerations for chillers and chilled Storages. Cool storages and their applications. Evaporative cooling and its applications

**UNIT III-FREEZING AND FROZEN STORAGE (9 hours)**

Freezing characteristics of foods, factors affecting the quality of frozen foods, Freezing rates, growth rate of ice crystals, crystal size and its effect of texture and quality of foods, methods of freezing foods, Refrigeration requirements of frozen foods, Packaging requirements of frozen foods, Effect of freezing on constituents of foods

**UNIT IV-FREEZING EQUIPMENTS IN FOOD INDUSTRIES (9 hours)**

Freezer types, Blast freezers, Contact Plate Freezers, conveyorized quick freezers, Individual quick freezing.,Cryogenic Freezing, Freezing practice as applied to marine foods, meat and poultry, fruit

**UNIT V-COLD STORAGE DESIGN AND CONSTRUCTION (9 hours)**

Small and large commercial storages, Cold Room temperatures, Insulation, Doors and other openings. Cold load estimation; prefabricated systems, walk-in-coolers, and Refrigerated container trucks: Freezer Storages, Freezer room Temperatures, insulation of freezer rooms: Pre-cooling and pre freezing. Cold Storage practice, Stacking and handling of material in and around cold rooms, Applications – Ice cream Plant, Diary plant, Marine air conditioning.

**TEXT BOOKS**

1. Fellows, P.J., "*Food Processing Technolgy – Principles and applications – 2nd edition",* CRC Press, Woodhead Publishing Ltd (2000).
2. Tressler D.K.and EversC.F.: "*The Freezing Preservation of Foods"* (Vol.1&2) AVI Publishing Company Inc. USA (1965).

**REFERENCES**


1. Raymond GuntherR.: "*Refrigeration, Air conditioning and Cold Storage Chilten Company"*, Philadelphia, USA 1957.
2. Clive DellinoD.J.: "*Cold and Chilled Storage Technology Publisher"*: Kluwer Academic Publishers (1997).
3. Ed.MalletC.P: Frozen Food Technology Balckie Academic and Professional, (1993).
4. Aurel Gobaneu and Gabriala Laseha and others (1976) Cooling Technology in the Food Industry: Abacus Press, Tunbridge Wells, U.K.
5. Colin Dennis and Michael Stringer: Chilled Foods – A Comprehensive Guide Ellis Horwood Publishing, New york (1992).
6. PruthiDJ.S.: Quick Freezing Preservation of Foods (2 Volumes) Allied Publishers, Mumbai (1999).


<table>
<tr><th colspan="13">ME1056 REFRIGERATION AND COLD CHAIN</th></tr>
<tr><td colspan="2">Course Designed by</td><td colspan="11">Department of Mechanical Engineering</td></tr>
<tr><td rowspan="2">1.</td><td rowspan="2">Student Outcomes</td><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td><td>f</td><td>g</td><td>h</td><td>i</td><td>j</td><td>k</td></tr>
<tr><td>x</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2.</td><td>Mapping of instructional objectives with student outcome</td><td>1 - 2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">3.</td><td rowspan="2">Category</td><td colspan="2">General (G)</td><td colspan="2">Basic Sciences(B)</td><td colspan="4">Engineering Sciences and Technical Arts(E)</td><td colspan="3">Professional Subjects(P)</td></tr>
<tr><td colspan="2">--</td><td colspan="2">--</td><td colspan="4">--</td><td colspan="3">x</td></tr>
<tr><td rowspan="2">4.</td><td rowspan="2">Broad area</td><td colspan="2">Basic Bio Sciences</td><td colspan="2">Food Engineering</td><td colspan="4">Product Development</td><td colspan="3">Industrial Application</td></tr>
<tr><td colspan="2">x</td><td colspan="2">--</td><td colspan="4">--</td><td colspan="3">--</td></tr>
<tr><td>5.</td><td>Approval</td><td colspan="11">23rd Meeting of Academic Council, May 2013</td></tr>
</table>

| | BIOSTATISTICS FOR FOOD PROCESS ENGINEERING | L | T | P | C |
|---|---|---|---|---|---|
| MA1016 | Total Contact Hours – 60 | 4 | 0 | 0 | 4 |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

To develop a thorough understanding of the methods of probability and statistics which are used to model engineering problems.

**INSTRUCTIONAL OBJECTIVES**

Students know about

| | |
|---|---|
| 1. | To gain knowledge in measures of central tendency and dispersion |
| 2. | To appropriately choose, define and/or derive probability distributions such as the Binomial, Poisson and normal distribution to solve engineering problems. |
| 3. | To learn how to formulate and test the hypotheses about means, proportions and standarddeviation to draw conclusions based on the results of statistical tests in large sample. |
| 4. | To learn how to formulate and test the hypotheses about means, variances for small samples using t and F test for small sample and have knowledge on ANOVA |
| 5. | To understand the fundamentals of quality control and the methods used to control systems and processes |

**UNIT I-INTRODUCTION TO BIO-STATISTICS(numerical problems only)**

**(12 hours)**

Handling univariate and bivariate data - Measures of central tendency - Measures of dispersion - Skewness & Kurtosis - Correlation and Regression.

**UNIT II-PROBABILITY & THEORETICAL DISTRIBUTIONS (12 hours)**

Probability concepts - conditional probability - Baye's theorem - one - dimensional random variables - expectation, variance, moments. Theoretical distributions : Binomial, Poisson, Normal (Problems only).

**UNIT III-TESTING OF HYPOTHESIS (12 hours)**

Introduction - Large sample tests based on normal distribution - Test for single mean, difference between means - proportion, difference between proportion - standard deviation, difference between standard deviation -Chi-square test for goodness of fit - Independence of attributes.

**UNIT IV-ANALYSIS OF VARIANCE (12 hours)**

Small sample tests based on t and F distribution - Test for, single mean, difference between means, Paired t-test, test for equality of variances. ANOVA-one -way classification, Two-way classification.

**UNIT V-STATISTICAL QUALITY CONTROL (12 hours)**

Introduction - Process control - control charts for variables - X and R, X and s charts control charts for attributes : p chart, np chart, c chart.

**TEXT BOOKS**

1. Gupta S.C.& KapoorV.K., "*Fundamentals of Mathematical Statistics"*, Sultan Chand and Sons, New Delhi,11th edition, 2007.
2. Ewans W. & GrantG., "*Statistical Methods in Bio informatics - An Introduction"*, Springer, 2nd edition, 2005.

**REFERENCES**


1. Pandey and Sukame, "*Statistical Methods*", ICAR Publication, New Delhi.
2. Kapoor. J.N. Saxsena, V.C. 1997. "*Mathematical statistics"*. S Chand &Co.
3. Rangasamy. R, "*A text book of Agricultural Statistics*". New Age International Publishers, New Delhi 2002.
4. Richard, A. Johnson, "*Miller and Freund's Probability and Statistics for Engineers"*. Eastern Economy Edition, Prentice hall of India Private Ltd., New Delhi 2002.


| **MA1016 BIOSTATISTICS FOR FOOD PROCESS ENGINEERING** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Designed by** | | **Department of mathematics** | | | | | | | | | | |
| 1. | Student Outcomes | a | b | c | d | e | f | g | h | i | j | k |
| | | X | | | | X | | | | | | |
| 2. | Mapping of instructional objectives with student outcome | 1 | | | | 5 | | | | | | |
| 3. | Category | General (G) | | Basic Sciences(B) | | Engineering Sciences and Technical Arts(E) | | | | Professional Subjects(P) | | |
| | | -- | | -- | | -- | | | | x | | |
| 4. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

| FP1011 | FOOD FERMENTATION TECHNOLOGY | L | T | P | C |
|---|---|---|---|---|---|
| | Total Contact Hours - 90 | 3 | 0 | 3 | 5 |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

To Impart knowledge and skills related to process technologies and equipment used for the production of various fermented food products.

**INSTRUCTIONAL OBJECTIVES**

Students completing this course students should be able

| | |
|---|---|
| 1. | To understand various concepts, principles and procedures involved in the area of fermented food production |
| 2.. | To familiarize with different fermentor types and their design criteria |

**UNIT I-FERMENTATIONPROCESS (9 hours)**

Introduction to fermentation - definition - benefit of fermentation - nutritive value of fermented foods - microbial changes in fermented foods - micro organism - proteolytic, liploytic and fermentative bacteria.

**UNIT II-FERMENTATION TYPES (9 hours)**

Selection of industrial importance microorganisms -production of single cell protein. Media for industrial fermentation - Medium Composition - Energy, CO2, nitrogen and other growth factors, buffering and foam agents. Types of fermentation - Ethonolic fermentation - mixed alcoholic and acidic fermentation - Lactic acid fermentation.

**UNIT III-STERILIZATION (9 hours)**

Sterilization - Principles, sterilization of fermentation media, fermenter - in-batch and continuous process - development of inoculum for industrial fermentation - criteria for transfer of inoculums - aseptic inoculation.

**UNIT IV-FERMENTOR (9 hours)**

Basic functions of fermentor - Design of fermentor - types of fermentor - different parts - agitator, impellers, aerator, baffles, process control, function and maintenance of various parts of fermentor.Recovery and purifications of food products - filtration - batch and continuous types - fermentor accessories.

**UNIT V-TECHNOLOGYOF FERMENTED FOOD PRODUCTS (9 hours)**

Traditional fermented foods - Curd, yoghurt, dhokla, miso, shrikand, cheese, butter milk, dosa. Modern fermented products - Wine, beer, brandy, vinegar,

baker's yeast, sauerkrauts, sausages, fermentation of milk, meat, fruits and vegetables.

**TEXT BOOKS**


1. Stanbury, P.F., Allan Whitaker and S.J. Hall, "*Principles of Fermentation Technology*". Aditya books private Ltd., New Delhi 2002.
2. James M. Jay, Martin.J. Loessner, David. A. Golden, "*Modern Food Microbiology"*. Springer Science Media Publisher, New York. USA 2005.


**REFERENCES**


1. Pederson, C.S., *"Microbiology of food fermentations*", AVI Publishing company. Westport, Connecticut 1971.
2. Joshi V.K, and Ashok Pandey, "*Biotechnology: Food Fermentation*" 2005.


**LIST OF EXPERIMENTS**

1. Standard plate count
2. Assay of quality of milk by methylene blue reduction test.
3. Isolation of lactic acid bacteria
4. Isolation of acetic acid bacteria
5. Microbial examination of water by multiple tube fermentation test
6. Hanging drop techniques
7. Control of microbial growth by physical methods-heat
8. Control of microbial growth by osmotic pressure and pH
9. Microbial examination of curd
10. Microbial examination of processed fruit and vegetable products
11. Microbial examination of canned foods
12. Microbial examination of egg
13. Negative straining technique
14. Structural straining-spore straining
15. Preparation of fermented milk product
16. Vinegar and pickle production
17. Bread preparation
18. Wine making
19. Sauerkrant fermentation

| FP1011FOOD FERMENTATION TECHNOLOGY | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Designed by** | | **Department of Food Process Engineering** | | | | | | | | | | |
| 1. | Student Outcomes | a | b | c | d | e | f | g | h | i | j | k |
| | | x | | | | | | | | | | |
| 2. | Mapping of instructional objectives with student outcome | 1 - 2 | | | | | | | | | | |
| 3. | Category | General (G) | | Basic Sciences(B) | | Engineering Sciences and Technical Arts(E) | | | | Professional Subjects(P) | | |
| | | -- | | -- | | -- | | | | x | | |
| 4. | Broad area | Basic Bio Sciences | | Food Engineering | | Product Development | | | | Industrial Application | | |
| | | x | | -- | | -- | | | | -- | | |
| 5. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

| FP1012 | COMPUTER AIDED DRAFTING IN FOOD PROCESSING | L | T | P | C |
|---|---|---|---|---|---|
| | Total Contact Hours - 60 | 0 | 1 | 3 | 3 |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

To provide hands on training in computer aided drafting in designing of food processing equipment

**INSTRUCTIONAL OBJECTIVES**

To impart the student about

1. Fundamentals of CAD
2. Drawing the components of food processing equipment

**LIST OF EXPERIMENTS**

1. Understanding the hardwares and softwares concepts of of CAD
2. Working with menu and files
3. Working with drawing editor - scale, UNITs and limits
4. Creation of layers, changing colours and line types
5. Drawing lines, plines and arc
6. Modifying the drawings-mirror, fillet and chamfer
7. Modifying the drawings- extend, stretch and trim commands
8. Hatching the drawings and filling with patterns

9. Working with text and dimensions
10. 3D objects and transforming 2D to 3D drawings
11. Design and drawing of food processing equipments
12. Preparation of production drawing and drawing outputs

**REFERENCE**

1. Computer Aided Drafting in Food Processing manual, Department of Food Process Engineering, SRM University.

| **FP1012COMPUTER AIDED DRAFTING IN FOOD PROCESSING** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Designed by** | | **Department of Food Process Engineering** | | | | | | | | | | |
| 1. | Student Outcomes | a | b | c | d | e | f | g | h | i | j | k |
| | | | X | | | | | | | | | |
| 2. | Mapping of instructional objectives with student outcome | | 1-2 | | | | | | | | | |
| 3. | Category | General (G) | | Basic Sciences(B) | | Engineering Sciences and Technical Arts(E) | | | | Professional Subjects(P) | | |
| | | -- | | x | | -- | | | | -- | | |
| 4. | Broad area | Basic Bio Sciences | | Food Engineering | | Product Development | | | | Industrial Application | | |
| | | -- | | x | | -- | | | | -- | | |
| 5. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

| | **FOOD PROCESS EQUIPMENT DESIGN AND DRAWING LABORATORY** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **FP1013** | Total Contact Hours - 60 | **0** | **0** | **4** | **2** |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

To develop skill to design and draw the process equipments used widely in a food process industry.

**INSTRUCTIONAL OBJECTIVES**

To familiarize:

| | |
|---|---|
| 1. | The design and drawing of fittings and ancillary parts of the food processing equipments. |
| 2. | The design and drawing of various types food processing equipments. |

**LIST OF EXPERIMENTS**

1. Design and drawing of Enclosures.
2. Design and drawing of Vessel supports
3. Design and drawing of Flanges.
4. Design and drawing of Agitators.
5. Design and drawing of Centrifuge.
6. Design and drawing of Filter press.
7. Design and drawing of Crystallizer.
8. Design and drawing of Heat Exchangers
9. Design and drawing of Evaporator
10. Design and drawing of Dryer

**TEXT BOOK**


1. Sinnott, R.K., Coulson & Richardson's,"*Chemical Engineering*", Volume 6, 3rdEdn., Butterworth Heinemann, New Delhi 1999.
2. Perry, R.H., and Green, D.W., "*Chemical Engineers'* Handbook", Seventh Edition,McGraw-Hill. New York 1997.


**REFERENCES**


1. Joshi, M.V., and Mahajani, V.V, "*Process Equipment Design*", 3rd Edn., Macmillan India Limited, New Delhi 1996.
2. McCabe, W.L., Smith, J.C., and Harriot, P, "*Unit Operations in Chemical Engineering"*, Sixth Edition, McGraw-Hill, New York 2001.


| **FP1013 FOOD PROCESS EQUIPMENT DESIGN AND DRAWING LABORATORY** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Designed by** | | **Department of Food Process Engineering** | | | | | | | | | | |
| 1. | Student Outcomes | a | b | c | d | e | f | g | h | i | j | k |
| | | | X | | | | | | | | | |
| 2. | Mapping of instructional objectives with student outcome | | 1-2 | | | | | | | | | |
| 3. | Category | General (G) | | Basic Sciences(B) | | Engineering Sciences and Technical Arts(E) | | | | Professional Subjects(P) | | |
| | | -- | | -- | | -- | | | | x | | |
| 4. | Broad area | Basic Bio Sciences | | Food Engineering | | Product Development | | | | Industrial Application | | |
| | | -- | | x | | -- | | | | -- | | |
| 5. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

| FP1049 | MINOR PROJECT | L | T | P | C |
|---|---|---|---|---|---|
| | Prerequisite | 0 | 0 | 2 | 1 |
| | Nil | | | | |

**PURPOSE**

To provide solution to practical problems faced in food industrial sector in the area of design and development of new equipments, preservation techniques, value addition of food commodities and food quality and safety issues etc.,

**INSTRUCTIONAL OBJECTIVES**

| | |
|---|---|
| 1. . | To understand the operations involved in Food processing |
| 2. | Develop and provide solutions to engineering problems. |

Students have to choose and work on a problem related to Food industrial sector. At the end of the work, students should submit a report as per the prescribed format to the department.

Students are expected to work on areas that involve:

a. Understanding the operation of food product development and operating procedures
b. Providing solutions to existing industrial problems or to improve the performance.
c. Understanding the food laws and regulations

**ASSESSMENT**

The student shall make a presentation before a committee constituted by the department which will assess the student based on the report submitted and the presentation made. Marks will be awarded and grades assigned as per the regulations.

| FP1049 MINOR PROJECT | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course Designed by | | Department of Food Process Engineering | | | | | | | | | | |
| 1. | Student Outcomes | a | b | c | d | e | f | g | h | i | j | k |
| | | X | X | X | | X | | X | | X | | X |
| 2. | Mapping of instructional objectives with student outcome | 1 | 1 | 1 | | 1 | | 1 | | 1 | | 1 |
| 3. | Category | General (G) | | Basic Sciences(B) | | Engineering Sciences and Technical Arts(E) | | | | Professional Subjects(P) | | |
| | | -- | | -- | | -- | | | | x | | |
| 4. | Broad area | Basic Bio Sciences | | Food Engineering | | Product Development | | | | Industrial Application | | |
| | | X | | X | | X | | | | X | | |
| 5. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

**SEMESTER VII**

| | | | | | |
|---|---|---|---|---|---|
| **FP1014** | **FOOD SAFETY AND REGULATIONS** | **L** | **T** | **P** | **C** |
| | Total Contact Hours – 45 | **3** | **0** | **0** | **3** |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

To impart the knowledge of food safety, food labeling, PRP and HACCP for food safety system.

**INSTRUCTIONAL OBJECTIVES**

After going through the course the students will be able to

1. Identify the wide variety of parameters affecting food safety
2. Implementation of HACCP in any food industry
3. Know the requirements of FSSAI.

**UNIT I-INTRODUCTION (9hours)**

Principles of food safety –Establishment: design and facilities - emergency preparedness – Maintenance cleaning and sanitation – personal hygienic – packaging and labeling – transportation – traceability – recall procedure.

**UNIT II-CODEX ALIMENTARIUS (9 hours)**

Codex Alimentarius – PRP – GMP – GAP - GRAS- SSOP, HACCP - principles – Hazard analysis – determine CCP – establish critical limit – establish monitoring procedure – establish corrective action – record keeping – verification – AOQL (Average Outgoing Quality Limit) – HACCP plan chart.

**UNIT III-ADULTRATION (9 hours)**

Intentional and unintentional - Preservatives - antioxidants, sweeteners, flavours, colours, vitamins, stabilizers - indirect additives - organic resides - inorganic residues and contaminants.

**UNIT IV-FOOD LAWS (9hours)**

FSSAI, Essential Commodities Act, BIS, organizational chart – prohibition and regulation of sales – Laboratory and sampling analysis – scope and objective of industry – food safety policy – environmental policy – glass policy – jewelry policy – visitor policy.

**UNIT V-FOOD SAFETY IMPLEMENTATION** **(9 hours)**

Implementation of food safety for a desired food processing industry

**TEXT BOOKS**

1. Food safety and standards regulations, 2010.
2. General requirements (Food Hygiene) of the Codex Alimentarius, Volume II. Food and Agriculture organization of the UNITed Nations.

**REFERENCES**

1. The ministry of health and family welfare, The Gazette of India : Extraordinary, Part- III, section

| FP1014FOOD SAFETY AND REGULATIONS | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course Designed by | | Department of Food Process Engineering | | | | | | | | | | |
| 1. | Student Outcomes | a | b | c | d | e | f | g | h | i | j | k |
| | | X | | | | | | | | | | |
| 2. | Mapping of instructional objectives with student outcome | 1-3 | | | | | | | | | | |
| 3. | Category | General (G) | | Basic Sciences(B) | | Engineering Sciences and Technical Arts(E) | | | | Professional Subjects(P) | | |
| | | -- | | -- | | -- | | | | x | | |
| 4. | Broad area | Basic Bio Sciences | | Food Engineering | | Product Development | | | | Industrial Application | | |
| | | -- | | X | | -- | | | | -- | | |
| 5. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

| FP1015 | BAKERY AND CONFECTIONERY TECHNOLOGY | L | T | P | C |
|---|---|---|---|---|---|
| | Total contact Hours - 90 | 3 | 0 | 3 | 5 |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

This course covers the fundamentals of equipment and raw material identification while focusing on the needs of bakers to understand measurements, scaling and basic baking techniques.

| INSTRUCTIONAL OBJECTIVES | |
|---|---|
| By the end of the course students will | |
| 1. | Develop an understanding of process technology of bakery and confectionery products |
| 2. | Exhibit the use of sanitation and safety practices in bakery and confectionery products production |

**UNIT I-INTRODUCTION (9 hours)**

Status of bakery and confectionery industries in India- Raw materials for bakery and confectionery products- Essential and optional. PFA Specification of raw materials.

**UNIT II-BAKERYPRODUCTS TECHNOLOGY (9 hours)**

Dough rheology – Bread making- methods-process- specification for various types of breads- Biscuit manufacturing process- Cookies- Crackers- Cakes- Buns- preservation of bakery products.

**UNIT III-BAKERYMACHINERY AND EQUIPMENT (9 hours)**

Weighing Equipment- Manual scale, Automatic weigh, liquid measuring. mixing- blenders, Horizontal and vertical planetary, continuous mixers. Make up equipment- Divider, Rounder, Proofer, moulder. Baking equipment – different oven, slicer.

**UNIT IV-CONFECTIONERYPRODUCTS (9 hours)**

Confectionery products- chocolate, fondant, caramels, fudge and toffee.Equipment and process.

**UNIT V-SAFETYAND SANITATION (9 hours)**

Health and safety- Food safety rules and regulations for bakery and confectionery products- safe practices in the work places- sanitation- duties of the sanitation equipments- Code for hygiene condition in bakery and confectionery manufacturing UNIT.

**TEXT BOOKS**


1. *"The complete Technology book on bakery products"* by NIIR Board.
2. Bernard. W. Minifie., PhD *"Chocolate, Cocoa, and confectionery"* (Science and Technology), 3rd edition,CBS publishers and Distributors,New Delhi-110002.

3. *"Indian standards Glossary of terms relation to flour milling industry"* by Indian standard institution, New Delhi.

**REFERENCES**


1. Dubey S.C.,"*Basic Baking"*, Science and craft
2. *"The prevention of food adulteration ACT"*, by Akalank publication, Delhi 1954.


**LIST OF EXPERIMENTS**

1. Experiments on raw material quality checks on wheat flour.
2. Experiment on calculation of ingredients quantity for bakery product preparation.
3. Experiments on baking of bread.
4. Experiment on preparation of icing
5. Preparation of different types of cakes.
6. Preparation of different types of cookies.
7. Experiment on stages of sugar cookery.
8. Manufacturing of chocolate.
9. Experiment on preparation of caramel candy.
10. Experiment on preparation of marshmallow.
11. Experiment on preparation fondant and fudges.
12. Experiment on design of a bakery UNIT.

**REFERENCE**

1. Laboratory Manual

| **FP1015 BAKERY AND CONFECTIONERY TECHNOLOGY** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Designed by** | | **Department of Food Process Engineering** | | | | | | | | | | |
| 1. | Student Outcomes | a | b | c | d | e | f | g | h | i | j | k |
| | | X | | | | | | | | | | |
| 2. | Mapping of instructional objectives with student outcome | 1-3 | | | | | | | | | | |
| 3. | Category | General (G) | | Basic Sciences(B) | | Engineering Sciences and Technical Arts(E) | | | | Professional Subjects(P) | | |
| | | -- | | -- | | -- | | | | x | | |
| 4. | Broad area | Basic Bio Sciences | | Food Engineering | | Product Development | | | | Industrial Application | | |
| | | -- | | -- | | x | | | | -- | | |
| 5. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

| FP1016 | FOOD PACKAGING TECHNOLOGY | L | T | P | C |
|---|---|---|---|---|---|
| | Total Contact Hours - 45 | 3 | 0 | 0 | 3 |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

Provides a perspective for understanding about modern food packaging materials and methods used in food industries.

**INSTRUCTIONAL OBJECTIVES**

| | |
|---|---|
| 1. | Understand the various properties of food packaging materials. |
| 2. | Select suitable packaging material for different food substances. |
| 3. | Understand the concept of canning of food products |

**UNIT I-INTRODUCTIONTO PACKAGING (9 hours)**

Introduction- evaluation of packaging- economics- packaging operations- packaging terminology. Hazards in distribution- functions of package- design of packages for various foods.

**UNIT II-PROPERTIESAND SHELF LIFE OF PACAKGING MATERIALS (9 hours)**

Development of protective packaging- shelf life studies using packaging materials- methods of shelf life estimation- packaging materials- properties and identification- paper and paper boards.

**UNIT III-TYPESAND METHODS OF PACKAGING (10 hours)**

Regenerated cellulose film- plastic films- Aluminium foils and laminations. Edible packaging- Food packages- bags, pouches, carton boxes, metal and plastic tubes, moulded plastic containers, glass containers. Special packaging methods- vacuum and gas packaging, shrink package, retort pouches- Bio degradable packages.

**UNIT IV-CANNINGOPERATIONS (8 hours)**

Canning of food products- types of cans- open top sanitary cans- tin plate grades- lacquering and sealing compounds for OTS cans- canning operations- can washing and sterilization- exhausting- seaming- reforming and flanging operations- retorting of cans.

**UNIT V-SELECTIONOF PACKAGING MATERIALS (9 hours)**

Special problems of packaging food stuffs- packaging of various foods- compatibility- toxicity- packaging equipments- packaging standards and regulations.

**TEXT BOOKS**

1. *"Food Packaging Technology Handbook (2nd revised edition)"* by NIIR Board, published by NIIR project consultancy service, ISBN: 9789381039090, Code: NI93 2012.

**REFERENCE**

1. Frank Albert Paine, Heather Y. Paine. "*Handbook of Food Packaging Technology"*. 2nd edition, published by Blackie academy and Professional, 1992.

| FP1016 FOOD PACKAGING TECHNOLOGY | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course Designed by | | Department of Food Process Engineering | | | | | | | | | | |
| 1. | Student Outcomes | a | b | c | d | e | f | g | h | i | j | k |
| | | X | | | | | | | | | | |
| 2. | Mapping of instructional objectives with student outcome | 1-3 | | | | | | | | | | |
| 3. | Category | General (G) | | Basic Sciences(B) | | Engineering Sciences and Technical Arts(E) | | | | Professional Subjects(P) | | |
| | | -- | | -- | | -- | | | | x | | |
| 4. | Broad area | Basic Bio Sciences | | Food Engineering | | Product Development | | | | Industrial Application | | |
| | | -- | | X | | -- | | | | -- | | |
| 5. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

| FP1017 | INSTRUMENTATION FOR FOOD ANALYSIS | L | T | P | C |
|---|---|---|---|---|---|
| | Total Contact Hours - 45 | 3 | 0 | 0 | 3 |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

This course makes the students to gain knowledge in advanced Instrumentation for food analysis. After successful completion of the students get familiarize with advanced instruments like HPLC, GC, Spectrophotometer etc.

| INSTRUCTIONAL OBJECTIVES | |
|---|---|
| 1. | To be familiar with different methods of investigation used in the analysis of foods |
| 2. | To gain knowledge about different instruments used in food analysis. |
| 3. | To know the principles and applications of different techniques used in food and Nutrition research. |

**UNIT I-TEMPERATURE AND PRESSURE MEASUREMENTS (7 hours)**

Thermoelectric temperature measurement, pressure, humidity – principles- types, calibration.

**UNIT II-BASIC CONCEPTS IN CHROMATOGRAPHY AND SPECTROMETRY (11 hours)**

Basic principles of chromatography.Paper chromatography, thin layer chromatography, HPLC (High performance liquid chromatography), Gas chromatography - Introduction, general principles, procedure, qualitative analysis, separation and resolution, quantitative analysis.Application in food analysis. Spectrophotometry introduction and principles- Atomic absorption spectroscopy - Introduction to AAS – Components of an AA spectrometer – Overview, Light sources, Nebuliser / Atomiser assemblies, Nebulisers, flames, optics, detectors, support gases, AAS measurements- Application in food analysis.

**UNIT III-NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY (9 hours)**

Electromagnetic spectrum – The NMR Phenomenon – Types of information provided by NMR spectra – Instrumental and Experimental Considerations – Solid state NMR –application of NMR to Food analysis.

**UNIT IV-MASS SPECTROMETRY (9 hours)**

Process – Ionisation techniques – Instrumentation – Linked scanning tecnhniques – application of MS in Food Science – application of GC/MS, LC/MS / FAB/MS / MS/MSand Linked scan techniques.

**UNITV-OTHER ANALYTICAL EQUIPMENTS (9 hours)**

FTIR, XRF, Differential Scanning Calorimenter, XRD, SEM, TEM, water activity meter, textural analyser, e –sensors, biosensors, Nitrogen analyzers - instrumentation, operating procedure and application in analysis of foods.

**TEXT BOOKS**

1. Pearson, D, "*The Chemical Analysis of Foods"*. Churchill Livingstone, New York 2002.
2. Sharma, B.K, "*Instrumental Methods of Chemical Analysis*". Goel Publishing House,New Delhi 2004.

**REFERENCES**

1. Nielsen, S.S, "*Introduction to the chemical analysis of foods*". Jones and Bartlett Publishers, Boston, London 2004.
2. Mahindru,S.N, "*Food additives. Characteristics, detection and estimation"*. Tata Mc Graw-Hill Publishing Company Limited, New Delhi 2000.

<table>
<tr><th colspan="14">FP1017 INSTRUMENTATION FOR FOOD ANALYSIS</th></tr>
<tr><td colspan="2">Course Designed by</td><td colspan="12">Department of Food Process Engineering</td></tr>
<tr><td rowspan="2">1.</td><td rowspan="2">Student Outcomes</td><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td><td>f</td><td>g</td><td>h</td><td>i</td><td>j</td><td>k</td></tr>
<tr><td>X</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2.</td><td>Mapping of instructional objectives with student outcome</td><td>1-3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">3.</td><td rowspan="2">Category</td><td colspan="2">General (G)</td><td colspan="2">Basic Sciences(B)</td><td colspan="4">Engineering Sciences and Technical Arts(E)</td><td colspan="3">Professional Subjects(P)</td></tr>
<tr><td colspan="2">--</td><td colspan="2">--</td><td colspan="4">--</td><td colspan="3">x</td></tr>
<tr><td rowspan="2">4.</td><td rowspan="2">Broad area</td><td colspan="2">Basic Bio Sciences</td><td colspan="2">Food Engineering</td><td colspan="4">Product Development</td><td colspan="3">Industrial Application</td></tr>
<tr><td colspan="2">--</td><td colspan="2">X</td><td colspan="4">--</td><td colspan="3">--</td></tr>
<tr><td>5.</td><td>Approval</td><td colspan="12">23rd Meeting of Academic Council, May 2013</td></tr>
</table>

| FP1018 | PROCESSING OF SPICES AND PLANTATION CROPS | L | T | P | C |
|---|---|---|---|---|---|
| | Total Contact Hours - 30 | **2** | **0** | **0** | **2** |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

This course provides knowledge about the different methods of processing and value added products made from spices, plantation and tuber crops

**INSTURCTIONAL OBJECTIVES**

| | |
|---|---|
| 1. | To study about processing of spices, equipments used and value addition |
| 2. | To enrich the knowledge about processing of plantation crops |
| 3. | To Update knowledge of tuber crops and medicinal crops |

**UNIT I-MPORTANCEAND PROCESSING OF SPICES (7 hours)**

Spices – production and importance – stage of harvesting and harvesting methods - processing of major and minor spices – pepper, cardamom, chilli, turmeric, ginger, clove, nutmeg, vanilla – UNIT operations involved – equipments used- value addition of spices.

**UNIT II-PROCESSINGOF COFFEE, TEA AND COCOA (5 hours)**

Processing of coffee, tea and cocoa – methods, process and equipment – value added products – grading and types – packaging and storage

**UNIT III-PROCESSINGOF COCONUT, ARECANUT AND CASHEW (6 hours)**

Processing of plantation crops – production and importance – processing of coconut, arecanut, cashew– harvesting and stages of harvest – drying, cleaning and grading – production of value added products – packaging and storage of produces.

**UNIT IV-PROCESSINGOF TUBER CROPS (6 hours)**

**J**Tuber crops- tapioca, potato, sweet potato, yam, sugar beet – processing, equipments used– processed products.

**UNIT V-PROCESSINGOF MEDICINAL CROPS (6 hours)**

Importance of medicinal crops – production and export status – processing of medicinal crops – equipments used – principles and operations – active components in various medicinal plants – application and uses – extraction methods

**TEXT BOOKS**


1. Pandey, P. H, "*Post Harvest Engineering of Horticultural Crops through Objectives*". Saroj Prakasam, Allahabad 2002.
2. Pruthi, J.S, "*Major Spices of India – Crop Management and Post Harvest Technology*". Indian Council of Agricultural Research, Krishi Anusandhan Bhavan, Pusa, New Delhi. PP. 514, (1998)
3. ASTA, "*Official analytical methods of the American Spice Trade Association*", Fourth Edition 1997.


**REFERENCES**


1. Purseglove, J.W., E.G.Brown, G.L.Green and S.R.J.Robbins, "*Cardamom – Chemistry. Spices, Vol. I, Tropical Agricultural Series*", Longman, London, 1: 605. (1981)

2. Pruthi, J.S, "*Spices and Condiments: Chemistry, Microbiology and Technology*". First Edition. Academic Press Inc., New York, USA 1980.

| FP1018 PROCESSING OF SPICES AND PLANTATION CROPS | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course Designed by | | Department of Food Process Engineering | | | | | | | | | | |
| 1. | Student Outcomes | a | b | c | d | e | f | g | h | i | j | k |
| | | X | | | | | | | | | | |
| 2. | Mapping of instructional objectives with student outcome | 1-3 | | | | | | | | | | |
| 3. | Category | General (G) | | Basic Sciences(B) | | Engineering Sciences and Technical Arts(E) | | | | Professional Subjects(P) | | |
| | | -- | | -- | | -- | | | | x | | |
| 4. | Broad area | Basic Bio Sciences | | Food Engineering | | Product Development | | | | Industrial Application | | |
| | | -- | | -- | | -- | | | | x | | |
| 5. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

| FP1048 | INDUSTRIAL TRAINING II (Training to be undergone after VI semester) | L | T | P | C |
|---|---|---|---|---|---|
| | 2 week practical training in industry | 0 | 0 | 1 | 1 |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

To provide hands-on experience at site / planning or design office where Food Process engineering projects are carried out

**INSTRUCTIONAL OBJECTIVES**

1. Students have to undergo three – week practical training in Food Process Engineering related project site or design / planning office so that they become aware of the practical application of theoretical concepts studied in the class rooms.

Students have to undergo two-week practical training in Food Process Engineering related project site or design / planning office of their choice butwith the approval of the department. At the end of the training student will submit a report as per the prescribed format to the department.

**Assessment process**

This course is mandatory and the student has to pass the course to become eligible for the award of degree. The student shall make a presentation before a committee constituted by the department which will assess the student based on the report submitted and the presentation made. Marks will be awarded out of 100 and appropriate grades assigned as per the regulations.

<table>
<tr><th colspan="13">FP1048 INDUSTRIAL TRAINING II</th></tr>
<tr><th colspan="2">Course Designed by</th><th colspan="11">Department of Food Process Engineering</th></tr>
<tr><td rowspan="2">1.</td><td rowspan="2">Student Outcomes</td><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td><td>f</td><td>g</td><td>h</td><td>i</td><td>j</td><td>k</td></tr>
<tr><td></td><td></td><td></td><td>X</td><td></td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td></td></tr>
<tr><td>2.</td><td>Mapping of instructional objectives with student outcome</td><td></td><td></td><td></td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td></td></tr>
<tr><td rowspan="2">3.</td><td rowspan="2">Category</td><td colspan="2">General (G)</td><td colspan="2">Basic Sciences(B)</td><td colspan="4">Engineering Sciences and Technical Arts(E)</td><td colspan="3">Professional Subjects(P)</td></tr>
<tr><td colspan="2">--</td><td colspan="2">--</td><td colspan="4">--</td><td colspan="3">x</td></tr>
<tr><td rowspan="2">4.</td><td rowspan="2">Broad area</td><td colspan="2">Basic Bio Sciences</td><td colspan="2">Food Engineering</td><td colspan="4">Product Development</td><td colspan="3">Industrial Application</td></tr>
<tr><td colspan="2">--</td><td colspan="2">--</td><td colspan="4">--</td><td colspan="3">X</td></tr>
<tr><td>5.</td><td>Approval</td><td colspan="11">23rd Meeting of Academic Council, May 2013</td></tr>
</table>

## SEMESTER VIII

| FP1050 | MAJOR PROJECT/PRACTICE SCHOOL | L | T | P | C |
|---|---|---|---|---|---|
| | Prerequisite | 0 | 0 | 24 | 12 |
| | Nil | | | | |

**PURPOSE**

To apply the various food processing principles and preservation techniques to develop new food products/equipments/improve the existence.

**INSTRUCTIONAL OBJECTIVES**

| | |
|---|---|
| 1. | To test the ability and capacity of the student to work individually and in a team |
| 2. | To apply his/her knowledge of food process engineering to design / / do research on food related processes/issues and to determine his/her proficiency level of the subjects learnt in the entire course. |

**PROJECT WORK**

Each student shall, on individual or in a group of not more than three students, work under the supervision of a faculty on their chosen /allotted area.
The project work may be carried out on one of the following broad areas.

a)Non-thermal methods of food preservation
b)Microencapsulation techniques
c)Nutraceuticals and functional foods
d)Prebiotic Foods
e)Value added products from grains, fruits and vegetables
f)Value added products from under utilized fruits and vegetables
g)Value addition of milk based products
h)Food industrial waste and byproduct utilization
i)Development of new food processing tool/equipments
j)Solving food safety issue
k)Improving the performance of food processing equipments/methodology

**ASSESSMENT**

The students have to prepare and submit a detailed report on their work. Assessment would be made on the basis of the submitted report and the presentation cum viva voce examination conducted by a board of examiners constituted by the Department.

| FP1050 MAJOR PROJECT | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Designed by** | | **Department of Food Process Engineering** | | | | | | | | | | |
| 1. | Student Outcomes | a | b | c | d | e | f | g | h | i | j | k |
| | | X | X | X | X | X | X | X | X | X | X | X |
| 2. | Mapping of instructional objectives with student outcome | 2 | 2 | 2 | 1 | 2 | 1 | 1 | 2 | 2 | 2 | 2 |
| 3. | Category | General (G) | | Basic Sciences(B) | | Engineering Sciences and Technical Arts(E) | | | | Professional Subjects(P) | | |
| | | -- | | -- | | -- | | | | x | | |
| 4. | Broad area | Basic Bio Sciences | | Food Engineering | | Product Development | | | | Industrial Application | | |
| | | X | | X | | X | | | | x | | |
| 5. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

## DEPARTMENT ELECTIVES

## SEMESTER IV

| FP1101 | FAT AND OIL PROCESSING TECHNOLOGY | L | T | P | C |
|---|---|---|---|---|---|
| | Total Contact Hours - 45 | 3 | 0 | 0 | 3 |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

This course enables the students to know about the technology of producing refined fat and oil.

**INSTRUCTIONAL OBJECTIVES**

| | |
|---|---|
| 1. | To identify the different sources of fat |
| 2. | To study the different UNIT operation involved in refining oil |
| 3. | To know the products made from fat and oil |

**UNIT I-SOURCES OF FAT (10 hours)**

Fat consumption-nutritive value- chemical composition of fat and oil- types of fatty acid - sources of fat- Physical, thermal and chemical properties of fat and oil. Pretreatment and storage of oil seeds.

**UNITII-INDUSTRIAL PRODUCTION OF OIL (10 hours)**

Production of oil-extraction of oil - cold pressing and hot pressing, solvent extraction, rendering-removal and recovery of solvent form miscella-removal and recovery of solvent from extracted residue-refining of oil-neutralization-degumming - bleaching - alkali refining-deoderization.

**UNIT III-EDIBLEOIL PRODUCTION (7 hours)**

Winterization of oil, hydrogenization of oil, generation and storage of hydrogen-production and regeneration of catalysts-filtration of hardened oil-production of palm oil –rice bran oil, soybean oil.

**UNIT IV-PROCESSINGOF ANIMAL FATS (8 hours)**

Animal fats-sources-nutritive value- industrial application-Lards-tallow-physical nature- production and storage, production of margarine, partial sterilization-emulsification-chilling-kneading and cooling-Incorporation of salt and colouring agent.

**UNIT V-PRODUCTMADE FROM FAT AND OIL (10 hours)**

Changes during storage of oil seeds-rancidity-causes-atmospheric oxidation and enzyme action-free fatty acids-Non edible oil-Castor oil-Linseed oil-vegetable waxes-production-industrial application of fats and oil-soap-candle –paints and varnishes.

**TEXT BOOKS**


1. Kirschentiuer, H.G, "*Fats and Oils*", Reinhold Publishing Corporation, New York 1944.
2. Weiss, T.J, "*Food oils and their Uses*". The AVI Publishing Company, Inc., Westport, Connecticut 1970.


**REFERENCES**


1. Hilditch, T.P, "*Industrial chemistry of fats and waxes*". Bailliere, Tindal and cox, London 1943.
2. Willans, P.N. and Devine, "*The Chemistry and technology of Edible oils and fats"* 1984.


| **FP1101 FAT AND OIL PROCESSING TECHNOLOGY** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Designed by** | | **Department of Food Process Engineering** | | | | | | | | | | |
| 1. | Student Outcomes | a | b | c | d | e | f | g | h | i | j | k |
| | | | | | | | | | | | | X |
| 2. | Mapping of instructional objectives with student outcome | | | | | | | | | | | 1-3 |
| 3. | Category | General (G) | | Basic Sciences(B) | | Engineering Sciences and Technical Arts(E) | | | | Professional Subjects(P) | | |
| | | -- | | -- | | -- | | | | x | | |
| 4. | Broad area | Basic Bio Sciences | | Food Engineering | | Product Development | | | | Industrial Application | | |
| | | -- | | -- | | -- | | | | X | | |
| 5. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

| FP1102 | CANE SUGAR TECHNOLOGY | L | T | P | C |
|---|---|---|---|---|---|
| | Total Contact Hours - 45 | 3 | 0 | 0 | 3 |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

Students will get to know the technology of producing and refining sugars

**INSTRUCTIONAL OBJECTIVES**

This course teaches about

| | |
|---|---|
| 1. | Methods of harvesting sugarcane |
| 2. | Technology of extracting juice |
| 3. | UNIT operations involved in the production of sugar |
| 4. | Utilization of by-products from sugar mills |

**UNIT I-PREPROCESSING OPERATIONS (7 hours)**

Sugarcane – Constituents – Harvesting indices – Cane cutting – Manual, Mechanical – Transportation – loading – Unloading – Cane conveyor – Washing – Shredders – Types.

**UNIT II-JUICEEXTRACTION (9 hours)**

Crushing – Crushers – Types, Crushing efficiency – Extraction of juice – methods, Accumulators – types – Maceration – Theory of cane diffusivity – different diffuser – ring diffuser – weighing of juice.

**UNIT III-CANEJUICE CLARIFICATION (9 hours)**

Clarification – methods – clarifying agent – bleaching agent - Role of pH, non-sugars, colloids and gums in cane juice clarification. Liming of cane juice – $CO_2$ , $P_2O_5$ and its importance.

**UNIT IV-FILTRATIONAND EVAPORATION PROCESS IN CANE INDUSTRY (11 hours)**

Filtration of mud – Filter types – filter press, rotary vacuum filter – Rapi – Floc process. Filter cake washing. Evaporation – Evaporation rate – types of evaporators used in cane sugar industry – Cleaning of evaporators – Entrainment separator – methods – Boiling in Vacuum pan – Footing magma – Massecuite A,B,C – Mother liquor, Molasses A,B,C Molasses exhaustibility.

**UNIT V-SUGARPRODUCTION FROM CANE JUICE (9 hours)**

Crystallization – Super saturation – Crystallizers type – batch and continuous. Centrifuge – types. Drying of sugar – conveyors for sugar – by-product from sugar mills – utilization.

**TEXT BOOKS**

1. Ram Behari Lal and Mathur, "*Hand book of cane sugar technology*". Oxford and IBH publishing company New Delhi 1972.
2. Earle, R.L. "*Unit Operations in Food Processing*". Pergamon press.

**REFERENCES**

1. Baikow, V.E, "*Manufacturing and refining of raw cane sugar*". Elsevier Publishing Company, New York 1967.
2. McCabe, W.L. and SmithJ.E., "*Unit operations in chemical engineering*". McGraw Hill Kogakusha Ltd., Tokyo 1976.

| **FP1102 CANE SUGAR TECHNOLOGY** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Designed by** | | **Department of Food Process Engineering** | | | | | | | | | | |
| 1. | Student Outcomes | a | b | c | d | e | f | g | h | i | j | k |
| | | | | | | | | | | | | X |
| 2. | Mapping of instructional objectives with student outcome | | | | | | | | | | | 1-3 |
| 3. | Category | General (G) | | Basic Sciences(B) | | Engineering Sciences and Technical Arts(E) | | | | Professional Subjects(P) | | |
| | | -- | | -- | | -- | | | | x | | |
| 4. | Broad area | Basic Bio Sciences | | Food Engineering | | Product Development | | | | Industrial Application | | |
| | | -- | | -- | | -- | | | | x | | |
| 5. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

| **FP1103** | **BOILER AND STEAM ENGINEERING** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | Total Contact Hours – 45 | **3** | **0** | **0** | **3** |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

This course aims to provide knowledge about steam production, properties and boiler operations.

| INSTRUCTIONAL OBJECTIVES | |
|---|---|
| This course familiarizes students in | |
| 1. | Fuel and its combustion |
| 2. | Steam production and its properties |
| 3. | Chimney design |
| 4. | Boiler design and its maintenance |

**UNIT I-FUELAND COMBUSTION (9 hours)**

Introduction – classification – solid, liquid and gaseous fuel – theory of combustion – calorific value.Bomb calorimeter – Determination of minimum air requirement for combustion – gas analysis.

**UNIT II-PROPERTIESOF STEAM (9 hours)**

Introduction – steam formation – Thermodynamic properties of steam – Sensible heat, latent heat, dryness fraction, wet fraction – superheated steam – steam table, expansion of steam.

**UNIT III-CHIMNEYDESING (9 hours)**

Introduction – Classification of draught – natural, forced, artificial, induced draught-draught losses – advances of mechanical draught- determination of height and diameter of chimney – condition of maximum discharge – efficiency of chimney.

**UNIT IV-BOILERS (9 hours)**

Introduction – classification of boilers – Cochran boiler, Lancaster boiler, locomotive boiler, vertical and horizontal return tube boilers, velox boiler – working principle. Merits and demerits of five tube and water tube boilers. Boiler mountings and boiler accessories.

**UNIT V-FITTING, SAFETY AND MAINTANENCE (9 hours)**

Selection of size of steam pipes – layout of pipe lines – Energy audit of steam boilers – economy of heat utilization – boiler codes – Indian boiler regulation act – safety in steam plant maintenance.

**TEXT BOOKS**

1. Everett. B. Woodreff, "*Steam plant operation*" 1998.
2. Frederick M. Steingress, "*Low pressure boiler*" 2000.

**REFERENCES**


1. Saidik kakac , "*Boilers, evaporators and condenser*" 1999.
2. Stultz SC., Kitto. JB, "*Steam its generation and use*" 1992.


| FP1103 BOILER AND STEAM ENGINEERING | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Designed by** | | **Department of Food Process Engineering** | | | | | | | | | | |
| 1. | Student Outcomes | a | b | c | d | e | f | g | h | i | j | k |
| | | X | | | | | | | | | | |
| 2. | Mapping of instructional objectives with student outcome | 1-4 | | | | | | | | | | |
| 3. | Category | General (G) | | Basic Sciences(B) | | Engineering Sciences and Technical Arts(E) | | | | Professional Subjects(P) | | |
| | | -- | | -- | | -- | | | | x | | |
| 4. | Broad area | Basic Bio Sciences | | Food Engineering | | Product Development | | | | Industrial Application | | |
| | | -- | | -- | | -- | | | | X | | |
| 5. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

## SEMESTER V

| FP1104 | FOOD BIOTECHNOLOGY | L | T | P | C |
|---|---|---|---|---|---|
| | Total Contact Hours - 45 | 3 | 0 | 0 | 3 |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

This course enables the students to understand application of biotechnology in Food processing industries.

**INSTRUCTIONAL OBJECTIVES**

After completing this course students should be able to

| | |
|---|---|
| 1. | List out the commercially important enzyme used in food industries |
| 2. | Know the techniques involved in the production of enzymes |
| 3. | Concept of bio process engineering |
| 4. | Understand downstream processing concepts |

**UNIT I-INTRODUCTION TO BIOTECHNOLOGY (9 hours)**

Introduction -Biotechnology relating to the food industry – application of genetics to food production – role of bio process engineering in biotechnology industry. Regulatory and Social aspects of biotechnology of foods.

**UNIT II-MICROBIALGENETICS (9 hours)**

Microbial genetics – mutation – induction of mutation – conjugation, transformation, transduction – heterokaryoses – paraesexuality – General mechanism of gene transfer techniques in genetic engineering. Principles of immunology – Antigen and antibody reaction – Development of vaccines – Microbial products and industrial application of microorganisms in foods.

**UNIT III-PRODUCTIONOF PRIMARY AND SECONDARY METABOLITES(9 hours)**

The process of production of some commercially important organic acids – citric acid, lactic acid, acidic acid, gluconic acid, amino acids and alcohol– Bio products for food industries – Natural bio-preservatives – Nisin.

**UNIT IV-DOWNSTREAM PROCESSING (9 hours)**

Principle of downstream processing –stages in downstream processing- solid liquid separation flotation-flocculation-filtration-types-centrifugation-cell disruption-concentration-evaporation liquid - liquid extraction-membrane filtration-precipitation-adsorption-purification by chromatography.

**UNIT V-APPLICATIONOF BIOTECHNOLOGY TO TRADITIONAL FERMENTED FOODS (9 hours)**

Milk derivatives- fermented milks-past, present and future-plant derivatives-biotechnology application in cassava processing-animal derivatives-fish meat sausage-human health safety and nutrition considerations-future directions.

**TEXT BOOKS**


1. Board R.B. Jones.D, "*Microbial Fermentation Beverages, Foods and Feeds"* 1995.
2. Sarah Elderidge, "*Food Biotechnology; Current issues and perspectives*". Nova science pub. Inc. 2003.
3. Rita Singh, "*Food Biotecnology*". Global vision publication house, Delhi 2004.


**REFERENCES**


1. Kalaichelvan, P.T, "*Bioprocess technology*", MJP publishers,Chennai 2007.
2. Sathnarayana U, "*Biotechnology*", Arunavhazan publishers, kolkatta 2006.
3. National Research Council, "*Application of biotechnology to traditional fermented foods*", National academy press, Washington 1992.


| FP1104FOOD BIOTECHNOLOGY | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Designed by** | | **Department of Food Process Engineering** | | | | | | | | | | |
| 1. | Student Outcomes | a | b | c | d | e | f | g | h | i | j | k |
| | | X | | | | | | | | | | |
| 2. | Mapping of instructional objectives with student outcome | 1-4 | | | | | | | | | | |
| 3. | Category | General (G) | | Basic Sciences(B) | | Engineering Sciences and Technical Arts(E) | | | | Professional Subjects(P) | | |
| | | -- | | -- | | -- | | | | x | | |
| 4. | Broad area | Basic Bio Sciences | | Food Engineering | | Product Development | | | | Industrial Application | | |
| | | x | | -- | | -- | | | | -- | | |
| 5. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

| FP1105 | ENZYME TECHNOLOGY | L | T | P | C |
|---|---|---|---|---|---|
| | Total Contact Hours - 45 | 3 | 0 | 0 | 3 |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

This course enables the students to know the different types of enzymes and its application in food industries

**INSTRUCTIONAL OBJECTIVES**

On completing this course students should be able to know about Isolation and Purification of enzymes, understand the concept of enzyme immobilization techniques and the application of enzymes in food industries.

**UNIT I-INTRODUCTION (9 hours)**

Introduction-Definition-Historical highlights-classification of enzymes-nomenclature- structural features of enzyme-Methods of extraction and purification of enzymes.

**UNIT II-MECHANISMOF ENZYME ACTION (9 hours)**

Specificity-types of specificity-role of 3D structure -active site-substrate and enzyme concentration relationships-different effects –pH and temperature.

**UNIT III-ENZYMEKINETICS (11 hours)**

MM equation, Lineweaver Plot, - kinetics. Immobilization-need for immobilization-advantages –disadvantages-immobilization techniques- -effects of pH, temperature, substrate concentration, stability, kinetic properties-role of immobilized enzymes in food processing-commercial food application.

**UNIT IV-ENZYMESOF FOOD IMPORTANCE (7 hours)**

Endogeneous enzymes in food quality- color- lipoxynase, chlorophyllase, polyphenol oxidase ,texture- Pectic enzymes, Amylases, cellulases, proteases, flavour and aroma-nutritional quality.

**UNIT V-APPLICATIONOF ENZYMES IN FOOD INDUSTRIES (11 hours)**

Mechanism and application of enzymes in food processing-enzymatic browning.Application of enzyme in meat industry, fruit and vegetable industry, dairy industry- bakery industry.

**TEXT BOOKS**


1. Price, N. L. and StevenL., "*Fundamentals of Enzymology*", Oxford Scientific 2000.
2. Godfrey T. West S (Eds), "*Industrial Enzymology*" 2nd Edition Mac Millan Press, London 1996.
3. Robert J.Whitehurst and Barry A. Law. Enzymes in food technology Sheffield packaging technology.
4. Asokan, P,*"Enzymes*".Chinna publications,Tamil nadu 2003.


**REFERENCES**


1. Colowick,S.P.and Kalpan,N.O.(Eds), "*Methods of enzymology*" Academic press 1977.
2. Tauber ph.D and Hentry,"*Enzyme technology*" 2000.
3. Marangoni, A.G, "*Enzyme Kinetics*". A modern approach A John Wiley & Sons 2003.
4. Trevor Palmer. Understanding Enzymes. Fourth Edition. Prentice Hall,LondonRobert L. Ory, Allen J. St. Angelo, "*Enzymes in food and beverage processing*" American chemical society 1977.


<table>
<tr><th colspan="13">FP1105ENZYME TECHNOLOGY</th></tr>
<tr><th colspan="2">Course Designed by</th><th colspan="11">Department of Food Process Engineering</th></tr>
<tr><td rowspan="2">1.</td><td rowspan="2">Student Outcomes</td><td>A</td><td>b</td><td>c</td><td>d</td><td>e</td><td>f</td><td>g</td><td>h</td><td>i</td><td>j</td><td>k</td></tr>
<tr><td>X</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2.</td><td>Mapping of instructional objectives with student outcome</td><td>1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">3.</td><td rowspan="2">Category</td><td colspan="2">General (G)</td><td colspan="2">Basic Sciences(B)</td><td colspan="4">Engineering Sciences and Technical Arts(E)</td><td colspan="3">Professional Subjects(P)</td></tr>
<tr><td colspan="2">--</td><td colspan="2">--</td><td colspan="4">--</td><td colspan="3">x</td></tr>
<tr><td rowspan="2">4.</td><td rowspan="2">Broad area</td><td colspan="2">Basic Bio Sciences</td><td colspan="2">Food Engineering</td><td colspan="4">Product Development</td><td colspan="3">Industrial Application</td></tr>
<tr><td colspan="2">x</td><td colspan="2">--</td><td colspan="4">--</td><td colspan="3">--</td></tr>
<tr><td>5.</td><td>Approval</td><td colspan="11">23rd Meeting of Academic Council, May 2013</td></tr>
</table>

| | BIOCHEMISTRY OF PROCESSING AND PRESERVATION OF FOODS | L | T | P | C |
|---|---|---|---|---|---|
| FP1106 | Total Contact Hours - 45 | 3 | 0 | 0 | 3 |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

This course helps the students to apply basic food science knowledge and get to know biochemical changes occurring during various processing and preservation techniques.

**INSTRUCTIONAL OBJECTIVES**

Upon completion of this course students should be able to understand

| | |
|---|---|
| 1. | The changes occurring during various food processing techniques |
| 2. | The changes during storage and preservation |
| 3. | The effect of enzymes on spoilage reactions of foods |

**UNIT I-INTRODUCTION (9 hours)**

Chemical changes in food during processing an overview. Food processing in perspective.Means of controlling chemical reactions in foods during processing and handling.

**UNIT II-EFFECTOF GERMINATION, COOKING AND HEAT PROCESSING ON THE NUTRITIVE VALUE OF FOODS (9 hours)**

Effect of nutritive value on various nutrients- carbohydrates, proteins, fats, proteins, vitamins, minerals, pigments, flavour components.Retention of nutritive value during processing and preparation.

**UNITIII-CHEMICALREACTIONS OF PROTEINS AND LIPIDS (9 hours)**

General chemistry of reactions, some typical reactions, some deteriorative reactions, unhealthful deteriorative products.Maillard reaction. Oxidation induced changes in food lipids.

**UNITIV-CHEMICALCHANGES IN, PECTIN, CELLULOSE AND STARCH DURING FOOD PROCESSING (9 hours)**

Cell wall structure, sugar composition, pectin methylation, pectin ionization, role of pectin in fruit and vegetable texture. Starch gelatinization, degradation, reterogradation, bread staling, etc.

**UNIT V-CHEMICALCHANGES OF VITAMINS, NATURAL PIGMENTS DURING FOOD PROCESSING (9 hours)**

Vitamin degradation reactions, conversion to products exhibiting reduced biological activity. Processing effects on vitamin bioavailability.Carotenoids, chlorophyll, heme pigments, anthocyanins, betalins.

**TEXT BOOKS**


1. Manoranjan Kalia and Sangita Sood, "*Food preservation and processing*", Kalyani Publishers. New Delhi 2004.
2. Richardson, T. and Finley, J.W, "*Chemical changes in food during processing*". Macmillon Publishers. Canada 2003.
3. David, S Robinson, "*Food Chemistry and nutritive value*". Longman group, UK 1997.


**REFERENCES**


1. Desrosier, N.W, "*The Technology of Food Preservation*", CBS Publishers and Distributors, New Delhi 1996.
2. Sadasivam, S and ManickamA., "*Biochemical methods for Agricultural Sciences"*, New Age International publishers, New Delhi 1996.


<table>
<tr><th colspan="13">FP1106 BIOCHEMISTRY OF PROCESSING AND PRESERVATION OF FOODS</th></tr>
<tr><td colspan="2">Course Designed by</td><td colspan="11">Department of Food Process Engineering</td></tr>
<tr><td rowspan="2">1.</td><td rowspan="2">Student Outcomes</td><td>a</td><td>b</td><td>C</td><td>d</td><td>e</td><td>f</td><td>g</td><td>h</td><td>i</td><td>j</td><td>k</td></tr>
<tr><td>X</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2.</td><td>Mapping of instructional objectives with student outcome</td><td>1-3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">3.</td><td rowspan="2">Category</td><td colspan="2">General (G)</td><td colspan="2">Basic Sciences(B)</td><td colspan="4">Engineering Sciences and Technical Arts(E)</td><td colspan="3">Professional Subjects(P)</td></tr>
<tr><td colspan="2">--</td><td colspan="2">--</td><td colspan="4">--</td><td colspan="3">x</td></tr>
<tr><td rowspan="2">4.</td><td rowspan="2">Broad area</td><td colspan="2">Basic Bio Sciences</td><td colspan="2">Food Engineering</td><td colspan="4">Product Development</td><td colspan="3">Industrial Application</td></tr>
<tr><td colspan="2">x</td><td colspan="2">--</td><td colspan="4">--</td><td colspan="3">--</td></tr>
<tr><td>5.</td><td>Approval</td><td colspan="11">23rd Meeting of Academic Council, May 2013</td></tr>
</table>

## SEMESTER VI

| | | | | | |
|---|---|---|---|---|---|
| **FP1107** | **MEAT, POULTRY AND FISH PROCESSING** | **L** | **T** | **P** | **C** |
| | Total Contact Hours – 45 | **3** | **0** | **0** | **3** |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

This course prepares the students for a position in the meat and poultry processing industry.

**INSTRUCTIONAL OBJECTIVES**

To familiarize with the

1. Advanced treatment of the concepts involved in the production, processing and acceptance of meat and poultry.
2. Products derived from meat and poultry.

**UNIT I-PRETREATMENTSOF MEAT (9 hours)**

Meat-nutritional quality of meat and poultry, structure of muscles-factor affecting quality of fresh meat-grading based on-maturity, degree of fat marbling-muscle firmness, colour. Slaughtering-pre slaughter care –stunning, methods of stunning –bleeding-skinning of animals.

**UNIT II-AGINGOF MEAT (7 hours)**

Post slaughter care-post mortem and Biochemical changes in meat-rigour mortis – tenderization-artificial tenderization-muscle stretching-mechanical disruption-artificial enzymes.

**UNIT III-MEATPRESERVATION AND PRODUCTS (11 hours)**

Meat preservation-Methods of preservation-low temperature, chilling and freezing-Thermal processing-dehydration-curing and smoking-preservation using antibiotics-preservation by irradiation.Meat products – Ham and Beckon, sausage, quality control and standardization of meat.

**UNIT IV-POULTRYAND EGGPROCESSING (9 hours)**

Composition and nutritive value of eggs-grading and preservation of egg defects – spoilage of egg-storage-manufacturing of egg powder, frozen egg. Waste from egg industry-utilization. Dressing –grading-slaughtering-scalding-Mechanical defeathering-eviscerating-preservation-Quality control and standardization of poultry meat.

**UNIT V-FISHPROCESSING** **(9 hours)**

Sea foods – nutritional composition- fishing resources – transportation of fish – grading – sea food products and processing – preservation methods – freezing – IQF- canning – salting –surumi process – quality control in fish processing.

**TEXT BOOKS**


1. Mead,"*Processing of poultry*" 1989.
2. Richardson and Mead,"*Poultry meat science*" 1999.
3. Pearson and Tauber,"*Muscle and meat biochemistry*" 1989.


**REFERENCES**


1. Barbut, "*Poultry products processing an industry guide*" 2002.
2. Pearson and Dutson, "*Quality attributes and their measurement in meat poultry and fish"* 1994.


| **FP1107MEAT, POULTRY AND FISH PROCESSING** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Designed by** | | **Department of Food Process Engineering** | | | | | | | | | | |
| 1. | Student Outcomes | a | b | c | d | e | f | g | h | i | j | k |
| | | X | | | | | | | | | | |
| 2. | Mapping of instructional objectives with student outcome | 1-2 | | | | | | | | | | |
| 3. | Category | General (G) | | Basic Sciences(B) | | Engineering Sciences and Technical Arts(E) | | | | Professional Subjects(P) | | |
| | | -- | | -- | | -- | | | | x | | |
| 4. | Broad area | Basic Bio Sciences | | Food Engineering | | Product Development | | | | Industrial Application | | |
| | | -- | | -- | | -- | | | | x | | |
| 5. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

| **FP1108** | **FOOD PLANT LAYOUT AND DESIGN** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | Total Contact Hours - 45 | **3** | **0** | **0** | **3** |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

To impart the basic principles and knowledge about the food plant layout and design, selection of location and machineries.

| INSTRUCTIONAL OBJECTIVES | |
|---|---|
| 1. | To educate the students regarding selection parameters for the location of food processing industry. |
| 2. | To enable the students to design layout of various types of food processing industries. |

**UNIT I-INTRODUCTION (9hours)**

Introduction to plant design - special features of food process industry-types of processing machineries-Manufacturing processes-concept -types-special features for fruit, vegetable, bakery & milk products - Characteristics of an efficient layout

**UNIT II-SELECTION OF PLANT LOCATION (9 hours)**

Plant location, location theory and models, Plant location factors-plant site selection-estimation of series- peak and critical load-Economic plant size-plant layout objectives-classical and practical layout.

**UNIT III-DEVELOPMENTOF THE LAYOUT (9 hours)**

Development and presentation of the layout, selection of site and Location of plant, General points of considerations for designing food plant, floor plant types of layouts Food building planning, -preparation of machinery layout for fruit, vegetables and meat-size reduction machinery layout

**UNIT IV-EVAPORATIONAND DRYING PLANT LAYOUT (9hours)**

Evaporation plant layout-single, multiple, vacuum and film evaporators-types and concepts, drying plant layout, drying process, drier types, selection of driers.

**UNIT V-PROCESSING PLANT LAYOUT (9 hours)**

Baking oven and frying plant-types, concepts and layout. Filling closing and labeling plant layout.Organization and trends in plant layout - sample layout, installation procedure for food processing plant.

**TEXT BOOKS**

1. James, M.More, "*Plant Layout and Design*". MacMillian Publishing Co., New York 1976.
2. Slade, F.H, "*Food processing plant*". Leonardhill Books, London1967.

**REFERENCES**


1. American Society of Heating, "*Refrigerating and Air-Conditioning Engineer*s", Ashrae Handbook, Fundamentals. ASHRAE, Atlanta, Georgia 1981.
2. Hall,H.S and Y.Rosen, "*Milk plant layout*" (F.A.O. Publication) 1976.


| FP1108FOOD PLANT LAYOUT AND DESIGN | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Designed by** | | **Department of Food Process Engineering** | | | | | | | | | | |
| 1. | Student Outcomes | a | b | c | d | e | f | g | h | i | j | k |
| | | X | | | | | | | | | | |
| 2. | Mapping of instructional objectives with student outcome | 1-2 | | | | | | | | | | |
| 3. | Category | General (G) | | Basic Sciences(B) | | Engineering Sciences and Technical Arts(E) | | | | Professional Subjects(P) | | |
| | | -- | | -- | | -- | | | | x | | |
| 4. | Broad area | Basic Bio Sciences | | Food Engineering | | Product Development | | | | Industrial Application | | |
| | | -- | | -- | | -- | | | | x | | |
| 5. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

| FP1109 | BEVERAGE PROCESSING | L | T | P | C |
|---|---|---|---|---|---|
| | Total Contact Hours - 45 | **3** | **0** | **0** | **3** |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

This subject is introduced with the basic objective to impart knowledge and skills of process techniques and equipment used for the production of beverages to the students.

**INSTRUCTIONAL OBJECTIVES**

At the end of this course students should be able to

| | |
|---|---|
| 1. | Understand various concepts, principles and procedures involved in processing of beverages. |
| 2. | Demonstrate various UNIT operations involved in the food beverage manufacturing. |
| 3. | List the quality control steps in beverage preparation. |

**UNIT I-BASICINGREDIENTS IN BEVERAGES (9 hours)**

Beverage-definition-why we drink beverages-ingredients- water, carbon dioxide, bulk and intense sweeteners, water miscible and water dispersible flavouring agents, colours – natural and artificial, Micro and nanoemulsions of flavors and colors in beverages,
preservatives, emulsifiers and stabilizers.

**UNIT II-BEERAND WINE MANUFACTURE (9 hours)**

Ingredients- Malt- hops- adjuncts- water, yeast. Beer manufacturing process-malting, preparation of sweet wort, brewing, fermentation, pasteurization and packaging. Beer defects and Spoilage.Wine-fermentation-types –red and white. Wine defects and spoilage

**UNIT III-CARBONATEDBEVERAGES (9 hours)**

Procedures- carbonation equipments-ingredients-preparation of syrups-Filling system-packaging-containers and closures

**UNIT IV-NON CARBONATED BEVERAGE (9 hours)**

Coffee bean preparation-processing-brewing-decaffeination- instant coffee-Tea-types-black, green and oolong- fruit juices, nectars, quash, RTS beverages, isotonic Beverages. Flash pasteurization, Canning and Aseptic Packaging of beverages

**UNIT V-QUALITYCONTROL (9 hours)**

Effective application of quality controls- sanitation and hygiene in beverage industry-Quality of water used in beverages - threshold limits of various ingredients according to PFA, EFSA and FDA – Absolute requirements of Soluble solids and titrable acidity in beverages.

**TEXT BOOKS**


1. Ashurst, P.R, "*Chemistry and technology of Soft drink and fruit juices*", 2nd edition, Blackwell Publishing Ltd. 2005.
2. Steen, D.P and Ashurst, P.R, "*Carbonated soft drinks – Formulation and manufacture*", Blackwell Publishing Ltd. 2000.
3. Shankunthala Manay, N. and Shadakdharaswamy, M, "*Foods – Facts and Principles*", New Age International Pvt. Ltd, 3rd revised edition 2000.
4. Charles, W.Bamforth, "*Food, fermentation and microorganisms*", Blackwell Science Publishing Ltd. 2005.

**REFERENCES**


1. Amalendu Chakraverty et al, "*Handbook of Post Harvest Technology"*, Ed:.,Marcel Dekker Inc. (Special Indian edition) 2000.
2. Robert.W.Hutkins, "*Microbiology and Technology of Fermented foods*", IFT Press, Blackwell Publishing Ltd. 2006.
3. *"Brewing yeast and fermentation Chris Boulton and David Quain"*, Blackwell Science Ltd
4. *"Prevention of Food Adulteration Acts and Rules Manual"*


<table>
<tr><td colspan="14">FP1109BEVERAGE PROCESSING</td></tr>
<tr><td colspan="2">Course Designed by</td><td colspan="12">Department of Food Process Engineering</td></tr>
<tr><td rowspan="2">1.</td><td rowspan="2">Student Outcomes</td><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td><td>f</td><td>g</td><td>h</td><td>i</td><td>j</td><td>k</td></tr>
<tr><td>X</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2.</td><td>Mapping of instructional objectives with student outcome</td><td>1-3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">3.</td><td rowspan="2">Category</td><td colspan="2">General (G)</td><td colspan="2">Basic Sciences(B)</td><td colspan="4">Engineering Sciences and Technical Arts(E)</td><td colspan="3">Professional Subjects(P)</td></tr>
<tr><td colspan="2">--</td><td colspan="2">--</td><td colspan="4">--</td><td colspan="3">x</td></tr>
<tr><td rowspan="2">4.</td><td rowspan="2">Broad area</td><td colspan="2">Basic Bio Sciences</td><td colspan="2">Food Engineering</td><td colspan="4">Product Development</td><td colspan="3">Industrial Application</td></tr>
<tr><td colspan="2">--</td><td colspan="2">--</td><td colspan="4">--</td><td colspan="3">x</td></tr>
<tr><td>5.</td><td>Approval</td><td colspan="12">23rd Meeting of Academic Council, May 2013</td></tr>
</table>

## SEMESTER VII

| | | | | | |
|---|---|---|---|---|---|
| **FP1110** | **FOOD ADDITIVES** | **L** | **T** | **P** | **C** |
| | Total Contact Hours - 45 | **3** | **0** | **0** | **3** |
| | Prerequisite | | | | |
| | Nil | | | | |

| **PURPOSE** | |
|---|---|
| 1. | To build fundamental knowledge of food additives |
| 2. | T o provide role of factors influencing the activity of food additives in food |

| **INSTRUCTIONAL OBJECTIVES** | |
|---|---|
| 1. | To inculcate the students about the role and activity of chemical and natural food additives theoretically. |
| 2. | Students will get exposure to food additives and their functions on food |
| 3. | They can access the quality and quantity of food additives |
| 4. | They can able to predict the permissible additives and limits in the food. |

**UNIT I-INTRODUCTION** **(8 hours)**

Food Additives-definition, properties, functions and usage of food additives.Intentional and non-intentional food additives.Chemical Preservative, bio preservatives, nutritive additives.

**UNIT II-FIAVOURANTS** **(9 hours)**

Flavourants flavour enhancers, solvents, enzymes, gases. Natural and synthetic flavourants. The chemical properties- level of addition of individual falvour enhancers. Sources of natural flavourants of synthesis and characterization of flavournats.Application of flavourants in food products.

**UNIT III-COLOURANTS** **(9 hours)**

Ingredients-Colouring agents.Natural and synthetic colorants.Types, chemical properties, levels of addition of individual products.Extraction and purification of colourants from natural sources.Usage of colournats in food product industries.

**UNIT IV-THERADDITIVES** **(9 hours)**

Antioxidants, emulsifiers, pH control agents and acidulants, texturizing agents.Artificial and natural sweeteners, chelating agents, anti -browning agents, humectants.Natural and synthetic agents and their usage food product industries.

**UNITV-LEGISLATIONAND LAWS GOVERNING FOOD ADDITIVES (10 hours)**

Food additives and food labelling in European Union.Determination of the limits for addition.Contaminants.Pesticide residues in food.Methods to determining toxicity.Food contaminants from industrial wastes -heavy metals, polychlorinated polyphenyls, dioxins. Toxicants formed during food processing polycyclic aromatic hydrocarbons, nitrosamines, etc. FDA, PFA, FPO and FSSA specifications for food additives. Laws and regulations for food additives and ingredients in processed foods.

**TEXT BOOKS**


1. Baines. D, "*Natural food additives, ingredients and flavourings*". WoodheadPublishingwebsite.http://www.woodheadpublishing.com/en/book.aspx?bookID=2063. (2000)
2. World Health Organization (WHO), "*Guidelines for Risk Assessment; Application of Risk Analysis to Food Standards Issues*", a Joint FAO/WHO Expert Consultation, Geneva, Switzerland, 13–17 March1995. http://www.who.int/foodsafety/publications/micro/march1995/en/ index.htm.


**REFERENCES**


1. Jim Smith and Hong Shum, "*Food Additives data book*". 2nd Edition, Wiley-Blackwell publishers (e-Book) 2011.
2. http://www.taylorandfrancis.com/books/textbooks/SCFS10.
3. Brannen A.L., Davidson P.M., Salminen S. and Thorngate J.H, "Food additives, 2nd Edition, Revised and Expanded. Marcel Dekker Inc. USA 2002.


| FP1110 FOOD ADDITIVES | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Designed by** | | **Department of Food Process Engineering** | | | | | | | | | | |
| 1. | Student Outcomes | a | b | c | d | e | f | g | h | i | j | k |
| | | X | | | | | | | | | | |
| 2. | Mapping of instructional objectives with student outcome | 1-4 | | | | | | | | | | |
| 3. | Category | General (G) | | Basic Sciences(B) | | Engineering Sciences and Technical Arts(E) | | | | Professional Subjects(P) | | |
| | | -- | | -- | | -- | | | | x | | |
| 4. | Broad area | Basic Bio Sciences | | Food Engineering | | Product Development | | | | Industrial Application | | |
| | | -- | | -- | | -- | | | | x | | |
| 5. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

| FP1111 | FOOD INDUSTRY WASTE MANAGEMENT | L | T | P | C |
|---|---|---|---|---|---|
| | Total Contact Hours - 45 | 3 | 0 | 0 | 3 |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

To make the students in understanding about the sources and nature of wastes obtained from various food industries and the ways to convert it into valuable products.

**INSTRUCTIONAL OBJECTIVES**

Students completing this course should

| | |
|---|---|
| 1. | Be able to list the wastes obtained from different food processing industries. |
| 2. | Understanding the properties of different food industry wastes. |
| 3. | Able to recognize and communicate common processes which allow the different food processing waste to be converted into valuable products. |

**UNIT I-WASTE UTILIZATION FROM CEREAL FOOD INDUSTRIES (11 hours)**

Different sources of wastes from food industries and their availability in India- nature of different waste - Waste utilisation from rice mill - Thermal and biotechnological uses of rice husk - pyrolysis and gasification of rice husk - cement preparation and different thermal applications - utilisation of rice bran - - stabilization - defatted bran utilisation.

**UNIT II-UTILIZATION OF FRUIT AND VEGETABLE WASTES (9 hours)**

Processes for Waste utilization from fruit and vegetable industries- Distillation for production of alcohol - oil extraction from waste - waste management in sugar mills - citric acid production from fruit waste.

**UNIT III-FISH, MEAT AND POULTRY WASTE UTILISATION (7 hours)**

Fish industry by products and waste utilisation - meat and poultry waste recycling.

**UNIT IV-TUBERCROPS WASTE UTILISATION (9 hours)**

Waste from tuber crops - effluent safe disposal- effluent treatment plant- waste recycling plant - feasibility report for food industries using food waste and by products.

**UNIT V-BY- PRODUCT UTILIZATION OF WHEAT AND PULSE MILL (9 hours)**

By products of wheat milling – germs and bran – by products of pulse milling – husk, germs and broken. Coconut processing – by- product utilization – fuel briquette.

**TEXT BOOKS**

1. Bor S. Luli (ed), "*Rice Production and Utilisation*"
2. Beagle, "*Rice Husk Conversion to Energy*"

**REFERENCES**

1. Chereminoff P. N. & A.C Morresi, "*Energy from Solid Wastes*" 1976,
2. Chakravarthy & De, "*Agricultural Waste and By Product Utilisation*".

| **FP1111 FOOD INDUSTRY WASTE MANAGEMENT** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Designed by** | | **Department of Food Process Engineering** | | | | | | | | | | |
| 1. | Student Outcomes | a | b | c | d | e | f | g | h | i | j | k |
| | | X | | | | | | | | | | |
| 2. | Mapping of instructional objectives with student outcome | 1-3 | | | | | | | | | | |
| 3. | Category | General (G) | | Basic Sciences(B) | | Engineering Sciences and Technical Arts(E) | | | | Professional Subjects(P) | | |
| | | -- | | -- | | -- | | | | x | | |
| 4. | Broad area | Basic Bio Sciences | | Food Engineering | | Product Development | | | | Industrial Application | | |
| | | -- | | -- | | -- | | | | x | | |
| 5. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

| **FP1112** | **MANAGEMENT OF FOOD PROCESS INDUSTRIES** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | Total Contact Hours – 45 | **3** | **0** | **0** | **3** |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

This course helps the student in understanding different techniques involved in managing food industries.

**INSTRUCTIONAL OBJECTIVES**

1. The concept of production and inventory management

| | |
|---|---|
| 2. | Understanding food quality and safety management system |
| 3. | Finance and market management |
| 4. | Know the concept and implementation of food product law in food industry |

**UNIT I-GENERALMANAGEMENT AND ECONOMICS (9 hours)**

Management-definition-functions of management- steps in planning- organizing-staffing-motivation- leadership and controlling process-economics-definition-types-demand and supply-theories-law of demand and supply-types of markets-types of pricing strategies

**UNIT II-PRODUCTIONMANAGEMENT (9 hours)**

Product design characteristics-new product development-types of production systems-plant location and layout techniques-process planning- MRP-I and MRP-II, Inventory management, EOQ, EBQ, ABC and VED analysis, CPM and PERT network analysis

**UNIT III-FOODQUALITY AND SAFETY MANAGEMENT SYSTEM (9 hours)**

Quality control vs quality assurance, principles of TQM,Quality control tools,food quality evaluation-subjective and objective methods-qualty factors in raw material-WIP and finished products-GMP-Hygiene and safety practices for building of machineries and equipments,food safety management system ISO (9000, 14000, 22000), BIS, APEDA and AGMARK

**UNIT IV-MARKETINGMANAGEMENT (9 hours)**

Marketingmanagement-definition-scope-significance-marketing environment-marketing mix-marketing segmenting-targeting and positioning-consumer buying behavior-CRM- market research and competition advantages and strategies

**UNITV-FOOD LAWS ANS REGULATIONS (9 hours)**

Prevention of food adulteration act- Fruit product order- Food and agriculture organization- world health organization-CODEX Alimentarius- Milk and milk product order- FSSAI

**TEXT BOOKS**


1. Sherilaker, "*Marketing management*". Himalaya Publishing Company 1985.
2. Metha, P.L, "*Managerial Economics*"- Analysis, Problems and cases, Sultan Chand and Sons, New Delhi 1999.
3. Krammer, A. and Twigg, B.A, "*Quality control for the food industry*". 3rd Ed., AVI. Westport 1970.

4. Ranganna, S, "*Hand book of analysis and Qualtiy control for fruits and vegetable products".* Tata Mc Graw hill. New Delhi 1986.

**REFERENCES**

1. Philip Kotler, "*Marketing management*", Prentice Hall of India 1985.
2. Brigham, Eugene, F, "*Fundamentals of financial management*", The dryden press 1989.
3. Sohrab, "*Integrated ISO 9001 HACCP system for food processing industries"*. Springer Publications2002.
4. Rekha.S.Singhtal, Pushpa. R.Gulgarni, "*Handbook of indices of food quality & HACCP-A practical approach*". Springer Publications 1998.

| FP1112 MANAGEMENT OF FOOD PROCESS INDUSTRIES | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course Designed by | | Department of Food Process Engineering | | | | | | | | | | |
| 1. | Student Outcomes | a | b | c | d | e | f | g | h | i | j | k |
| | | X | | | | | | | | | | |
| 2. | Mapping of instructional objectives with student outcome | 1-4 | | | | | | | | | | |
| 3. | Category | General (G) | | Basic Sciences(B) | | Engineering Sciences and Technical Arts(E) | | | | Professional Subjects(P) | | |
| | | -- | | -- | | -- | | | | x | | |
| 4. | Broad area | Basic Bio Sciences | | Food Engineering | | Product Development | | | | Industrial Application | | |
| | | -- | | -- | | -- | | | | x | | |
| 5. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

| FP1113 | EMERGING NON THERMAL METHODS OF FOOD PRESERVATION | L | T | P | C |
|---|---|---|---|---|---|
| | Total Contact Hours – 45 | 3 | 0 | 0 | 3 |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

To develop an appreciation of need and methods of non thermal food preservation technologies.

**INSTRUCTIONAL OBJECTIVES**

This course provide the knowledge on

| | |
|---|---|
| 1. | The need of preserving food substances by non thermal methods |
| 2. | Irradiation of foods |
| 3. | The application of ozone in food industries |
| 4. | Other emerging non-thermal methods of food preservation techniques. |

**UNIT I-FOOD IRRADIATION (9 hours)**

Introduction, type and sources of radiation, dosimetry, mode of action of ionizing radiation – direct and indirect effect, radiation effect on food constituents, dose requirement for different products and regulations.

**UNIT II-EMERGING STORAGE AND PACKAGING METHODS (11 hours)**

Controlled atmosphere storage- modified atmosphere storage- Diffusion channel - controlled atmosphere packaging, modified atmosphere packaging, vacuum packaging - need of modifying atmospheric gas composition – types of scrubbers

**UNIT III-MINIMAL PROCESSING (9 hours)**

Minimal processing – hurdle technology – various parameters which inhibits the growth of microorganism. Ozone – its role in food industry – generation – application. Intermediate moisture foods – formulation – preparation

**UNIT IV-MEMBRANE TECHNOLOGY (9 hours)**

Membrane technology – terminologies-types of membrane- types of membrane modules- osmosis- reverse osmosis- ultra filtration- changes during concentration.

**UNIT V-RECENT ADVANCEMENT IN FOOD PRESERVATION (7 hours)**

Pulsed electrified sterilization - application. High pressure technology – application, Oscillating magnetic field sterilization, Ultra sound, Ohmic heating – application in food industry.

**TEXT BOOKS**


1. Lal and Siddappa., "*Fruit and Vegetable preservation*", ICMR 1986.
2. Manoranjan Kalia and Sangita, "*Food preservation and processing*". Kalyani Publishers. Ludhiana 1996.
3. Srivastha R.P. and Sanjeev kumar, "*Fruit and vegetable Preservation*" 1998.


**REFERENCES**


1. Fellows, P.J, "*Food Processing Technology*" 2001.

2. Leninger, H.A. and Beverlod, W.A. "*Food Process Engineering*", D.Reicle Pub. Corp.

| FP1113 EMERGING NON THERMAL METHODS OF FOOD PRESERVATION | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Designed by** | | **Department of Food Process Engineering** | | | | | | | | | | |
| 1. | Student Outcomes | a | b | c | d | e | f | g | h | i | j | k |
| | | X | | | | | | | | | | |
| 2. | Mapping of instructional objectives with student outcome | 1-4 | | | | | | | | | | |
| 3. | Category | General (G) | | Basic Sciences(B) | | Engineering Sciences and Technical Arts(E) | | | | Professional Subjects(P) | | |
| | | -- | | -- | | -- | | | | x | | |
| 4. | Broad area | Basic Bio Sciences | | Food Engineering | | Product Development | | | | Industrial Application | | |
| | | -- | | x | | -- | | | | x | | |
| 5. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

| FP1114 | NUTRACEUTICALS AND FUNCTIONAL FOODS | L | T | P | C |
|---|---|---|---|---|---|
| | Total Contact Hours – 45 | 3 | 0 | 0 | 3 |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

This course will cover the classification, brief history and the impact of nutraceuticals and functional foods on health and disease prevention. Nutraceuticals to be covered in the course include isoprenoids, isoflavones, flavanoids, carotenoids, lycopene, garlic, omega 3 fatty acids, sphingolipids, vitamin E and antioxidants, herbal products in foods. Also marketing issues related to functional foods and nutraceuticals as well as stability testing will be reviewed.

**INSTRUCTIONAL OBJECTIVES**

| | |
|---|---|
| 1. | To understand the interrelationship between nutraceuticals and health maintenance. |
| 2. | Cite the evidence supporting the efficacy and safety of nutraceutical and functional food products |
| 3. | To explain the metabolic consequences of nutraceuticals and functional foods. |
| 4. | Describe the physiologic and biochemical changes associated with consumption of nutraceuticals. |

**UNIT I-INTRODUCTION (8 hours)**

Introduction, definition, Modification in the definition of nutraceuticals.Classification of nutraceuticals, Nutraceuticals market scenario, formulation considerations.Challenges for Nutraceuticals.

**UNIT II-POTENTIALNUTRACEUTICAL INGREDIENTS FROM PLANT ORIGIN (10 hours)**

Nutraceuticals value of spices and seasoning – Turmeric, mustard, chilli cumin, fenugreek, black cumin, fennel, asafoetidia, garlic, ginger, onion, clove, cardamom etc., Nutraceuticals from fruits and vegetables- mango, apple, grapes, bel, banana, broccoli, tomato, bitter melon, bitter organge.

**UNIT III-NUTRACEUTICALSFROM ANIMAL AND MINERAL (9 hours)**

Omega -3 fatty acids from fish- Typical properties, structural formula, functional category. CLA- typical properties, structural formula, functional category.Application in Nutraceuticals.Calcium, chromium, copper, iodine, iron, magnesium, Zn- mechanism of action, bioavailability, uses and deficiency, dietary sources.

**UNIT IV-PROBIOTICSAND PREBIOTICS AS NUTRACEUTICAL (10 hours)**

Definition, classification – Type of classification (Probiotics, probiotics and synbiotics: Taxonomy and important features of probiotic microorganisms. Health effects of probiotics including mechanism of action. Probiotics in various foods: fermented milk products, non-milk products etc. Prebiotics. Definition, chemistry, sources, metabolism and bioavailability, effect of processing, physiological effects, effects on human health and potential applications in risk reduction of diseases, perspective for food applications for the following: Non-digestible carbohydrates/oligosaccharides: Dietary fibre, Resistant starch, Gums.

**UNIT V-PHYSIOCHEMICALCHARACTERIZATION OF NUTRACEUTICALS AND THIER ANTIOXIDANT ACTIVITY (8 hours)**

Phytosterol, fatty acids, carotenoids, anthocyanins, carotenoids, amino acids, water soluble vitamins, Free radical biology and antioxidant activity of nutraceuticals.

**TEXT BOOKS**

1. Kramer, Hoppe and Packer,"*Nutraceuticals in Health and Disease Prevention*", Marcel Dekker, Inc., NY 2001.
2. Bao and Fenwick, "*Phytochemicals in Helath and Disease*", Marcel Decker, Inc. NY 2004.

**REFERENCES**

1. Yashwant Pathak, "*Handbook of Nutraceuticals and Functional Foods. Vol. 1. (Ingredients, formulations, and applications)"* CRC Press 2005.
2. Robert Wildman, "*Handbook of Nutraceuticals and Functional Foods*". 2nd edition. CRC Press 2001.

| **FP1114 NUTRACEUTICALS AND FUNCTIONAL FOODS** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Designed by** | | **Department of Food Process Engineering** | | | | | | | | | | |
| 1. | Student Outcomes | a | b | c | d | e | f | g | h | i | j | k |
| | | X | | | | | | | | | | |
| 2. | Mapping of instructional objectives with student outcome | 1-4 | | | | | | | | | | |
| 3. | Category | General (G) | | Basic Sciences(B) | | Engineering Sciences and Technical Arts(E) | | | | Professional Subjects(P) | | |
| | | -- | | -- | | -- | | | | x | | |
| 4. | Broad area | Basic Bio Sciences | | Food Engineering | | Product Development | | | | Industrial Application | | |
| | | -- | | -- | | -- | | | | x | | |
| 5. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

| **FP1115** | **NANOTECHNOLOGY IN FOOD PROCESSING** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | Total Contact Hours - 45 | **3** | **0** | **0** | **3** |
| | Prerequisite | | | | |
| | Nil | | | | |

**PURPOSE**

Provides the knowledge about nano materials and its application in food industries.

**INSTRUCTIONAL OBJECTIVES**

| | |
|---|---|
| 1. | To provide basic information about nano materials for manufacturing nano particles. |
| 2. | To learn about instrumentation for analyzing nanoparticles. |
| 3. | To adopt nanotechnology techniques in food industries |

**UNIT I-INTRODUCTION** **(9 hours)**

Definition of nanotechnology, potential applications related to food, functional materials in food nanotechnology, nano-nutraceuticals and nano functional foods, nanotechnology and risk assessment-regulatory approaches to nanotechnology in food industries

**UNIT II-NANOMATERIALSAND MANUFACTURE** **(9 hours)**

Nanomaterials technology- nano powder production-nano particles manufacture-nanotechnology devices- analytical methods for nanotechnology

**UNIT III - NANOPARTICLES** **(9 hours)**

Nanofilters, nanotubes, nanoclay, nanofilms, nanomembranes, nanoemulsions, nanocomposite, nano laminates, nanoscale food additives – nanolycopene

**UNIT IV-NANOSCALEDELIVERY SYSTEMS FOR FOOD FUNCTIONALIZATION**

Liposomes- nano cochleates- hydrogels based nanoparticles- dendrimers- lipid nanoparticles- polymeric nano particles- anno crystalline particles – delivery systems – mode of action.

**UNIT V-NANOTECHFOR FOOD INDUSTRIES** **(11 hours)**

Nanotechnology in food industry- Food quality monitoring- nanosensors-nanotechnology in food microbiology-bacterial identification- antimicrobial packaging-improved food storage- green packaging-tracking-tracing and brand products-nanotechnology research in food industry.

**TEXT BOOKS**


1. Pandua W., "*Nanotech research methods for foods and bioproducts*", Wiley publications 2012.
2. FulekarM.H.,"*Nanotechnology-Implications and applications*", International Publishing House (P) ltd 2010.


**REFERENCES**


1. Lestie prey, "*Nanotech in food products*", Wiley publications 2010.
2. James A Schwarz, "*Dekker encyclopedia of nanoscience and nanotechnology*". Marcel From instrumentation to nanotechnology. J. Gardner.1992. Taylor and Francis 2004.

| FP1115 NANOTECHNOLOGY IN FOOD PROCESSING | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Designed by** | | **Department of Food Process Engineering** | | | | | | | | | | |
| 1. | Student Outcomes | a | b | c | d | e | f | g | h | i | j | k |
| | | X | | | | | | | | | | |
| 2. | Mapping of instructional objectives with student outcome | 1-3 | | | | | | | | | | |
| 3. | Category | General (G) | | Basic Sciences(B) | | Engineering Sciences and TechnicalArts(E) | | | | Professional Subjects(P) | | |
| | | -- | | -- | | -- | | | | x | | |
| 4. | Broad area | Basic Bio Sciences | | Food Engineering | | Product Development | | | | Industrial Application | | |
| | | -- | | -- | | -- | | | | x | | |
| 5. | Approval | 23rd Meeting of Academic Council, May 2013 | | | | | | | | | | |

## AMENDMENT

| S.No. | Details of Amendment | Effective from | Approval with date |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |