# *Autonomy Curriculum Structure (to be effective from 2018-19 admission batch)*

# Department: FOOD TECHNOLOGY

## Curriculum for B. Tech.

| 1st Semester | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Sl No** | **Course Code** | **Paper Code** | **Theory** | **Contact Hours /Week** | | | | **Credit Points** |
| | | | | **L** | **T** | **P** | **Total** | |
| **A. THEORY** | | | | | | | | |
| 1 | BS | M 101 | Mathematics –I | 3 | 1 | 0 | 4 | 4 |
| 2 | BS | PH 101 | Physics- I | 3 | 0 | 0 | 3 | 3 |
| 3 | ES | EC 101 | Basic Electronics Engineering | 3 | 0 | 0 | 3 | 3 |
| 4 | HS | HU 101 | English | 2 | 0 | 0 | 2 | 2 |
| **Total of Theory** | | | | | | | **12** | **12** |
| **B. PRACTICAL** | | | | | | | | |
| 5 | BS | PH191 | Physics- I Lab | 0 | 0 | 3 | 3 | 1.5 |
| 6 | ES | EC 191 | Basic Electronics Engineering Lab | 0 | 0 | 3 | 3 | 1.5 |
| 7 | ES | ME 192 | Workshop/Manufacturing Practices | 0 | 0 | 3 | 3 | 1.5 |
| 8 | PROJ | PR 191 | PROJECT-IA | 0 | 0 | 1 | 1 | 0.5 |
| 9 | PROJ | PR 192 | PROJECT-IB | 0 | 0 | 1 | 1 | 0.5 |
| **C. MANDATORY ACTIVITIES / COURSES** | | | | | | | | |
| 10 | MC | MC 181 | Induction Program | 0 | 0 | 0 | 0 | |
| **Total of Theory, Practical & Mandatory Activities/Courses** | | | | | | | **22** | **17.5** |

| 2nd Semester | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Sl No** | **Course Code** | **Paper Code** | **Theory** | **Credit Hours /Week** | | | | **Credit Points** |
| | | | | **L** | **T** | **P** | **Total** | |
| **A. THEORY** | | | | | | | | |
| 1 | BS | M 201 | Mathematics –II | 3 | 1 | 0 | 4 | 4 |
| 2 | BS | CH 201 | Chemistry | 3 | 0 | 0 | 3 | 3 |
| 3 | ES | EE 201 | Basic Electrical Engineering | 3 | 0 | 0 | 3 | 3 |
| 4 | ES | CS 201 | Programming for Problem Solving | 3 | 0 | 0 | 3 | 3 |
| 5 | ES | ME 201 | Engineering Mechanics | 3 | 0 | 0 | 3 | 3 |
| **Total of Theory** | | | | | | | **16** | **16** |
| **B. PRACTICAL** | | | | | | | | |
| 6 | ES | CS291 | Programming for Problem Solving Lab | 0 | 0 | 3 | 3 | 1.5 |
| 7 | BS | CH 291 | Chemistry Lab | 0 | 0 | 3 | 3 | 1.5 |
| 8 | ES | EE 291 | Basic Electrical Engineering Lab | 0 | 0 | 3 | 3 | 1.5 |
| 9 | ES | ME 291 | Engineering Graphics & Design | 0 | 0 | 3 | 3 | 1.5 |
| 10 | HS | HU 291 | Language Lab | 0 | 0 | 2 | 2 | 1 |
| 11 | PROJ | PR 291 | Project-II | 0 | 0 | 1 | 1 | 0.5 |
| 12 | PROJ* | PR 292 | Innovative activities-I | 0 | 0 | 0 | 0 | 0.5 |
| **C. MANDATORY ACTIVITIES / COURSES** | | | | | | | | |
| 13 | MC | MC 281 | NSS/ Physical Activities/Meditation & Yoga/Photography/ Nature Club | 0 | 0 | 0 | 3 | |
| **Total of Theory, Practical & Mandatory Activities/Courses** | | | | | | | **34** | **24.0** |

* Inter/ Intra Institutional Activities viz; Training with higher Institutions; Soft skill training organized by Training and Placement Cell of the respective institutions; contribution at incubation/ innovation /entrepreneurship cell of the institute; participation in conferences/ workshops/ competitions etc.; Learning at Departmental Lab/ Tinkering Lab/ Institutional workshop; Working in all the activities of Institute's Innovation Council for eg: IPR workshop/Leadership Talks/ Idea/ Design/ Innovation/ Business Completion/ Technical Expos etc. (evaluation by Programme Head through certification)

Innovative activities to be evaluated by the Programme Head/ Event coordinator based on the viva voce and submission of necessary certificates as evidence of activities.

| 3rd Semester | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Sl No** | **Field** | **Paper Code** | **Theory** | **Contact Hours /Week** | | | | **Credit Points** |
| | | | | **L** | **T** | **P** | **Total** | |
| **A. THEORY** | | | | | | | | |
| 1 | ES | CH(FT) 301 | Environmental Engineering | 2 | 0 | 0 | 2 | 2 |
| 2 | BS | CH(FT) 302 | Chemistry-2 | 2 | 1 | 0 | 3 | 3 |
| 3 | ES | FT 301 | Thermodynamics & Kinetics | 2 | 1 | 0 | 3 | 3 |
| 4 | PC | FT 302 | Food Microbiology | 2 | 1 | 0 | 3 | 3 |
| 5 | PC | FT303 | Chemistry of food | 2 | 1 | 0 | 3 | 3 |
| **Total of Theory** | | | | | | | **14** | **14** |
| **B. PRACTICAL** | | | | | | | | |
| 6 | ES | CH (FT)391 | Environmental Engineering Lab | 0 | 0 | 3 | 3 | 1.5 |
| 7 | BS | CH(FT)392 | Chemistry-2 Lab | 0 | 0 | 3 | 3 | 1.5 |
| 8 | PC | FT391 | Chemistry of Food Lab–I | 0 | 0 | 3 | 3 | 1.5 |
| 9 | PC | FT392 | Food Microbiology Lab | 0 | 0 | 3 | 3 | 1.5 |
| 10 | PROJ | PR 391 | Project-III | 0 | 0 | 2 | 2 | 1 |
| 11 | PROJ* | PR 392 | Innovative activities-II | 0 | 0 | 0 | 1 | 0.5 |
| **C. MANDATORY ACTIVITIES / COURSES** | | | | | | | | |
| 12 | MC | MC 381 | Behavioral and Interpersonal Skills | 0 | 0 | 3 | 3 | |
| **Total of Theory, Practical & Mandatory Activities/Courses** | | | | | | | **32** | **21.5** |

*Students may choose either to work on participation in all the activities of Institute's Innovation Council for eg: IPR workshop/ Leadership Talks/ Idea/ Design/ Innovation/ Business Completion/ Technical Expos etc.

Innovative activities to be evaluated by the Programme Head/ Event coordinator based on the viva voce and submission of necessary certificates as evidence of activities.

| 4th Semester | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Sl No** | **Field** | **Paper Code** | **Theory** | **Contact Hours /Week** | | | | **Credit Points** |
| | | | | **L** | **T** | **P** | **Total** | |
| **A. THEORY** | | | | | | | | |
| 1 | ES | M(FT)401 | Numerical Methods | 2 | 0 | 0 | 2 | 2 |
| 2 | PC | FT401 | Biochemistry & Nutrition | 2 | 1 | 0 | 3 | 3 |
| 3 | BS | CH401 | Chemical Stoichiometry | 2 | 1 | 0 | 3 | 3 |
| 4 | PC | FT402 | Principles of Food Preservation | 2 | 1 | 0 | 3 | 3 |
| 5 | HS | HU 401 | Values & Ethics in Profession | 2 | 0 | 0 | 2 | 2 |
| 6 | PE | FT 403 | A. Unit Operation of Chemical Engineering-1<br>B. Transport Phenomena | 3 | 0 | 0 | 3 | 3 |
| **Total of Theory** | | | | | | | **16** | **16** |
| **B. PRACTICAL** | | | | | | | | |
| 6 | PC | FT491 | Biochemistry Lab | 0 | 0 | 3 | 3 | 1.5 |
| 7 | PC | FT 492 | Chemistry of Food Lab-II | 0 | 0 | 3 | 3 | 1.5 |
| 8 | PE | FT 493 | A. Unit operation Lab–I<br>B. Transport phenomena Lab | 0 | 0 | 3 | 3 | 1.5 |
| 9 | PROJ | PR 491 | Project-IV | 0 | 0 | 2 | 2 | 1 |
| 10 | PROJ* | PR 492 | Innovative activities-III | 0 | 0 | 0 | 0 | 0.5 |
| **C. MANDATORY ACTIVITIES / COURSES** | | | | | | | | |
| 11. | MC | MC 401 | Environment Sciences | 3 | 0 | 0 | 3 | |
| | | | | | | | | |
| **Total of Theory, Practical & Mandatory Activities/Courses** | | | | | | | **30** | **22** |

*Students may choose either to work on participation in all the activities of Institute's Innovation Council for eg: IPR workshop/ Leadership Talks/ Idea/ Design/ Innovation/ Business Completion/ Technical Expos etc.

Innovative activities to be evaluated by the Programme Head/ Event coordinator based on the viva voce and submission of necessary certificates as evidence of activities.

| 5th Semester | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Sl No** | **Field** | **Paper Code** | **Theory** | **Contact Hours /Week** | | | | **Credit Points** |
| | | | | **L** | **T** | **P** | **Total** | |
| **A. THEORY** | | | | | | | | |
| 1 | HS | HU 502 | Economics for Engineers | 2 | 0 | 0 | 2 | 2 |
| 2 | PC | FT501 | Food Process Technology–I (Cereals, Fruits, Vegetables, Beverages) | 3 | 0 | 0 | 3 | 3 |
| 3 | PC | FT502 | Food Process Technology–II (Fish, Meat, Poultry) | 3 | 1 | 0 | 4 | 4 |
| 4 | PC | FT503 | Food Process Engineering | 2 | 1 | 0 | 3 | 3 |
| 5 | PE | FT 504 | A. Unit Operations of Chemical Engineering–II<br>B. Separation Process | 3 | 0 | 0 | 3 | 3 |
| **Total of Theory** | | | | | | | **15** | **15** |
| **B. PRACTICAL** | | | | | | | | |
| 6 | PC | FT591 | Food Processing Lab–I | 0 | 0 | 3 | 3 | 1.5 |
| 7 | PC | FT592 | Food Analysis & Quality Control Lab | 0 | 0 | 3 | 3 | 1.5 |
| 8 | PE | FT 593 | A. Unit Operation Lab–II<br>B. Separation Process Lab | 0 | 0 | 3 | 3 | 1.5 |
| 9 | PROJ | PR 591 | Project-V | 0 | 0 | 2 | 2 | 1 |
| 10 | PROJ* | PR 592 | Innovative activities-IV | 0 | 0 | 0 | 0 | 0.5 |
| **C. MANDATORY ACTIVITIES / COURSES** | | | | | | | | |
| 11. | MC | MC 581 | Social Awareness | 0 | 0 | 3 | 3 | |
| **Total of Theory, Practical & Mandatory Activities/Courses** | | | | | | | **29** | **21** |

* Students may choose either to work on participation in Hackathons etc. Development of new product/ Business Plan/ registration of start-up.

Students may choose to undergo Internship / Innovation / Entrepreneurship related activities. Students may choose either to work on innovation or entrepreneurial activities resulting in start-up or undergo internship with industry/ NGO's/ Government organizations/ Micro/ Small/ Medium enterprises to make themselves ready for the industry/ Long Term goals under rural Internship. (Duration 4-6 weeks)

Innovative activities to be evaluated by the Programme Head/ Event coordinator based on the viva voce and submission of necessary certificates as evidence of activities.

| 6th Semester | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Sl No** | **Field** | **Paper Code** | **Theory** | **Contact Hours /Week** | | | | **Credit Points** |
| | | | | **L** | **T** | **P** | **Total** | |
| **A. THEORY** | | | | | | | | |
| 1 | PC | FT601 | Food Process Technology–III (Milk and Milk Products) | 3 | 1 | 0 | 4 | 4 |
| 2 | PC | FT602 | Food Process Technology–IV (Edible Fats and Oils) | 3 | 1 | 0 | 4 | 4 |
| 3 | PC | FT603 | Bakery, Confectionary and Extruded Foods | 3 | 0 | 0 | 3 | 3 |
| 4 | OE | FT604 | A. Microbial Technology & Food Biotechnology<br>B. Environmental Biotechnology | 3 | 0 | 0 | 3 | 3 |
| 5 | OE | FT 605 | A. Data Structure and Algorithm<br>B. Database Management System<br>C. Software Engineering | 3 | 0 | 0 | 3 | 3 |
| **Total of Theory** | | | | | | | **17** | **17** |
| **B. PRACTICAL** | | | | | | | | |
| 6 | PC | FT 691 | Food Processing Lab–II | 0 | 0 | 3 | 3 | 1.5 |
| 7 | OE | FT 692 | A. Microbial Technology Lab<br>B. Environmental Biotechnology Lab | 0 | 0 | 3 | 3 | 1.5 |
| 8 | OE | FT 693 | A. Data Structure and Algorithm Lab<br>B. Database Management System Lab<br>C. Software Engineering Lab | 0 | 0 | 3 | 3 | 1.5 |
| 9 | PROJ | PR 691 | Project-VI | 0 | 0 | 2 | 2 | 1 |
| 10 | PROJ* | PR 692 | Innovative activities-V | 0 | 0 | 0 | 0 | 0.5 |
| **C. MANDATORY ACTIVITIES / COURSES** | | | | | | | | |
| 11 | MC | MC601 | Constitution of India | 3 | 0 | 0 | 3 | |
| **Total of Theory, Practical & Mandatory Activities/Courses** | | | | | | | **31** | **23** |

*Students may choose either to work on participation in all the activities of Institute's Innovation Council for eg: IPR workshop/ Leadership Talks/ Idea/ Design/ Innovation/ Business Completion/ Technical Expos etc.

Innovative activities to be evaluated by the Programme Head/ Event coordinator based on the viva voce and submission of necessary certificates as evidence of activities.

| 7th Semester | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Sl No** | **Field** | **Paper Code** | **Theory** | **Contact Hours /Week** | | | | **Credit Points** |
| | | | | **L** | **T** | **P** | **Total** | |
| **A. THEORY** | | | | | | | | |
| 1 | HS | HU704 | Principles of Management | 2 | 0 | 0 | 2 | 2 |
| 2 | PC | FT701 | Waste Management of Food Industries | 2 | 1 | 0 | 3 | 3 |
| 3 | PE | FT 702 | A. Enzyme Technology<br>B. Renewable Energy Technology<br>C. Plant Maintenance, Safety& Hygiene | 3 | 0 | 0 | 3 | 3 |
| 4 | PE | FT703 | A. Food Packaging Technology<br>B. Functional Foods & Nutraceuticals<br>C. Protein Technology | 3 | 0 | 0 | 3 | 3 |
| 5 | OE | FT 704 | A. Process Instrumentation<br>B. Process Control Systems | 3 | 0 | 0 | 3 | 3 |
| **Total of Theory** | | | | | | | **14** | **14** |
| **B. PRACTICAL** | | | | | | | | |
| 6 | PC | FT791 | Food Engineering Lab | 0 | 0 | 3 | 3 | 1.5 |
| 7 | OE | FT792 | A. Instrumentation Laboratory<br>B. Process Control Systems Laboratory | 0 | 0 | 2 | 2 | 1 |
| 8 | PROJ | PR 791 | Project-VII | 0 | 0 | 0 | 5 | 2.5 |
| 9 | PROJ* | PR 792 | Innovative activities-VI | 0 | 0 | 0 | 0 | 0.5 |
| **C. MANDATORY ACTIVITIES / COURSES** | | | | | | | | |
| 10 | MC | MC781 | Innovation-Project Based-Sc. Tech, Social, Design & Innovation | 0 | 0 | 3 | 3 | |
| **Total of Theory, Practical & Mandatory Activities/Courses** | | | | | | | **27** | **19.5** |

*Students may choose either to work on participation in Hackathons etc. Development of new product/ Business Plan/ registration of start-up.

Students may choose to undergo Internship / Innovation / Entrepreneurship related activities. Students may choose either to work on innovation or entrepreneurial activities resulting in start-up or undergo internship with industry/ NGO's/ Government organizations/ Micro/ Small/ Medium enterprises to make themselves ready for the industry/ Long Term goals under rural Internship. (Duration 4-6 weeks)

Innovative activities to be evaluated by the Programme Head / Event Coordinator based on the viva voce and submission of necessary certificates as evidence of activities.

| 8th Semester | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Sl No** | **Field** | **Paper Code** | **Theory** | **Contact Hours /Week** | | | | **Credit Points** |
| | | | | **L** | **T** | **P** | **Total** | |
| **A. THEORY** | | | | | | | | |
| 1 | OE | FT 801 | A. Entrepreneurship Development and start-up management<br>B. Project Engineering & Plant Layout | 3 | 0 | 0 | 3 | 3 |
| 2 | PE | FT802 | A. Principles of Biochemical Engineering<br>B. Modeling & Simulation of Food Processing | 3 | 0 | 0 | 3 | 3 |
| **Total of Theory** | | | | | | | **6** | **6** |
| **B. PRACTICAL** | | | | | | | | |
| 3 | PC | FT891 | Product Development & Quality Assurance Lab | 0 | 0 | 3 | 3 | 1.5 |
| 4 | PROJ | PR 891 | Project-VIII | 0 | 0 | 8 | 8 | 4 |
| **C. MANDATORY ACTIVITIES / COURSES** | | | | | | | | |
| 5 | MC | MC801 | Essence of Indian Knowledge Tradition | 3 | 0 | 0 | 3 | |
| **Total of Theory, Practical & Mandatory Activities/Courses** | | | | | | | **20** | **11.5** |

***Mandatory Credit Point=160***

**For Honors additional 20 Credit Point is to be earned (1st Sem to 8th Sem) through MOOCs courses. All the Certificates received by the students across all semester for MOOCs Courses from approved organization (Appendix A) is to be submitted to CoE office prior to 8th Semester Examination.**

**Credit Distribution Ratio:**

| **Category** | **Total Credit Allocation** | **Credit Allocation As per AICTE** |
|---|---|---|
| Basic Sciences (BS) | 24.5 | 25* |
| Humanities & Social Sciences (HS) | 9 | 12* |
| Engineering Sciences and Skills (ES) | 28 | 24* |
| Professional Core (PC) | 49.5 | 48* |
| Professional Electives (PE) | 18 | 18* |
| Open Elective (OE) | 16 | 18* |
| Project work, seminar, internship | 15 | 15* |
| Mandatory Courses [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Knowledge Tradition etc.] | (non-credit) | (non-credit) |
| Total | 160 | 160 |

*Minor variation is allowed as per need of the respective disciplines (as per AICTE)

**Subject Distribution in Different Category:**

| Sl No | Paper Code | Theory | Contact Hours /Week | | | | Credit Points |
|---|---|---|---|---|---|---|---|
| | | | L | T | P | Total | |
| **A. Humanities, Social Sciences & Management Courses (HS)** | | | | | | | |
| 1 | HU 101 | English | 2 | 0 | 0 | 2 | 2 |
| 2 | HU 291 | Language Lab | 0 | 0 | 2 | 2 | 1 |
| 3 | HU 401 | Values & Ethics in Profession | 2 | 0 | 0 | 2 | 2 |
| 4 | HU 502 | Economics for Engineers | 2 | 0 | 0 | 2 | 2 |
| 5 | HU 704 | Principles of Management | 2 | 0 | 0 | 2 | 2 |
| | | **Total Credit:** | | | | | **9** |
| **B. Basic Sciences Courses (BS)** | | | | | | | |
| 1 | M 101 | Mathematics -I | 3 | 1 | 0 | 4 | 4 |
| 2 | CH 101/ PH | Chemistry (Gr. A) / Physics- I (Gr. B) | 3 | 0 | 0 | 3 | 3 |
| 3 | CH 191/ PH191 | Chemistry Lab (Gr. A) / Physics- I Lab (Gr. B) | 0 | 0 | 3 | 3 | 1.5 |
| 4 | M 201 | Mathematics -II | 3 | 1 | 0 | 4 | 4 |
| 5 | CH 201/ PH 201 | Chemistry - (Gr. B) / Physics – I (Gr. A) | 3 | 0 | 0 | 3 | 3 |
| 6 | CH 291/ PH 291 | Chemistry Lab (Gr. B) / Physics - I Lab (Gr. A) | 0 | 0 | 3 | 3 | 1.5 |
| 7 | CH (FT) 302 | Chemistry -2 | 3 | 0 | 0 | 3 | 3 |
| 8 | CH (FT) 392 | Chemistry -2 Lab | 0 | 0 | 3 | 3 | 1.5 |
| 9 | CH 401 | Chemical Stoichiometry | 2 | 1 | 0 | 3 | 3 |
| | | **Total Credit:** | | | | | **24.5** |
| **C. Engineering Sciences Courses including Workshop, Drawing, Basics of Electrical/Mechanical/Computer etc (ES)** | | | | | | | |
| 1 | EE 101/ EC 101 | Basic Electrical Engineering (Gr. A) / Basic Electronics Engineering (Gr. B) | 3 | 0 | 0 | 3 | 3 |
| 2 | EE 191/ EC 191 | Basic Electrical Engineering Lab (Gr. A) / Basic Electronics Engineering Lab (Gr. B) | 0 | 0 | 3 | 3 | 1.5 |
| 3 | ME 191/ ME 192 | Engineering Graphics & Design (Gr A) / Workshop/Manufacturing Practices (Gr-B) | 0 | 0 | 3 | 3 | 1.5 |
| 4 | EE 201/ EC 201 | Basic Electrical Engineering (Gr. B) / Basic Electronics Engineering (Gr. A) | 3 | 0 | 0 | 3 | 3 |
| 5 | CS 201 | Programming for Problem Solving | 3 | 0 | 0 | 3 | 3 |
| 6 | ME 201 | Engineering Mechanics | 3 | 0 | 0 | 3 | 3 |
| 7 | CS291 | Programming for Problem Solving Lab | 0 | 0 | 3 | 3 | 1.5 |
| 8 | EE 291/ EC 291 | Basic Electrical Engineering Lab (Gr. B) / Basic Electronics Engineering Lab (Gr. A) | 0 | 0 | 3 | 3 | 1.5 |
| 9 | ME 291/ ME 292 | Engineering Graphics & Design (Gr B) / Workshop/Manufacturing Practice (Gr-A) | 0 | 0 | 3 | 3 | 1.5 |
| 10 | CH (FT) 301 | Environmental Engineering | 2 | 0 | 0 | 2 | 2 |
| 11 | CH (FT) 391 | Environmental Engineering Lab | 0 | 0 | 3 | 3 | 1.5 |
| 12 | FT 301 | Thermodynamics & Kinetics | 2 | 1 | 0 | 3 | 3 |
| 13 | M (FT) 401 | Numerical Methods | 2 | 0 | 0 | 2 | 2 |
| | | **Total Credit:** | | | | | **28** |
| **D. Professional Core Courses (PC)** | | | | | | | |
| 1 | FT 302 | Food Microbiology | 2 | 1 | 0 | 3 | 3 |
| 2 | FT303 | Chemistry of food | 2 | 1 | 0 | 3 | 3 |
| 3 | FT391 | Chemistry of Food Lab–I | 0 | 0 | 3 | 3 | 1.5 |
| 4 | FT392 | Food Microbiology Lab | 0 | 0 | 3 | 3 | 1.5 |
| 5 | FT401 | Biochemistry & Nutrition | 2 | 1 | 0 | 3 | 3 |
| 6 | FT402 | Principles of Food Preservation | 2 | 1 | 0 | 3 | 3 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 7 | FT491 | Biochemistry Lab | 0 | 0 | 3 | 3 | 1.5 |
| 8 | FT 492 | Chemistry of Food Lab-II | 0 | 0 | 3 | 3 | 1.5 |
| 9 | FT501 | Food Process Technology–I (Cereals, Fruits, Vegetables, Beverages) | 3 | 0 | 0 | 3 | 3 |
| 10 | FT502 | Food Process Technology–II (Fish, Meat, Poultry) | 3 | 1 | 0 | 4 | 4 |
| 11 | FT503 | Food Process Engineering | 2 | 1 | 0 | 3 | 3 |
| 12 | FT591 | Food Processing Lab–I | 0 | 0 | 3 | 3 | 1.5 |
| 13 | FT592 | Food Analysis & Quality Control Lab | 0 | 0 | 3 | 3 | 1.5 |
| 14 | FT601 | Food Process Technology–III (Milk and Milk Products) | 3 | 1 | 0 | 4 | 4 |
| 15 | FT602 | Food Process Technology–IV (Edible Fats and Oils) | 3 | 1 | 0 | 4 | 4 |
| 16 | FT603 | Bakery, Confectionary and Extruded foods | 3 | 0 | 0 | 3 | 3 |
| 17 | FT 691 | Food Processing Lab–II | 0 | 0 | 3 | 3 | 1.5 |
| 18 | FT701 | Waste Management of Food Industries | 2 | 1 | 0 | 3 | 3 |
| 19 | FT791 | Food Engineering Lab | 0 | 0 | 3 | 3 | 1.5 |
| 20 | FT891 | Product Development & Quality Assurance Lab | 0 | 0 | 3 | 3 | 1.5 |
| | | Total Credit: | | | | | 49.5 |
| **E. Professional Elective Courses relevant to chosen specialization/Branch (PE)** | | | | | | | |
| 1 | FT 403 | A. Unit Operation of Chemical Engineering-1<br>B. Transport Phenomena | 3 | 0 | 0 | 3 | 3 |
| 2 | FT 493 | A. Unit operation Lab–I<br>B. Transport phenomena Lab | 0 | 0 | 3 | 3 | 1.5 |
| 3 | FT 504 | A. Unit Operations of Chemical Engineering–II<br>B. Separation Process | 3 | 0 | 0 | 3 | 3 |
| 4 | FT 593 | A. Unit Operation Lab–II<br>B. Separation Process Lab | 0 | 0 | 3 | 3 | 1.5 |
| 5 | FT 702 | A. Enzyme Technology<br>B. Renewable Energy Technology<br>C. Plant Maintenance, Safety& Hygiene | 3 | 0 | 0 | 3 | 3 |
| 6 | FT 703 | A. Food Packaging Technology<br>B. Functional Foods & Nutraceuticals<br>C. Protein Technology | 3 | 0 | 0 | 3 | 3 |
| 7 | FT 802 | A. Principles of Biochemical Engineering<br>B. Modeling & Simulation of Food Processing | 3 | 0 | 0 | 3 | 3 |
| | | **Total Credit:** | | | | | **18** |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **F. Open Elective Courses-Electives from other technical and / or emerging subjects (OE):** | | | | | | | |
| 1 | FT604 | A. Microbial Technology & Food Biotechnology<br>B. Environmental Biotechnology | 3 | 0 | 0 | 3 | 3 |
| 2 | FT 605 | A. Data Structure and Algorithm<br>B. Database Management System<br>C. Software Engineering | 3 | 0 | 0 | 3 | 3 |
| 3 | FT 692 | A. Microbial Technology Lab<br>B. Environmental Biotechnology Lab | 0 | 0 | 3 | 3 | 1.5 |
| 4 | FT 693 | A. Data Structure and Algorithm Lab<br>B. Database Management System Lab<br>C. Software Engineering Lab | 0 | 0 | 3 | 3 | 1.5 |
| 5 | FT 704 | A. Process Instrumentation<br>B. Process Control Systems | 3 | 0 | 0 | 3 | 3 |
| 6 | FT792 | A. Instrumentation Laboratory<br>B. Process Control Systems Laboratory | 0 | 0 | 2 | 2 | 1 |
| 7 | FT 801 | A. Entrepreneurship Development for Food Technologists<br>B. Project Engineering & Food Plant Layout | 3 | 0 | 0 | 3 | 3 |
| | | **Total Credit:** | | | | | **16** |
| **G. Project work, seminar and internship in industry or elsewhere (PW)** | | | | | | | |
| 1 | PR 191 | Project-IA | 0 | 0 | 1 | 1 | 0.5 |
| 2 | PR 192 | Project-IB | 0 | 0 | 1 | 1 | 0.5 |
| 3 | PR 291 | Project-II | 0 | 0 | 1 | 1 | 0.5 |
| 4 | PR 292 | Innovative activities-I | 0 | 0 | 0 | 0 | 0.5 |
| 5 | PR 391 | Project-III | 0 | 0 | 2 | 2 | 1 |
| 6 | PR 392 | Innovative activities-II | 0 | 0 | 0 | 1 | 0.5 |
| 7 | PR 491 | Project-IV | 0 | 0 | 1 | 1 | 1 |
| 8 | PR 492 | Innovative activities-III | 0 | 0 | 0 | 0 | 0.5 |
| 9 | PR 591 | Project-V | 0 | 0 | 2 | 2 | 1 |
| 10 | PR 592 | Innovative activities-IV | 0 | 0 | 0 | 0 | 0.5 |
| 11 | PR 691 | Project-VI | 0 | 0 | 2 | 2 | 1 |
| 12 | PR 692 | Innovative activities-V | 0 | 0 | 0 | 0 | 0.5 |
| 13 | PR 791 | Project-VII | 0 | 0 | 0 | 5 | 2.5 |
| 14 | PR 792 | Innovative activities-VI | 0 | 0 | 0 | 0 | 0.5 |
| 15 | PR 891 | Project-VIII | 0 | 0 | 0 | 8 | 4 |
| | | **Total Credit:** | | | | | **15.0** |

| H. Mandatory Courses [Environmental Science, Induction Training, Indian Constitution, Essence of Indian Knowledge Tradition and other Co & extracurricular activities (MC) | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | MC181 | Induction Program | 0 | 0 | 6 | 6 | |
| 2 | MC 281 | NSS/ Physical Activities/Meditation & Yoga/Photography/ Nature Club | 0 | 0 | 3 | 3 | |
| 3 | MC 381 | Behavioral & Interpersonal skills | 0 | 0 | 3 | 3 | |
| 4 | MC 401 | Environmental Science | 3 | 0 | 0 | 3 | |
| 5 | MC 581 | Social Awareness | 0 | 0 | 3 | 3 | |
| 6 | MC 601 | Constitution of India | 3 | 0 | 0 | 3 | |
| 7 | MC 781 | Innovation-Project Based-Sc. Tech, Social, Design & Innovation | 0 | 0 | 3 | 3 | |
| 8 | MC 801 | Essence of Indian Knowledge Tradition | 3 | 0 | 0 | 3 | |

# Format for Project Work Evaluation (B.Tech)

**College Name:** **Department :**

**Paper Name :** **Paper Code :**

**STREAM :** **Semester :**

| University Roll No. | Name of the Student | Title of the Project | Semester Examination | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Project Report (10) | Development of Prototype/ Model (20) | Power point Presentation (15) | Viva-Voce (15) | Usage of Modern Tool / Technology (10) | Innovative-ness (10) | Individual Contribution (10) | Group activity (10) | Total (100) |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

(Signature of the Project Supervisor(s)) (Signature of the HoD)

# MOOCs Courses
# For B.Tech Students for AY 2018-19
## (1st Semester to 8th Semester)

## Total Credit for MOOCs Subjects will be 20.

### *List of websites which offers online certification Courses*

List of Websites which offers online certification courses:

1. Swayam- https://swayam.gov.in/
2. NPTEL- https://onlinecourses.nptel.ac.in/
3. Mooc- http://mooc.org/
4. Edx - https://www.edx.org/
5. Coursera- https://www.coursera.org/
6. Udacity - https://in.udacity.com/
7. Udemy - https://www.udemy.com/
8. Khan academy - https://www.khanacademy.org/
9. Skill sahre - https://www.skillshare.com/
10. Harvard University - https://online-learning.harvard.edu/
11. Ted - https://ed.ted.com/
12. Alison - https://alison.com/
13. Future learn - https://www.futurelearn.com/
14. Web Development - https://digitaldefynd.com/best-free-web-development-courses-tutorials-certification/
15. Digital Marketing - https://digitaldefynd.com/best-free-digital-marketing-certifications/
16. ios app development - https://digitaldefynd.com/best-ios-app-development-course-tutorial/
17. Open Learn - http://www.open.edu/openlearn/
18. Future Learn - https://www.futurelearn.com/
19. Tuts Plus - https://tutsplus.com/
20. Open Culture - http://www.openculture.com/

***For Honors additional 20 Credit Point is to be earned (1st Sem to 8th Sem) through MOOCs courses. All the Certificates received by the students across all semester for MOOCs Courses from approved organization, should be submitted to CoE office prior to 8th Semester Examination.***

The distribution of the credit with respect to weeks are as follows:
4 to 7 weeks: 2 Credit
8 to 11 weeks: 3 Credits
12 to 15 weeks: 4 Credits
16 or more than that: 6 Credits

***20 credit for Honors, should be earned by the students from the MOOC Basket and any other subjects related to the specific program of the respective departments.***

# MOOCs Basket for Food Technology

| No. | Course Name |
|---|---|
| 1 | Commercial Fruit Production: Pomegranate & Guava |
| 2 | Life with Diabetes |
| 3 | Nutrition and Health: Food Risks |
| 4 | Thermal Operations in Food Process Engineering: Theory and Applications |
| 5 | Introduction to the Internet of Things (IoT) |
| 6 | Introduction to Machine Learning (IITM) |
| 7 | Developing Soft Skills and Personality |
| 8 | Data Science for Engineers |
| 9 | INTRODUCTION TO CYBER SECURITY |
| 10 | Nutrition, Heart Disease and Diabetes |
| 11 | Science & Cooking: From Haute Cuisine to Soft Matter Science (physics) |
| 12 | Sustainable Agri- food Marketing |
| 13 | Sustainable Food Security: Food Access |
| 14 | Sustainable Food Security: The value of systems thinking |
| 15 | Food for Thought |

# Appendix B

**Mandatory Additional Requirement (MAR):**

**List of Activity Heads and Sub-Activity Heads along with their capping of the Activity Points that can be earned by the students during the entire B.Tech duration.**

| Sl. No. | Name of the Activity | Points | Maximum Points Allowed |
|---|---|---|---|
| 1. | MOOCS (SWAYAM/NPTEL/Spoken Tutorial) (per course) | 20 | 40 |
| 2. | Tech Fest/Teachers Day/Freshers Welcome | | |
| | Organizer | 5 | 10 |
| | Participants | 3 | 6 |
| 5. | Rural Reporting | 5 | 10 |
| 6. | Tree Plantation (per tree) | 1 | 10 |
| 7. | Participation in Relief Camps | 20 | 40 |
| 8. | Participation in Debate/Group Discussion/ Tech quiz | 10 | 20 |
| 9. | Publication of Wall magazine in institutional level (magazine/article/internet) | 10 | 20 |
| 10. | Publication in News Paper, Magazine & Blogs | 10 | 20 |
| 11. | Research Publication (per publication) | 15 | 30 |
| 12. | Innovative Projects (other than course curriculum) | 30 | 60 |
| 13. | Blood donation | 8 | 16 |
| | Blood donation camp Organization | 10 | 20 |
| 15. | Participation in Sports/Games | | |
| | College level | 5 | 10 |
| | University Level | 10 | 20 |
| | District Level | 12 | 24 |
| | State Level | 15 | 30 |
| | National/International Level | 20 | 20 |
| 21. | Cultural Programme (Dance, Drama, Elocution, Music etc.) | 10 | 20 |
| 22. | Member of Professional Society | 10 | 20 |
| 23. | Student Chapter | 10 | 20 |
| 24. | Relevant Industry Visit & Report | 10 | 20 |
| 25. | Photography activities in different Club ( Photography club, Cine Club, Gitisansad) | 5 | 10 |
| 26. | Participation in Yoga Camp (Certificate to be submitted) | 5 | 10 |
| 27. | Self-Entrepreneurship Programme | 20 | 20 |
| 28. | Adventure Sports with Certification | 10 | 20 |
| 29. | Training to under privileged/Physically challenged | 15 | 30 |
| 30. | Community Service & Allied Activities | 10 | 20 |

# Record of Activities for Mandatory Additional Requirement

| College Name (College Code): | | | | | | | | Department: | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Student Name: | | University Roll No: | | | | | | Registration No: | | | | | |
| Sl No | Activity | Points | Max. Points Allowed | Points Earned | | | | | | | | | |
| | | | | Sem1 | Sem2 | Sem3 | Sem4 | Sem5 | Sem6 | Sem7 | Sem8 | Total |
| 1 | *MOOCS (SWAYAM/NPTEL/Spoken Tutorial) per course* | | | | | | | | | | | |
| | For 12 weeks duration | **20** | **40** | | | | | | | | | |
| | For 8 weeks duration | **16** | | | | | | | | | | |
| 2 | *Tech Fest/Teachers Day/Freshers Welcome* | | | | | | | | | | | |
| | Organizer | **5** | **10** | | | | | | | | | |
| | Participants | **3** | **6** | | | | | | | | | |
| 3 | Rural Reporting | **5** | **10** | | | | | | | | | |
| 4 | Tree Plantation and up keeping (per tree) | **1** | **10** | | | | | | | | | |
| 5 | Participation in Relief Camps | **20** | **40** | | | | | | | | | |
| 6 | Participation in Debate/Group Discussion/ Tech quiz | **10** | **20** | | | | | | | | | |
| 7 | *Publication of Wall magazine in institutional level (magazine/article /internet)* | | | | | | | | | | | |
| | Editor | **10** | **20** | | | | | | | | | |
| | Writer | **6** | **12** | | | | | | | | | |
| 8 | Publication in News Paper, Magazine & Blogs | **10** | **20** | | | | | | | | | |
| 9 | Research Publication (per publication) | **15** | **30** | | | | | | | | | |
| 10 | Innovative Projects (other than course curriculum) | **30** | **60** | | | | | | | | | |
| 11 | Blood donation | **8** | **16** | | | | | | | | | |
| | Blood donation camp Organization | **10** | **20** | | | | | | | | | |

# Record of Activities for Mandatory Additional Requirement (Contd.

| Sl No | Activity | Points | Max. Points Allowed | Points Earned | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Sem1 | Sem2 | Sem3 | Sem4 | Sem5 | Sem6 | Sem7 | Sem8 | Total |
| 12 | *Participation in Sports/Games* | | | | | | | | | | | |
| | College level | **5** | **10** | | | | | | | | | |
| | University Level | **10** | **20** | | | | | | | | | |
| | District Level | **12** | **24** | | | | | | | | | |
| | State Level | **15** | **30** | | | | | | | | | |
| | National/International Level | **20** | **20** | | | | | | | | | |
| 13 | Cultural Programme (Dance, Drama, Elocution, Music etc.) | **10** | **20** | | | | | | | | | |
| 14 | Member of Professional Society | **10** | **20** | | | | | | | | | |
| 15 | Student Chapter | **10** | **20** | | | | | | | | | |
| 16 | Relevant Industry Visit & Report | **10** | **20** | | | | | | | | | |
| 17 | Photography activities in different Club(Photography club, Cine Club, Gitisansad) | **5** | **10** | | | | | | | | | |
| 18 | Participation in Yoga Camp (Certificate to be submitted) | **5** | **10** | | | | | | | | | |
| 19 | Self-Entrepreneurship Programme | **20** | **20** | | | | | | | | | |
| 20 | Adventure Sports with Certification | **10** | **20** | | | | | | | | | |
| 21 | Training to under privileged / Differently abled | **15** | **30** | | | | | | | | | |
| 22 | Community Service & Allied Activities | **10** | **20** | | | | | | | | | |
| **Total Points** | | | | | | | | | | | | |
| **Signature of Mentor** | | | | | | | | | | | | |
| **Signature of HoD** | | | | | | | | | | | | |

# *Department: Food Technology*
# *Curriculum Structure & Syllabus*
# *(Effective from 2018-19 admission batch)*

| 1st Semester | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Sl No** | **Course Type** | **Course Code** | **Theory** | **Contact Hours /Week** | | | | **Credit Points** |
| | | | | **L** | **T** | **P** | **Total** | |
| **A. THEORY** | | | | | | | | |
| 1 | BS | M 101 | Mathematics -I | 3 | 1 | 0 | 4 | 4 |
| 2 | BS | CH 101/ PH 101 | Chemistry (Gr. A) / Physics- I (Gr. B) | 3 | 0 | 0 | 3 | 3 |
| 3 | ES | EE 101/ EC 101 | Basic Electrical Engineering (Gr. A) / Basic Electronics Engineering (Gr. | 3 | 0 | 0 | 3 | 3 |
| 4 | HS | HU 101 | English | 2 | 0 | 0 | 2 | 2 |
| **Total of Theory** | | | | | | | **12** | **12** |
| **B. PRACTICAL** | | | | | | | | |
| 5 | BS | CH 191/ PH191 | Chemistry Lab (Gr. A) / Physics- I Lab (Gr. B) | 0 | 0 | 3 | 3 | 1.5 |
| 6 | ES | EE 191/ EC 191 | Basic Electrical Engineering Lab (Gr. A) / Basic Electronics Engineering Lab (Gr. | 0 | 0 | 3 | 3 | 1.5 |
| 7 | ES | ME 191/ ME 192 | Engineering Graphics & Design (Gr A) / Workshop/Manufacturing Practices (Gr- | 0 | 0 | 3 | 3 | 1.5 |
| 8 | PROJ | PR 191 | PROJECT-IA | 0 | 0 | 1 | 1 | 0.5 |
| 9 | PROJ | PR 192 | PROJECT-IB | 0 | 0 | 1 | 1 | 0.5 |
| **C. MANDATORY ACTIVITIES / COURSES** | | | | | | | | |
| 10 | MC | MC 181 | Induction Program | 0 | 0 | 0 | 0 | |
| **Total of Theory, Practical & Mandatory Activities/Courses** | | | | | | | **23** | **17.5** |

# Syllabus- 1st Semester

**Course Name: Mathematics-I**
**Course Code: M 101**

**Contact: 3:1:0**

**Total Contact Hours: 48**
**Credits: 4**

**Prerequisites:**

The students to whom this course will be offered must have the concept of (10+2) standard matrix algebra and calculus.

***Course Objectives:***

The objective of this course is to disseminate the prospective engineers with techniques in matrix algebra and calculus. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

***Course Outcomes:***

On successful completion of the learning sessions of the course, the learner will be able to:

**CO1:** Recall the distinctive characteristics of matrix algebra and calculus.

**CO2:** Understand the theoretical working of matrix algebra and calculus.

**CO3:** Apply the principles of matrix algebra and calculus to address problems in their disciplines.

**CO4: Examine the nature of system using the concept of matrix algebra and calculus.**

**Course Content:**

**Module I: Matrix Algebra (11)**

Echelon form and Normal (Canonical) form of a matrix; Inverse and rank of a matrix; Consistency and inconsistency of system of linear equations, Solution of system of linear equations; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton theorem.

**Module II: Differential Calculus and Infinite Series (10)**

Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; Concept of sequence and series, Tests for convergence of infinite series: Comparison test, D'Alembert's ratio test, Raabe's test, Cauchy's root test, Power series; Taylor's series, Series for exponential, trigonometric and logarithm functions.

## Module III: Multivariable Calculus (Differentiation) - I (9)

Function of several variables, Concept of limit, continuity and differentiability; Partial derivatives, Total derivative and its application; Chain rules, Derivatives of implicit functions Euler's theorem on homogeneous function, Jacobian.

## Module IV: Multivariable Calculus (Differentiation) - II (7)

Maxima and minima of functions of two variables, Method of Lagrange multipliers; Directional derivatives, Gradient, Divergence, Curl.

## Module V: Integral Calculus (11)

Evolutes and involutes; Evaluation of definite integrals and its applications to evaluate surface areas and volumes of revolutions; Improper integrals; Beta and Gamma functions and their properties.

### *Text Books:*


1. Kreyszig, E., Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. Ramana, B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
3. Veerarajan, T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Grewal, B.S., Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
5. Bali, N.P. and Goyal, M., A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.


### *Reference Books:*


1. Thomas, G.B. and Finney, R.L., Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Apostol, M., Calculus, Volumes 1 and 2 (2nd Edition), Wiley Eastern, 1980.
3. Kumaresan, S., Linear Algebra - A Geometric approach, Prentice Hall of India, 2000.
4. Poole, D., Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
5. Bronson, R., Schaum's Outline of Matrix Operations. 1988.
6. Piskunov, N., Differential and Integral Calculus, Vol. I & Vol. II, Mir Publishers, 1969


**COs-POs-PSOs MAPPING:**

| CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** | **3** |
| CO1 | 3 | 2 | 1 | - | - | - | - | 1 | - | - | 1 | 1 | - | - | - |
| CO2 | 3 | 3 | 2 | - | - | - | - | - | - | 1 | 1 | - | - | - | - |
| CO3 | 3 | 2 | 3 | - | - | - | - | 1 | - | - | - | 1 | 3 | - | - |
| CO4 | 3 | 3 | 2 | 2 | 1 | - | - | 1 | - | - | - | 1 | 1 | - | 2 |
| **Overall CO Mapping** | **3** | **2.5** | **2** | 2 | 1 | - | - | 1 | - | 1 | 1 | 1 | **2** | | **2** |

**Course Name: Physics –I**
**Course Code: PH 101**
**Contact: 3:0:0**
**Total Contact Hours: 36**
**Credits: 3**

**Pre requisites:** Knowledge of Physics up to 12th standard.

## *Course Objective:*

The aim of courses in Physics is to provide an adequate exposure and develop insight about the basic physics principles along with the possible applications. The acquaintance of basic principles of physics would help engineers to understand the tools and techniques used in the industry and provide the necessary foundations for inculcating innovative approaches. It can also create awareness of the vital role played by science and engineering in the development of new technologies. It also gives necessary exposure to the practical aspects, which is an essential component for learning sciences.

## *Course Outcomes:*

**CO1:** Describe various types mechanical resonance and its electrical equivalence

**CO2:** Explain basic principles of Laser, Optical fibers and various types of semiconductors

**CO3:** Apply superposition to explain interference and diffraction as well as apply wave mechanics for attainment of Heisenberg's uncertainty principle

**CO4:** Analyze importance of light as a carrier of information and examine different crystallographic structures according to their co-ordination number and packing factors

**CO5:** Justify the need of quantum mechanics as remedy to overcome limitations imposed by classical physics

## *Course Content:*

**Module 1 (6L):**
**Waves & Oscillations:**
Simple Harmonic Motion (only preliminary idea), damped harmonic motion-over damped, critically damped and under damped motion, energy decay, logarithmic decrement, force vibration and resonance (amplitude, velocity resonance), sharpness of resonance, quality factor, related numerical problems.

### *Module 2 (8L):*

**Classical Optics:**
**2.01- Interference of light:** Huygens's principle, superposition of waves, conditions of sustained interference, Newton's ring (qualitative descriptions of working principles and procedures-no deduction required). Engineering applications, Numerical Problems.

**2.02- Diffraction of light:** Fresnel and Fraunhofer class, Fraunhoffer diffraction of a single slit, multiple slits, intensity distributions, missing order, Rayleigh criterion (no deduction) and resolving power of grating and microscope (no deduction), related numerical problems.

***Module 3 (8L):***

**Quantum Mechanics-I:**

**Quantum Theory**: Inadequacy of classical physics and its modifications by Planck's quantum hypothesis-qualitative (no deductions), particle concept of electromagnetic wave (example: photoelectric and Compton Effect; no derivation required, origin of modified and unmodified lines), wave particle duality; phase velocity and group velocity; de Broglie hypothesis; Davisson and Germer experiment.

**Quantum Mechanics 1:** Concept of wave function, physical significance of wave function, probability interpretation; normalization of wave functions; uncertainty principle, relevant numericaproblems.

***Module 4 (7L):***

**Solid State Physics-I:**

**Crystal Structure:** Structure of solids, amorphous and crystalline solids (definition and examples), lattice, basis, unit cell, Fundamental types of lattices –Bravais lattice, simple cubic, fcc and bcc lattices, Miller indices and miller planes, co-ordination number and atomic packing factor, Bragg's equation, applications, numerical problems.

**Semiconductor:** Physics of semiconductors, electrons and holes, metal, insulator and semiconductor, intrinsic and extrinsic semiconductor, p-n junction.

***Module 5 (7L):***

**Modern Optics-I:**

**5.01- Laser:** Concepts of various emission and absorption process, Einstein A and B coefficients and equations, working principle of laser, metastable state, population inversion, condition necessary for active laser action, optical resonator, illustrations of Ruby laser, He-Ne laser, Semiconductor laser, applications of laser.

**5.02-Fibre optics:** Principle and propagation of light in optical fibres- Numerical aperture and Acceptance angle, Numerical problems.

***Text Books:***

**Waves & Oscillations:**

1. Sound-N. K. Bajaj (TMH)
2. Advanced Acoustics-D. P. Roy Chowdhury (Chayan Publisher)
3. Principles of Acoustics-B.Ghosh (Sridhar Publisher)
4. A text book of sound-M. Ghosh ( S. Chand publishers)
5. A text book of Light- K.G. Mazumder & B.Ghoshs, (Book & Allied Publisher)
6. Physics of Oscillations and Waves- R.P. Singh
7. College Physics Vol. II - A.B. Gupta
8. Vibration, Waves and Acoustics- Chattopadhyay and Rakshit

***Classical & Modern Optics:***

1. A text book of Light- K.G. Mazumder & B.Ghoshs (Book & Allied Publisher)
2. A text book of Light-Brijlal & Subhramanium, ( S. Chand publishers)
3. Modern Optics-A. B. Gupta ( Book & Allied Publisher)
4. Optics-Ajay Ghatak (TMH)
5. Optics-Hecht
6. Optics-R. Kar, Books Applied Publishers
7. Physical Optics Möler
8. Optics -F.A. Jenkins and H.E White

***Quantum Mechanics-I***

1. Introduction to Quantum Mechanics-S. N. Ghoshal (Calcutta Book House)
2. Quantum Mechanics-Bagde and Singh (S. Chand Publishers)
3. Perspective of Quantum Mechanics-S. P. Kuilla (New Central Book Agency)
4. Quantum Mechanics-Binayak Datta Roy (S. Chand Publishers)
5. Quantum Mechanics-Bransden (Pearson Education Ltd.)
6. Perspective of Modern Physics-A. Beiser (TMH)
7. Quantum mechanics -A.K. Ghatak and S Lokenathan
8. Modern Physics -E.E. Anderson
9. Physics Volume 2 -Haliday, Resnick & Krane, Published by Wiley India

***Solid State Physics-I:***

1. Solid state physics-Puri & Babbar ( S. Chand publishers)
2. Materials Science & Engineering-Kakani Kakani
3. Solid state physics- S. O. Pillai
4. Introduction to solid state physics-Kittel (TMH)
5. Solid State Physics and Electronics-A. B. Gupta and Nurul Islam (Book & Allied Publisher)
6. Problem in Solid state physics -S.O. Pillai (a. b.)

***Reference Books:***

**1.** Refresher courses in physics (Vol. 1, Vol. 2 & Vol. 3)-C. L. Arora (S. Chand Publishers)
**2.** Basic Engineering Physics-Amal Chakraborty (Chaya Prakashani Pvt. Ltd.)
**3.** Perspective & Concept of Modern Physics -Arthur Baiser
**4.** Principles of engineering physics – Md. N Khan and S Panigrahi.

**CO-PO-PSO Mapping:**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | - | - | - | - | - | - | 1 | - | - | 2 | 3 | 3 | |
| **CO2** | 3 | - | - | 1 | - | - | - | - | 1 | - | - | 2 | 3 | 2 | |
| **CO3** | 3 | 2 | 2 | - | 2 | - | - | 1 | 1 | 1 | - | 1 | 1 | | |
| **CO4** | 2 | 3 | - | - | 2 | - | - | 1 | 1 | - | 1 | 1 | 2 | 3 | |
| **CO5** | 1 | 3 | - | - | - | - | - | - | 1 | - | - | 1 | | | |
| **Overall CO Mapping** | 2.4 | 2.5 | 2 | 1 | 2 | | | 1 | 1 | 1 | 1 | 1.4 | **2.25** | **2.67** | |

**Course Name: Basic Electronics Engineering**
**Course Code: EC101**
**Contact: 3:0:0**
**Total Contact Hours: 36**
**Credits: 3**

**Prerequisites**:

Electric current and voltage-D.C and A.C., Complex impedance, conductivity, resistivity, transformer charging and discharging of capacitor, active and passive elements.

## *Course Objective:*

1. To understand the behavior of Conductors, Insulators, and Semiconductors based on energy-band theory and relevant problems.
2. To instill the knowledge of working principles of P-N Junction Diode, Zener diode and analyze their applications in the rectifier, clipper, clamper, regulator etc.
3. To familiarize with the characteristics of Bipolar junction transistor(BJT) under CE, CE, CC mode of operation and its biasing mechanisms.
4. To understand working principles of JFET, MOSFET and perform operations under CG, CS, CD configurations for parametric observation.
5. To determine the parameters due to the effect of feedback in amplifier to ,adder circuit , integrator and differentiator circuit using Operational Amplifier.

**Course Outcome:**

**CO1**: Understand the PN junction diode, ideal diode, diode models and its circuit analysis, Remember the application of diodes and special diodes.

**CO2:** Analyse how operational amplifiers are modelled and analysed, and to design Op-Amp circuits to perform operations such as integration differentiation on electronic signals.

**CO3:** Assess both positive and negative feedback in electronic circuits.

**CO4:** Develop the capability to analyse and design simple circuits containing non-liner elements such as transistors using the concepts of load lines, operating points and incremental analysis.

**Course Content:**

**Module-I: Basics of semiconductor (6L)**

Conductors, Insulators, and Semiconductors- crystal structure, Fermi Dirac function, Fermi level, Energy band diagrams, valence band, conduction band, and band gap; intrinsic, and extrinsic ( p-type and n-type) semiconductors, position of Fermi level in intrinsic and extrinsic semiconductor, drift and diffusion current – expression only ( no derivation) , mass action law , charge neutrality in semiconductor, Einstein relationship in semiconductor , Numerical problems.

***Module-II: P-N Junction Diode and its applications (8L)***

p-n junction formation and depletion region, energy band diagram of p-n junction at equilibrium and barrier energy, built in potential at p-n junction, energy band diagram and current through p-n junction at forward and reverse bias, Static and Dynamic resistance of Diode, Transition capacitance and diffusion capacitance, V-I characteristics and current expression of diode, temperature dependencies of V-I characteristics of diode, p-n junction breakdown – conditions, avalanche and Zener breakdown, Concept of Junction capacitance, Zener diode and characteristics.

Diode half wave and full wave rectifiers (centre tapped and bridge) circuits and operation ($I_{DC,}$ $I_{rms}$, $V_{Dc,}$ $V_{rms)}$, ripple factor without filter, efficiency, PIV, TUF; Reduction of ac ripples using filter circuit (Qualitative analysis); Design of diode clipper and clamper circuit - explanation with example, application of Zener diode in regulator circuit. Numerical problems.

***Module-III: Bipolar junction transistor (6L)***

Concept of "Transistor", Formation of PNP/NPN Transistors, energy band diagram, current conduction mechanism, CE, CB, CC configurations, transistor static characteristics in CE, CB and CC mode, junction biasing condition for active, saturation and cut-off modes, current gain $\alpha$, $\beta$ and $\gamma$, early effect.

Biasing and bias stability; biasing circuits - fixed bias; voltage divider bias; collector to base bias, D.C. load line and Quiescent point, calculation of stability factors for different biasing circuits.

BJT as an amplifier and as a switch – Graphical analysis; Numerical Problems.

***Module-IV: Field effect transistor (6L)***

Concept of "field effect", Classification of FETs-JFET, MOSFET, operating principle of JFET. Drain and transfer characteristics of JFET (n-channel and p-channel), CS, CG, CD configurations, Relation between JFET parameters. FET as an amplifier and as a switch– graphical analysis. E-MOSFET (n-channel and p-channel), D-MOSFET (n-channel and p-channel), Numerical Problems.

### *Module-V: Feedback and Operational Amplifier (8L)*

Concept of feedback with block diagram, positive and negative feedback, gain with feedback. Feedback topologies, effect of feedback on input and output impedance, distortion, concept of oscillation and Barkhausen criterion.

Operational amplifier – electrical equivalent circuit, ideal characteristics, non-ideal characteristics of op-amp – offset voltages; bias current; offset current; Slew rate; CMRR and bandwidth, Configuration of inverting and non-inverting amplifier using Op-amp, closed loop voltage gain of inverting and non-inverting amplifier, Concept of virtual ground, Applications op-amp – summing amplifier; differential amplifier; voltage follower; basic differentiator and integrator, Numerical Problems.

### *Module-VI: Cathode Ray Oscilloscope (2L)*

Operating principle of CRO with block diagram, measurement of voltage, frequency and phase.

### *Text Books :*

1.D. Chattopadhyay, P. C. Rakshit, Electronics Fundamentals and Applications, New Age International
2.Millman & Halkias, Integrated Electronics, Tata McGraw Hill.
3.Sedra & Smith, Microelectronics Engineering

### *Reference Books :*

1.John D. Ryder, Electronic Fundamentals and Applications, PHI
2.J.B.Gupta, Basic Electronics, S.K. Kataria.
3. Malvino: Electronic Principle.
4. Boyelstad & Nashelsky: Electronic Devices & Circuit Theory, McGraw Hill, 1976.

### *CO-PO –PSO Mapping:*

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 1 | 2 | - | - | - | 1 | - | - | 2 | 1 | 1 | 2 |
| CO2 | 3 | 3 | 3 | 2 | 2 | - | - | - | 1 | 2 | - | 2 | 2 | 1 | 2 |
| CO3 | 3 | 3 | 3 | 2 | 1 | - | - | - | 1 | - | - | 3 | 2 | 1 | 1 |
| CO4 | 3 | 3 | 2 | 3 | 2 | - | - | 2 | 1 | - | - | 3 | 1 | 1 | 2 |
| **Overall CO Mapping** | 3 | 2.75 | 2.5 | 2 | 1.75 | | | 2 | 1 | 2 | | 2.5 | 1.5 | 1 | 1.75 |

**Course Name: English**
**Course Code: HU101**
**Contact: 2:0:0**
***Total Contact Hours: 24***

**Credits: 2**

**Prerequisites:** The course presupposes a high school level knowledge of English grammar, punctuation, and elementary to intermediate reading and writing skills.

**Course Objectives**: The basic objectives of this course are to impart professional communication skills in the globalized workplace context, to enable functional competence in reading and writing so as to create industry-ready personnel.

**Course Outcomes:** By pursuing this course the students shall be able to:
**CO1:** Able to comprehend the basic knowledge of communication skills in English through exposure to communication theory and practice.
**CO2:** Apply the basic grammatical skills of the English language through intensive practice.
**CO3:** Able to develop listening and writing skills.
**CO4:** Able to write Official Letters , Technical report, memo, notice, minutes, agenda, resume, curriculum vitae.
**CO5:** Able to apply /illustrate all sets of English Language and Communication skills in creative and effective ways in the professional sphere of their life.

***Course Content:***

**Module 1: Communication in a Globalized World** **4L**
Definition, Process, Types of Communication
Verbal and Non-Verbal Communication
Barriers to Communication
Workplace Communication

***Module 2: Functional Grammar*** ***4L***
Articles, Prepositions and Verbs
Verb-Subject Agreement
Voice, Modality and Modifiers
Direct and Indirect Speech
Common Errors in English

***Module 3: Vocabulary and Reading*** ***6L***
Word Roots, Prefixes and Suffixes
Antonyms, Synonyms and one word Substitution
Reading—Purposes and Skills (Skimming, Scanning & Intensive Reading)
Reading Comprehension (Fictional and Non-fictional prose)

***Module 4: Professional Writing*** ***10L***
Writing Functions: Describing, Defining, ClassifyingStructuring—coherence and clarity
Business Writing—Letters (Enquiry, Order, Sales, Complaint, Adjustment, Job Application letters), Memos, Notices, Circulars, Agendas and Minutes of Meetings).
E-mails—types, conventions, jargons and modalities.
Reports and Proposals

Précis writing

Essay writing
Punctuation and its importance in writing
Writing for an Audience

***Text Books:***

1. Ruskin Bond: The Night Train at Deoli OR Khushwant Singh: The Portrait of a Lady
2. Roald Dahl: Lamb to the Slaughter OR Somerset Maugham: The Man with the Scar
3. Anne Frank: The Diary of a Young Girl (Letters of 3rd February 1944, 12th February 1944 and 13th February 1944) OR Jawaharlal Nehru: "How Britain Ruled India" (Glimpses of World History, Chap 112)

***Reference Books:***

1. Raymond Murphy. English Grammar in Use. 3rd Edn. CUP, 2001.
2. A. J Thomson and A. V. Martinet. A Practical English Grammar Oxford: OUP, 1980.
3. Michael Swan. Practical English Usage. Oxford: OUP, 1980.
4. Simeon Potter. Our Language. Oxford: OUP, 1950.
5. Pickett, Laster and Staples. Technical English: Writing, Reading & Speaking. 8th ed. London: Longman, 2001.
6. Ben Heasley and Liz Hamp-Lyons. Study Writing. Cambridge: CUP, 2006.

**CO-PO & PSO Mapping**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | - | - | 1 | - | - | 1 | - | 2 | 3 | 3 | 3 | 3 | **1** | **-** | **3** |
| **CO2** | - | - | - | - | - | 2 | - | - | 2 | 3 | 3 | 3 | **-** | **1** | **3** |
| **CO3** | - | 3 | 2 | 2 | - | 3 | 2 | 2 | 3 | 3 | 3 | 3 | **-** | **2** | **3** |
| **CO4** | - | - | - | 2 | - | 2 | - | - | 3 | 3 | 2 | 3 | **-** | **2** | **3** |
| **CO5** | - | 2 | 1 | - | - | 2 | 2 | 2 | 3 | 3 | 2 | 3 | | | |
| **Overall CO Mapping** | | 2.5 | 1.3 | 2 | | 2 | 2 | 2 | 2.8 | 3 | 2.6 | 3 | **1** | **1.6** | **3** |

***Course Name: Physics I Lab***
***Course Code: PH 191***

***Contact: 0:0:3***
**Credits: 1.5**

**Pre requisites:** Knowledge of Physics upto $12^{th}$ standard.

***Course Outcomes:***

**CO1 :** Demonstrate experiments allied to their theoretical concepts

**CO2 :** Conduct experiments using LASER, Optical fiber, Torsional pendulum, Spctrometer

**CO3 :** Participate as an individual, and as a member or leader in groups in laboratory sessions actively

**CO4 :** Analyze experimental data from graphical representations , and to communicate effectively them in Laboratory reports including innovative experiments

***List of Experiments:***

**General idea about Measurements and Errors (One Mandatory):**

i) Error estimation using Slide calipers/ Screw-gauge/travelling microscope for one experiment.
ii) Proportional error calculation using Carrey Foster Bridge.

**Any 6 to be performed from the following experiments**

**Experiments on Waves & Oscillations:**
1. Study of Torsional oscillation of Torsional pendulum & determination of time period using various load of the oscillator.
2. Determination of elastic moduli of different materials (Young's modulus /Rigidity modulus)

***Experiments on Classical Optics:***
3. Determination of wavelength of light by Newton's ring method.
4. Determination of wavelength of light by Laser diffraction method.

***Experiments on Quantum Physics-I:***
5. Determination of Planck's constant using photoelectric cell.
6. Verification of Bohr's atomic orbital theory through Frank-Hertz experiment.
7. Determination of Stefan's Constant

***Experiments on Solid State Physics-I:***
8. Determination of Band gap of a semiconductor

**In addition it is **recommended** that each student should carry out at least one experiment beyond the syllabus/one experiment as Innovative experiment.

***Probable experiments beyond the syllabus:***

1. Determination of wavelength of light by Fresnel's bi-prism method (beyond the syllabus).
3. Study of dispersive power of material of a prism.
4. Study of viscosity using Poiseullie's capillary flow method/using Stoke's law.
5. Measurement of nodal and antinodal points along transmission wire and measurement of wave length.
**6.** Any other experiment related to the theory**.**

**CO-PO-PSO Mapping:**

| **CO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 1 | - | - | - | 2 | 2 | - | 2 | - | 1 | 2 | 3 | 1 | 1 | 2 |
| **CO2** | 3 | 3 | 3 | - | - | - | - | - | - | - | - | 2 | 1 | 1 | 1 |
| **CO3** | 2 | 2 | 2 | 2 | 2 | - | - | - | 1 | - | - | 3 | 2 | 1 | 1 |
| **CO4** | 1 | 2 | 2 | 2 | 2 | - | - | - | - | - | - | 2 | 1 | 2 | 3 |
| **Overall CO Mapping** | 1.8 | 2.3 | 2.3 | 2 | 2 | 2 | | 2 | 1 | 1 | 2 | 2.5 | 1.2 | 1.2 | 1.7 |

**Course Name: Basic Electronics Engineering Lab**
**Course Code: EC 191**
**Contact: 0:0:3**
**Credit: 1.5**

**Prerequisites:** A basic course in electronics and Communication engineering Progresses from the fundamentals of electricity, active and passive components, basic electronics laws like Ohm's law, Ampere's law.

***Course Objective:***

The objectives of this course are

1. To prepare the students to have a basic knowledge of active and passive components.
2. To build knowledge to distinguish pure and impure DC signals.
3. To grow measuring ability of signals through multi meter and CRO
4. To understand characteristics of proper biasing for BJT and FET.
5. To encourage in developing circuits using diodes, transistors, FETs and OPAMPs.

***Course Outcomes:***

CO1: Knowledge of Electronic components such as Resistors, Capacitors, Diodes, Transistors measuring equipment like DC power supply, Multimeter, CRO, Signal generator, DC power supply.

CO2: Analyse the characteristics of Junction Diode, Zener Diode, BJT & FET and different types of Rectifier Circuits.

CO3: Determination of input-offset voltage, input bias current and Slew rate, Common- mode Rejection ratio, Bandwidth and Off-set null of OPAMPs.

CO4: Able to know the application of Diode, BJT & OPAMP.

**List of Experiments:**

1. Familiarization with passive and active electronic components such as Resistors, Inductors, Capacitors, Diodes, Transistors (BJT) and electronic equipment like DC power supplies, millimeters etc.
2. Familiarization with measuring and testing equipment like CRO, Signal generators etc.
3. Study of I-V characteristics of Junction diodes.
4. Study of I-V characteristics of Zener diodes.
5. Study of Half and Full wave rectifiers with Regulation and Ripple factors.
6. Study of I-V characteristics of BJTs.
7. Study of I-V characteristics of Field Effect Transistors.
8. Determination of input-offset voltage, input bias current and Slew rate of OPAMPs.
9. Determination of Common-mode Rejection ratio, Bandwidth and Off-set null of OPAMPs.
10. Study of OPAMP circuits: Inverting and Non-inverting amplifiers, Adders, Integrators and Differentiators.

11. Study of Logic Gates and realization of Boolean functions using Logic Gates.
12. Study of Characteristic curves for CB, CE and CC mode transistors.
13. Innovative Experiment

***Text Books:***

1.D. Chattopadhyay, P. C. Rakshit, Electronics Fundamentals and Applications, New Age International
2.Millman & Halkias, Integrated Electronics, Tata McGraw Hill.
3.Sedra & Smith, Microelectronics Engineering

***Reference Books:***

1.John D. Ryder, Electronic Fundamentals and Applications, PHI
2.J.B. Gupta, Basic Electronics, S.K. Kataria.
3.Malvino: Electronic Principle.
4.Boyelstad & Nashelsky: Electronic Devices & Circuit Theory, McGraw Hill, 1976.

***CO-PO-PSO Mapping:***

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 1 | 2 | - | 1 | - | - | 1 | - | 2 | 1 | 1 | 2 |
| CO2 | 3 | 3 | 3 | 2 | 2 | - | - | 3 | - | - | - | 2 | 2 | 1 | 1 |
| CO3 | 3 | 3 | 3 | 2 | 1 | - | - | - | 1 | - | - | 3 | 2 | 1 | 1 |
| CO4 | 3 | 3 | 2 | 3 | 2 | 2 | 1 | - | - | - | 1 | 3 | 1 | - | 2 |
| **Overall CO Mapping** | 3 | 2.75 | 2.5 | 2 | 1.75 | 2 | 1 | 3 | 1 | 1 | 1 | 2.5 | 1.5 | 1 | 1.5 |
| | 3 | 2 | 2 | 1 | 2 | - | 1 | - | - | 1 | - | 2 | | | |

**Course Name: Workshop/Manufacturing Practices**
**Course Code: ME 192**
**Contact: 0:0:3**
**Credit: 1.5**

**Prerequisite: Higher Secondary with Mathematics, Physics and Chemistry**

**Course Objectives:**

To understand the basic knowledge of Workshop Practice and Safety. To identify and use of different hand tools and other instruments like Hack Saw, Jack Plane, Chisels etc. and operations like Marking, Cutting etc. To expose students to different types of manufacturing/fabrication processes

**Course Outcomes (COs):**

On successful completion of the learning sessions of the course, the learner will be able to:

**CO1:** Get introduced with Engineering Graphics and visual aspects of design.
**CO2:** Know and use common drafting tools with the knowledge of drafting standards.
**CO3:** Apply computer aided drafting techniques to represent line, surface or solid models in different Engineering viewpoints.
**CO4**: Produce part models; carry out assembly operation and show working procedure of a designed project work using animation.

***Course Content:***

(i) Theoretical discussion & videos: (3P)

Detailed contents:

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods
2. Fitting operations & power tools
3. Carpentry
4. Welding (arc welding & gas welding), brazing
5. Electrical & Electronics
6. Metal casting
7. CNC machining, Additive manufacturing
8. Plastic moulding& Glass Cutting.

(ii) Workshop Practice:

***Module 1 - Machine shop*** *(6P)*

Typical jobs that may be made in this practice module:

i. To make a pin from a mild steel rod in a lathe.

ii. To make rectangular and vee slot in a block of cast iron or mild steel in a shaping and / or milling machine.

***Module 2 - Fitting shop*** *(6P)*

Typical jobs that may be made in this practice module:

i. To make a Gauge from MS plate.

***Module 3 - Carpentry*** *(6P)*

Typical jobs that may be made in this practice module:

i. To make wooden joints and/or a pattern or like.

**Module 4 - Welding shop (Arc welding 3P + gas welding 3P)** (3P)

Typical jobs that may be made in this practice module:

i. ARC WELDING (3P): To join two thick (approx 5mm) MS plates by manual metal arcwelding.

ii. GAS WELDING (3P): To join two thin mild steel plates or sheets by gas welding.

***Module 5 - Electrical & Electronics*** *(3P)*

House wiring, soft Soldering

***Module 6 – Smithy*** *(3P)*

Typical jobs that may be made in this practice module:

i. A simple job of making a square rod from a round bar or like.

For further study (Optional)

Module 7 - Casting

Typical jobs that may be made in this practice module:

i. One/ two green sand moulds to prepare, and a casting be demonstrated.

**Module 8 - Plastic moulding & Glass Cutting** (3P)

Typical jobs that may be made in this practice module:

i. For plastic moulding, making at least one simple plastic component should be made.

ii. At least one sample shape on glass should be made using laser cutting machine.

Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

**Text Books:**

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of WorkshopTechnology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers privatelimited, Mumbai.
2. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGrawHill House, 2017.

**Reference Books:**

1. Gowri P., Hariharan and A. Suresh Babu, Manufacturing Technology – I, Pearson Education, 2008.

2. Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.

3. Kalpakjian S. and Steven S. Schmid, Manufacturing Engineering and Technology, 4th edition, Pearson Education India Edition, 2002.

4. Manufacturing Science by A.Ghosh and A.K.Mallick, Wiley Eastern.

5. Principles of Metal Cutting/Principles of Machine Tools by G.C.Sen and A.Bhattacharya, New Central Book Agency, Kolkata.

**COs-POs-PSOs MAPPING:**

| CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** | **3** |
| **CO1** | 3 | 1 | 2 | 1 | 1 | - | - | - | 2 | 1 | - | 2 | 2 | 1 | 1 |
| **CO2** | 3 | 3 | 2 | 2 | 1 | - | - | - | 2 | 1 | - | 2 | 3 | 2 | 2 |
| **CO3** | 3 | 2 | 2 | 2 | 1 | 1 | - | 2 | 2 | 2 | 3 | 2 | 3 | 3 | 3 |
| **CO4** | 1 | 2 | 1 | 2 | 1 | 1 | - | 2 | 2 | 2 | 3 | 2 | 3 | 3 | 3 |
| **Overall CO Mapping** | 2.5 | 2 | 1.75 | 1.75 | 1 | 1 | | 2 | 2 | 1.5 | 3 | 2 | **2.8** | **2.3** | **2.3** |

# Curriculum for B.Tech 2nd Semester

| *2nd Semester* | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Sl No** | **Course Type** | **Course Code** | **Theory** | **Credit Hours /Week** | | | | **Credit Points** |
| | | | | **L** | **T** | **P** | **Total** | |
| **A. THEORY** | | | | | | | | |
| 1 | BS | M 201 | Mathematics -II | 3 | 1 | 0 | 4 | 4 |
| 2 | BS | CH 201/ PH 201 | Chemistry - (Gr. B) / Physics – I (Gr. A) | 3 | 0 | 0 | 3 | 3 |
| 3 | ES | EE 201/ EC 201 | Basic Electrical Engineering (Gr. B) / Basic Electronics Engineering (Gr. A) | 3 | 0 | 0 | 3 | 3 |
| 4 | ES | CS 201 | Programming for Problem Solving | 3 | 0 | 0 | 3 | 3 |
| 5 | ES | ME 201 | Engineering Mechanics | 3 | 0 | 0 | 3 | 3 |
| **Total of Theory** | | | | | | | **16** | **16** |
| **B. PRACTICAL** | | | | | | | | |
| 6 | ES | CS291 | Programming for Problem Solving Lab | 0 | 0 | 3 | 3 | 1.5 |
| 7 | BS | CH 291/ PH 291 | Chemistry Lab (Gr. B) / Physics - I Lab (Gr. A) | 0 | 0 | 3 | 3 | 1.5 |
| 8 | ES | EE 291/ EC 291 | Basic Electrical Engineering Lab (Gr. B) / Basic Electronics Engineering Lab (Gr. A) | 0 | 0 | 3 | 3 | 1.5 |
| 9 | ES | ME 291/ ME 292 | Engineering Graphics & Design (Gr B) / Workshop/Manufacturing | 0 | 0 | 3 | 3 | 1.5 |
| 10 | HS | HU 291 | Language Lab | 0 | 0 | 2 | 2 | 1 |
| 11 | PROJ | PR 291 | Project-II | 0 | 0 | 1 | 1 | 0.5 |
| 12 | PROJ* | PR 292 | Innovative activities-I | 0 | 0 | 0 | 0 | 0.5 |
| **C. MANDATORY ACTIVITIES / COURSES** | | | | | | | | |
| 13 | MC | MC 281 | NSS/ Physical Activities/Meditation & Yoga/Photography/ Nature Club | 0 | 0 | 0 | 3 | |
| **Total of Theory, Practical & Mandatory Activities/Courses** | | | | | | | **34** | **24** |

* Inter/ Intra Institutional Activities viz; Training with higher Institutions; Soft skill training organized by Training and Placement Cell of the respective institutions; contribution at incubation/ innovation /entrepreneurship cell of the institute; participation in conferences/ workshops/ competitions etc.; Learning at Departmental Lab/ Tinkering Lab/ Institutional workshop; Working in all the activities of Institute's Innovation Council for eg: IPR workshop/Leadership Talks/ Idea/ Design/ Innovation/ Business Completion/ Technical Expos etc. (evaluation by Programme Head through certification)

Innovative activities to be evaluated by the Programme Head/ Event coordinator based on the viva voce and submission of necessary certificates as evidence of activities.

# Syllabus- 2nd Semester

**Course Name: Mathematics - II**
**Course Code: M 201**
**Contact: 3:1:0**
**Total Contact Hours: 48**
**Credit: 4**

**Prerequisites:** The students to whom this course will be offered must have the concept of (10+2) standard calculus.

**Course Objectives:** The objective of this course is to disseminate the prospective engineers with techniques in multivariable calculus, ordinary differential equations and Laplace transform. It aims to equip the students with concepts and tools at an intermediate to advanced level of mathematics and applications that they would find useful in their disciplines.

**Course Outcomes (COs):**

On successful completion of the learning sessions of the course, the learner will be able to:

**CO1:** Recall the properties of Laplace Transform to evaluate multiple integrals and their usage
**CO2:** Understand the concept of Laplace transform to solve ordinary differential equations
**CO 3:** Apply effective mathematical tools for the solutions of ordinary differential equations that model physical processes.

**CO4:** Analyze to mathematical tools to evaluate multiple integrals and vector integral

**Course Content:**

**Module I: Multivariable Calculus (Integration): (12 L)**

Double integration, Change of order of integration in double integrals, Triple integrals, vector line integrals, scalar surface integrals, vector surface integrals, Green's theorem, Gauss divergence theorem and Stokes' theorem.

**Module II: First Order Ordinary Differential Equations: (10 L)**

Solution of first order and first degree ODE: Exact ODE, Rules for finding Integrating factors, Linear ODE, Bernoulli's equation, Solution of first order and higher degree ODE: solvable for ▫, solvable for ▫ solvable for ▫ and Clairaut's equation.

**Module III: Second Order Ordinary Differential Equations: (12 L)**

Solution of second order ODE with constant coefficients: C.F. & P.I., Method of variation of parameters, Cauchy-Euler equations, Reduction of $2^{nd}$ order ODE to a pair of first order ODEs, Solution of simultaneous linear ODEs.

### *Module IV: Laplace Transform: (14L)*

Definition and existence of LT, LT of elementary functions, First and second shifting properties, Change of scale property, LT of $t^n f(t)$, LT of $\frac{f(t)}{t}$, LT of derivatives of f (t), LT of $\int_0^t f(t)\,dt$,

Evaluation of improper integrals using LT, LT of periodic and step functions, Inverse LT: Definition and its properties, Convolution theorem (statement only) and its application to the evaluation of inverse LT, Solution of linear ODE with constant coefficients (initial value problem) using LT.

### *Text Books:*


1. Kreyszig, E., Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. Ramana, B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
3. Veerarajan, T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Grewal, B.S., Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
5. Bali, N.P. and Goyal, M., A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.


### *Reference Books:*


1. Thomas, G.B. and Finney, R.L., Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Boyce, W. E. and DiPrima, R. C., Elementary Differential Equations and Boundary Value Problems, 9th Edn., Wiley India, 2009.
3. Ross, S. L., Differential Equations, 3rd Ed., Wiley India, 1984.
4. Piskunov, N., Differential and Integral Calculus, Vol. I & Vol. II, Mir Publishers, 1969.
5. Coddington, E. A., An Introduction to Ordinary Differential Equations, Prentice Hall, India, 1995.

**COs-POs-PSOs MAPPING:**

| CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO6 | PO 7 | PO 8 | PO 9 | PO10 | PO 11 | PO12 | PSO 1 | PSO2 | PSO 3 |
| **M 201.1** | 3 | 2 | 2 | 2 | - | - | - | 1 | 1 | - | - | 1 | - | - | - |
| **M201.2** | 3 | 2 | 2 | 2 | - | - | - | 1 | 1 | - | - | 1 | - | - | - |
| **M 201.3** | 3 | 2 | - | 2 | 2 | - | - | 1 | 1 | - | - | 1 | 3 | - | - |
| **M 201.4** | 3 | 3 | 2 | 2 | 2 | - | - | 1 | 1 | - | - | 1 | 1 | - | 2 |
| **M 101 CO** | 3 | 2.25 | 2 | 2 | 2 | | | 1 | 1 | | | 1 | **2** | | **2** |

**Course Name: Chemistry**
**Course Code: CH201**
**Contact: 3:0:0**
**Total Contact Hours: 36**
**Credits: 3**

**Pre requisites:** Knowledge of Chemistry up to 12th standard.

**Course Objective:**

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications.

## *Course Outcomes*

**CO1:** Able to remember fundamental concepts of Chemistry and define relevant terminologies.
**CO2:** Able to understand the principles of thermodynamics, spectroscopy and related physical properties of molecules.
**CO3:** Able to apply the basic concept of Organic Chemistry and knowledge of chemical reactions to industries and technical fields.
**CO4:** Able to analyze and explain protective measures of corrosion of metals in the industries.

*CO5: Able to assesstheoretical and practical aspects relating to the transfer of the production of chemical products from laboratories to the industrial scale, in accordance with environmental considerations.*

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**Course Content:**

**Module I: Inorganic Chemistry (9 L)**

**(i) Atomic structure (5 L)**

Bohr's theory to hydrogen-like atoms and ions; spectrum of hydrogen atom. Quantum numbers, Introduction to the concept of atomic orbitals, diagrams of s, p and d orbitals, Pauli's exclusion principle, Hund's rule, exchange energy, Aufbau principle and its limitation, introduction to Schrodinger equation.

**(ii) Periodic properties (4 L)**

Modern Periodic table, group trends and periodic trends in physical properties: electron affinity, electronegativity, polarizability, oxidation states, effective nuclear charges, penetration of orbitals, variations of s, p and d orbital energies of atoms.

***Module II: Physical Chemistry (8 L)***

**(i) Use of free energy in chemical equilibria (6 L)**

Thermodynamic functions: internal energy, enthalpy, entropy and free energy. 2nd Law of Thermodynamics, Estimations of entropy and free energies, Free energy and emf, Cell potentials, the Nernst equation and applications.

***(ii) Real Gases (2 L)***

Reason for deviation of real gases from ideal behavior, Equations of state of real

gases, Vander Waals' equation, pressure & volume correction, validity, critical state of gas.

***Module III: Organic Chemistry (8 L)***

**(i) Stereochemistry (4 L)**

Representations of 3 dimensional structures, Chirality, optical activity, isomerism, structural isomerism, stereoisomers, enantiomers, diastereomers, configurations (D,L & cis trans), racemisation.

**(ii) Organic reactions (4L)**

Concepts of inductive effect, resonance, hyperconjugation, introduction to reactions involving substitution, addition, elimination, oxidation (Baeyer villiger oxidation), reduction (Clemmensen reduction, Wolff-Kishner reduction)

***Module IV: Industrial Chemistry 8L***

(i) **Water (2 L):** Hardness, alkalinity, numerical

(ii) **Corrosion. (2 L):** Types of corrosion: wet & dry, preventive measures

(iii) **Polymers (3 L):** Classification of polymers, conducting polymers, biodegradable polymers

(iv) **Synthesis of a commonly used drug molecule. (1 L):** Paracetamol, Aspirin

***Module V: Spectroscopic techniques in Chemistry (3L)***

Electromagnetic radiation, Principles of spectroscopy, spectrophotometer, infrared spectroscopy, fingerprint region, functional group region, UV-VIS spectroscopy, $^{1}H$ Nuclear magnetic resonance spectroscopy, chemical shift

**Text Books**

(i) A Text Book of Organic Chemistry, Arun Bahl & Arun Bahl
(ii) General & Inorganic Chemistry, P.K. Dutt
(iii) General & Inorganic Chemistry, Vol I, R.P. Sarkar
(iv) Physical Chemistry, P.C. Rakshit

***Reference Books***

(v) Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane (iii)Fundamentals of Molecular Spectroscopy, by C. N. Banwell

(iv) Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan

(v) Physical Chemistry, by P. W. Atkins

(vi) Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition http://bcs.whfreeman.com/vollhardtschore5e/default.asp.

***CO-PO-PSO Mapping:***

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **P10** | **P11** | **P12** | **PSO1** | **PSO 2** | **PS O3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 1 | 3 | 2 | 2 | | - | - | - | - | 1 | 2 | 2 | 2 | - | - |
| **CO2** | 3 | 3 | 3 | 2 | 1 | - | 2 | 2 | - | 1 | - | 2 | 1 | 1 | - |
| **CO3** | 3 | 3 | 3 | 3 | 1 | 1 | 1 | 2 | - | 1 | - | 2 | 1 | 1 | - |
| **CO4** | 2 | 3 | 3 | 3 | 1 | - | - | - | - | 1 | 1 | 2 | - | - | - |
| **CO5** | 3 | 3 | 3 | 3 | 1 | 1 | 1 | - | 1 | - | 2 | 2 | 1 | - | - |
| **Overall CO Mapping** | 2.4 | 3 | 2.8 | 2.6 | 1 | 1 | 1.3 | 2 | 1 | 1 | 1.7 | 2 | 1.2 | **1** | - |

**Course Name: Basic Electrical Engineering**
**Course Code: EE201**
**Contact: 3:0:0**
**Total Contact hours: 36**
**Credits: 3**

**Prerequisites:**

- Basic $12^{th}$ standard Physics and Mathematics.
- Concept of components of electric circuit.

### *Course Objective:*

To introduce the students to basic principles of DC and AC circuits, Electrical Machines and Electrical Systems.

**Course Outcome:** After completion of the course students able to
**CO1.** Understand Basic Electrical circuits, Power distribution and Safety measures.
**CO2.** Analyze an apply DC network theorems.
**CO3.** Analyze and apply concept of AC circuits of single-phase and three-phase.
**CO4.** Understand basic principles of Transformers and Rotating Machines.

### *Course contents:*

**Module I: DC Circuits (9L)**

Definition of electric circuit, linear circuit, non-linear circuit, bilateral circuit, unilateral circuit, Dependent source, node, branch, active and passive elements, Kirchhoff's laws, Source equivalence and conversion, Network Theorems - Superposition Theorem, Thevenin's Theorem, Norton Theorem, Maximum Power Transfer Theorem, Star-Delta Conversions.

### *Module II: AC Fundamentals (9L)*

Sinusoidal quantities, Average and RMS values, peak factor, Form factor, Phase and Phase difference, concept of phasor diagram, V-I Relationship in R, L, C circuit, Combination R-L-C in series and parallel circuits with phasor diagrams, impedance and admittance, impedance triangle and power triangle, Power factor, concept of resonance, Power in AC circuit, simple problems (series and parallel circuit only), Three-phase balanced circuits, Concept of three-phase power measurement.

### *Module III: Single-Phase Transformer (5L)*

Brief idea on constructional parts, classifications, working principle. Problems on EMF equation. Phasor diagram, Equivalent circuit.

***Module IV: Electrical Rotating Machines***

***(8L) a)DC Machines (4L)***

Brief idea on constructional features, classifications, working principle of both motor and generator. Simple problems on Voltage equation.

***b) Three-Phase Induction Motor (4L)***

Basic concept of three phase circuit and production of rotating magnetic field. Working principle of three-phase induction motor and torque-speed characteristics (concept only). No numerical problem.

***Module V: General Structure of Electrical Power System (1L)***

Power generation to distribution through overhead lines and underground cables with single line diagram.

***Module VI: Electrical Installations (4L)***

Earthing of Electrical Equipment, ideas of basic components- MCB, MCCB, ELCB, SFU, Megger.

***Text books:***


1. D. P. Kothari & I. J. Nagrath, Basic Electrical Engineering, TMH.
2. V. Mittle & Arvind Mittal, Basic Electrical Engineering, TMH.
3. Ashfaq Hussain, Basic Electrical Engineering, S. Chand Publication.
4. Chakrabarti,Nath & Chanda, Basic Electrical Engineering, TMH.
5. C.L. Wadhwa, Basic Electrical Engineering, Pearson Education.


**Reference books:**


1. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
2. V. D. Toro, "Electrical Engineering Fundamentals", Printice Hall India, 1989.


***CO-PO-PSO Mapping:***

| COs | PO1 | PO2 | PO 3 | PO 4 | PO5 | PO 6 | PO7 | PO 8 | PO9 | PO10 | PO11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 1 | - | - | - | 2 | - | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 2 |
| **CO2** | 2 | 3 | - | - | - | - | - | - | 1 | - | 1 | 2 | 3 | - | 1 |
| **CO3** | 2 | 3 | 1 | - | - | - | - | 1 | 1 | - | 1 | 2 | 3 | - | 2 |
| **CO4** | 1 | 2 | 3 | 1 | - | - | - | - | 1 | - | - | 2 | 3 | 2 | 2 |
| **Overall CO Mapping** | 2 | 2.25 | 2 | 1 | | 2 | | 1 | 1 | 2 | 1.3 | 2 | 3 | 2.5 | 1.75 |

**Course Name: Programming for Problem Solving**
**Course Code: CS 201**
**Contact: 3:0:0**
**Total Contact Hours: 36**
**Credits: 3**

**Prerequisites:** Number system, Boolean Algebra

***Course Outcomes:***

| | |
|---|---|
| CO1 | Understand and differentiate among different programming languages for problem solving. |
| CO2 | Describe the way of execution and debug programs in C language. |
| CO3 | Define, select, and compare data types, loops, functions to solve mathematical and scientific problem. |
| CO4 | Understand the dynamic behavior of memory by the use of pointers. |
| CO5 | Design and develop modular programs using control structure, selection structure and file. |

**Course Content:**

**Fundamentals of Computer: (8 L)**

History of Computer, Generation of Computer, Classification of Computers, Basic structure of Computer System, Primary & Secondary Memory, Processing Unit, Input & Output devices. 2L

Binary and Allied number systems representation of signed & unsigned numbers, BCD, ASCII, Binary number. Arithmetic – Addition and Subtraction (using 1's complement and 2's complement). 2L

Overview of Procedural vs Structural language, compiler and assembler (basic concepts) 1L

Problem solving- Algorithm & flow chart. 2L

***C Fundamentals: (28 L)***

***Variable and Data Types:***

The C character set identifiers and keywords, data type & sizes, variable names, declaration, statements. 2L

***C Operators & Expressions:***

Arithmetic operators, relational operators, logical operators, increment and decrement operators, bitwise operators, assignment operators, conditional operators, special operators - type conversion, C expressions, precedence and associativity.

Input and Output: Standard input and output, formatted output - printf, formatted input scanf, bit fields. 4L

***Branching and Loop Statements:***

Statement and blocks, if - else, switch, goto and labels, Loops - while, for, do while, break and continue. 4L

***Fundamentals and Program Structures:***

auto, external, static and register variables Functions, function types, function prototypes, functions returning values, functions not returning values, scope rules, recursion, C preprocessor and macro. 5L

***Arrays, Strings and Pointers:***

One dimensional arrays, Two-dimensional arrays, Multidimensional arrays. Passing an array to a function Character array and string, array of strings, Passing a string to a function, String related functions, Pointers, Pointer and Array, Pointer and String, Pointer and functions, Dynamic memory allocation. 7L

***Structures and Unions:***

Basic of structures, arrays of structures, structures and pointers, structures and functions. 3L

***Files handling with C:***

formatted and unformatted files, Command line arguments, fopen, fclose, fgetc, fputc, fprintf, fscanf function. 3L

***Text book:***

Kerninghan B.W. & Ritchie D.M. - The C Programming Language ,PHI, 2nd Edition

Kanetkar Y. - Let us C, BPB Publication, 15th Edition

***Reference Books:***

E Balagurusamy – Programming in ANSI C, TMH, 3rd Edition

K R Venugopal & S R Prasad – MASTERING C, TMH, 2nd Edition

Reema Thareja – INTRODUCTION TO C PROGRAMMING, OXFORD UNIVERSITY PRESS, 2nd Edition.

***CO- PO-PSO Mapping:***

| **CO** | **PO** | | | | | | | | | | | | **PSO** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** | **3** |
| CO1 | 3 | 2 | 1 | 1 | - | - | 1 | - | 3 | 3 | 1 | 1 | - | - | - |
| CO2 | 2 | 2 | 3 | 3 | 1 | 2 | - | - | 3 | 3 | 3 | 3 | - | - | - |
| CO3 | 2 | 2 | 2 | 2 | 1 | 1 | - | - | 3 | 3 | 1 | 3 | 3 | - | - |
| CO4 | 3 | 2 | 2 | 2 | 1 | 3 | - | - | 3 | 3 | 2 | 3 | 1 | - | 2 |
| **Overall CO Mapping** | 3 | 3 | 3 | 3 | 1 | 3 | - | - | 3 | 3 | 3 | 3 | **2** | | **2** |

**Course Name: Engineering Mechanics**
**Course Code: ME 201**
**Contacts: 3:0:0**
**Total Contact Hours: 36**
**Credits: 3**

**Prerequisites:** Basic Concept of Physics

### *Course Objective:*

This course teaches students how to apply Newtonian physics to relatively simple real life applications. This course covers statics, dynamics and elementary part of strength of materials.

**Course Outcomes (COs):**

On successful completion of the learning sessions of the course, the learner will be able to:

**CO1:** To understand representation of force, moments for drawing free-body diagrams and analyze friction based systems in static condition
**CO2:** To locate the centroid of an area and calculate the moment of inertia of a section.
**CO3:** Apply of conservation of momentum & energy principle for particle dynamics and rigid body kinetics
**CO4:** Understand and apply the concept of virtual work, rigid body dynamics and systems under vibration.

.

### *Course Content:*

**Module 1: Introduction to Engineering Mechanics:** Force Systems Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy. 6L

**Module 2: Friction:** Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack. 2L

**Module 3: Basic Structural Analysis:** Equilibrium in three dimensions; Method of Sections; Method of Joints; How to determine if a member is in tension or compression; Simple Trusses; Zero force members; Beams & types of beams; Frames & Machines. 3L

**Module 4: Centroid and Centre of Gravity:** Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia-Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook. 5L

**Module 5: Virtual Work and Energy Method:** Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom. Active force diagram, systems with friction, mechanical efficiency. Conservative forces and potential energy (elastic and gravitational), energy equation for equilibrium. Applications of energy method for equilibrium. Stability of equilibrium. 5L

**Module 6: Review of particle dynamics:** Rectilinear motion; Plane curvilinear motion (rectangular, path, and polar coordinates). 3-D curvilinear motion; Relative and constrained motion; Newton's 2nd law (rectangular, path, and polar coordinates). Work-kinetic energy, power, potential energy.Impulse-momentum (linear, angular); Impact (Direct and oblique). 5L

**Module 7: Introduction to Kinetics of Rigid Bodies:** Basic terms, general principles in dynamics; Types of motion, Instantaneous centre of rotation in plane motion and simple problems; D'Alembert's principle and its applications in plane motion and connected bodies; Work energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation. 5L

**Module8: Mechanical Vibrations:** Basic terminology, free and forced vibrations, resonance and its effects; Degree of freedom; Derivation for frequency and amplitude of free vibrations without damping and single degree of freedom system, simple problems, types of pendulum, use of simple, compound and torsion pendulums. 5L

***Text books:***

1. Irving H. Shames (2006), Engineering Mechanics, 4th Edition, Prentice Hall
2. F. P. Beer and E. R. Johnston (2011), Vector Mechanics for Engineers, Vol I - Statics, Vol II, – Dynamics, 9th Ed, Tata McGraw Hill
3. R.C. Hibbler (2006), Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press.
4. Andy Ruina and Rudra Pratap (2011), Introduction to Statics and Dynamics, Oxford University Press
5. Shanes and Rao (2006), Engineering Mechanics, Pearson Education,
6. Hibler and Gupta (2010),Engineering Mechanics (Statics, Dynamics) by Pearson Education

***Reference books:***

1. Reddy Vijaykumar K. and K. Suresh Kumar(2010), Singer's Engineering Mechanics
2. Bansal R.K.(2010), A Text Book of Engineering Mechanics, Laxmi Publications
3. Khurmi R.S. (2010), Engineering Mechanics, S. Chand & Co.
4. Tayal A.K. (2010), Engineering Mechanics, Umesh Publications

***CO- PO-PSO Mapping:***

| CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** | **3** |
| **CO1** | 3 | 3 | 2 | 2 | - | - | - | - | 1 | - | - | - | 3 | 1 | 2 |
| **CO2** | 3 | 3 | 2 | 2 | - | - | - | 1 | 1 | - | - | 1 | 2 | 1 | 2 |
| **CO3** | 3 | 2 | 3 | 2 | 1 | - | - | - | 1 | - | - | 1 | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | - | - | - | - | 1 | - | 1 | - | 3 | 3 | 3 |
| **Overall CO Mapping** | 3 | 2.75 | 2.5 | 2.25 | 1 | | | 1 | 1 | | 1 | 1 | **2.8** | **2** | **2.5** |

**Course Name: Programming for Problem Solving**
**Lab Course Code: CS291**
**Contacts: 0:0:3**
**Credits: 1.5**

**Prerequisites:** Number system, Boolean Algebra.

## Course Outcomes:

After completion of this course student will be able to

**CO1:** Learn the concept of DOS system commands and editor.
**CO2:** To formulate the algorithms for simple problems and to translate given algorithms to a working and correct program
**CO3:** To be able to identify and correct syntax errors / logical errors as reported during compilation time and run time.
**CO4:** To be able to write iterative as well as recursive programs
**CO5:** Learn the concept of programs with Arrays, Pointers, Structures, Union and Files.

**List of Experiment:**

- Some basic commands of DOS, Windows and Linux Operating System, File handling and Directory structures, file permissions, creating and editing simple C program, compilation and execution of C program.
- Writing C Programs on variable, expression, operator and type-casting.
- Writing C Programs using different structures of if-else statement and switch-casestatement.
- Writing C Programs demonstrating use of loop (for loop, while loop and do-while loop) concept and use of break and continue statement.
- Writing C Programs demonstrating concept of Single & Multidimensional arrays.
- Writing C Programs demonstrating concept of Function and Recursion.
- Writing C Programs demonstrating concept of Pointers, address of operator, declaring pointers and operations on pointers.
- Writing C Programs demonstrating concept of structures, union and pointer to structure.
- Writing C Programs demonstrating concept of String and command line arguments.
- Writing C Programs demonstrating concept of dynamic memory allocation.
- Writing C Programs demonstrating concept of File Programming.

***CO-PO-PSO Mapping:***

| **CO** | **PO** | | | | | | | | | | | | **PSO** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** | **3** |
| CO 1 | 1 | - | - | - | 1 | 2 | - | 2 | - | 1 | 2 | 3 | - | - | - |
| CO2 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | 2 | - | - | - |
| CO3 | 2 | 2 | 2 | 2 | 1 | - | - | - | - | - | - | 3 | 3 | - | - |
| CO4 | 1 | 2 | 2 | 2 | 1 | - | - | - | - | - | - | 2 | 1 | - | 2 |
| CO5 | 2 | 3 | 3 | 3 | 1 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | | | |
| **Overall CO Mapping** | 1.8 | 2.5 | 2.5 | 2.3 | 1 | 2 | 3 | 2 | 3 | 2 | 2.5 | 2.6 | **2** | | **2** |

**Course Name: Chemistry Lab**
**Course Code: CH 291**
**Contact: 0:0:3**
**Credits: 1.5**

**Prerequisites:** Knowledge of Physics up to 12th standard.

## *Course Objective:*

- Study the basic principles of pH meter and conductivity meter for different applications.
- Analysis of water for its various parameters & its significance in industries.
- Learn to synthesis Polymeric materials and drugs.
- Study the various reactions in homogeneous and heterogeneous medium.

**Course Outcome**

CO1: Able to operate different types of instruments for estimation of small quantities chemicals used in industries and scientific and technical fields.
CO2: Able to work as an individual also as a team member
CO3: Able to analyse different parameters of water considering environmental issues
CO4: Able to synthesize nano and polymer materials.
CO5: Capable to design innovative experiments applying the fundamentals of chemistry

**List of Experiment:**

**Choice of 10-12 experiments from the following:**

- Determination of surface tension and viscosity
- Thin layer chromatography
- Determination of hardness of water
- Determination of chloride content of water
- Determination of the rate constant of a reaction
- Determination of cell constant and conductometric tritration
- pH metric titrations
- Synthesis of a polymer/drug
- Saponification/acid value of an oil
- Chemical analysis of a salt
- Chemical oscillations- Iodine clock reaction
- Determination of the partition coefficient of a substance between two immiscible liquids
- Adsorption of acetic acid by charcoal

## *Innovative experiments (any one)*

- Synthesis of silver nano particles
- Green synthesis

***CO-PO-PSO Mapping:***

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **P10** | **P11** | **P12** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 1 | 3 | 2 | 2 | 2 | - | - | - | - | 1 | 2 | 2 | 2 | 1 | - |
| **CO2** | 3 | 3 | 3 | 2 | 1 | - | 3 | 3 | - | 1 | - | 3 | 1 | - | - |
| **CO3** | 3 | 3 | 3 | 3 | 3 | 1 | 3 | 3 | - | 1 | - | 2 | - | 1 | - |
| **CO4** | 2 | 3 | 3 | 3 | 3 | - | - | - | - | 1 | 1 | 2 | 1 | - | - |
| **CO5** | 3 | 3 | 3 | 3 | 1 | 1 | 3 | - | 1 | - | 2 | 3 | 2 | 1 | - |
| **Overall CO Mapping** | 2.4 | 3 | 2.8 | 2.6 | 2 | 1 | 3 | 3 | 1 | 1 | 1.67 | 2.4 | 1.5 | 1 | - |

**Course Name: Basic Electrical Engineering Laboratory**
**Course Code: EE291**
**Contact: 0:0:3**
**Credits: 1.5**

**Prerequisites:**

- Basic Physics and applied physics.
- Basic Mathematics.
- Basic concept of Electric Circuit

## *Course Objective:*

To impart and apply knowledge about the Basic Electrical Components, Machineries, Instruments and Safety measures.

**Course Outcome:**

**CO1.** Identify and use common electrical components.
**CO2.** **D**evelop electrical networks by physical connection of various components andanalyze the circuit behaviour.
**CO3.** Apply and analyze the operational characteristics of electrical machines.
**CO4.** Apply and analyze the equivalent parameters, Losses, efficiency of transformers

## *List of Experiments:*

1. Basic safety precautions – earthing, introduction to measuring instruments – Voltmeter, Ammeter, Multimeter, Wattmeter, Real life Resistor, Capacitor, Inductor.
2. Verification of Thevenin's and Norton's Theorem.
3. Verification of Superposition and Maximum Power Transfer Theorem.
4. Characteristics of Fluorescent, Tungsten and Carbon filament lamps.
5. Study of R-L-C series circuit.
6. Three-phase Power measurement with two wattmeter method.
7. Demonstration of cut-out sections of machines: DC Machine (commutator-brush arrangement), Induction Machine (squirrel cage rotor).
8. Measurement of primary and secondary voltage and current of single-phase transformer – Open Circuit and Short Circuit Test.
9. Starting, Reversing and speed control of DC shunt motor.
10. Torque-Speed characteristics of DC Machine.
11. Torque-Speed characteristics of Three-phase Induction Motor.
12. Test on single-phase Energy Meter.

## *CO-PO-PSO Mapping:*

| Cos | PO1 | PO2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO9 | PO1 0 | PO 11 | PO 12 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | - | - | - | - | 2 | - | 2 | - | - | - | 3 | 3 | 3 | 3 | 1 |
| **CO2** | 3 | 3 | - | - | 2 | - | - | - | - | - | 1 | 3 | 3 | 3 | 2 | - |
| **CO3** | 3 | - | - | - | - | - | - | - | 1 | - | 1 | 3 | 3 | 1 | 2 | 3 |
| **CO4** | 3 | 2 | 3 | 2 | 1 | - | - | 2 | 1 | 1 | - | - | 3 | 1 | 2 | 3 |
| **Overall CO Mapping** | 3 | 2.5 | 3 | 2 | 1.5 | 2 | | 2 | 1 | 1 | 1 | 3 | 3 | 2 | 2.25 | 2.75 |

**Course Name: Engineering Graphics & Design**
**Course Code: ME 291**
**Contact: 0:0:3**
**Credits: 1.5**

**Prerequisites:** Basic knowledge of geometry

### *Course Objectives:*

To learn detailed drawing and modeling of a system, component, or process which meets desired needs within realistic constraints. It will help students to use the techniques, skills, and modern engineering tools and communicate effectively.

**Course Outcomes (COs):**

On successful completion of the learning sessions of the course, the learner will be able to:

**CO1:** Get introduced with Engineering Graphics and visual aspects of design.
**CO2:** Know and use common drafting tools with the knowledge of drafting standards.
**CO3:** Apply computer aided drafting techniques to represent line, surface or solid models in different Engineering viewpoints.
**CO4**: Produce part models; carry out assembly operation and show working procedure of a designed project work using animation.

### *List of Drawing:*

**Traditional Engineering Graphics**:

Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.

### Module 1: Introduction to Engineering Drawing

Principles of Engineering Graphics and their significance, Usage of Drawing instruments, lettering, Conic sections including Rectangular Hyperbola (General method only); Cycloid, Epicycloid and Involute; Scales – Plain, Diagonal and Vernier Scales.

**Module 2: Orthographic & Isometric Projections**

Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes; Projection of Solids inclined to both the Planes- Auxiliary Views; Isometric Scale, Isometric Views of lines, Planes,

Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa.

**Module 3: Sections and Sectional Views of Right Angular Solids**

Drawing sectional views of solids for Prism, Cylinder, Pyramid, Cone and project the true shape of the sectioned surface, Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw sectional orthographic views of objects from industry and dwellings (foundation to slab only)

***Computer Graphics****:*

Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Co-ordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modeling; Solid Modeling.

**Module 4: Overview of Computer Graphics**

Demonstration of CAD software [The Menu System, Toolbars (Standard, Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), Zooming methods, Select and erase objects].

**Module 5: CAD Drawing, Customization, Annotations, layering**

Set up of drawing page including scale settings, ISO and ANSI standards for dimensioning and tolerancing; Using various methods to draw straight lines, circles, applying dimensions and annotations to drawings; Setting up and use of Layers, Changing line lengths (extend/lengthen); Printing documents; Drawing sectional views of solids and project the true shape of the sectioned surface; Drawing annotation, CAD modeling of parts and assemblies with animation, Parametric and non parametric solid, surface and wireframe modeling, Part editing and two dimensional documentation of models.

**Module 6:**

**Demonstration of a simple team design project**

Illustrating Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; Meshed topologies for engineering analysis and tool-path generation for component manufacture, Use of solid-modeling software for creating associative models at the component and assembly levels.

**Text Books:**

1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House

2. (Corresponding set of) CAD Software Theory and User Manuals

**Reference Books:**

1. K. Venugopal**,** Engineering Drawing + AutoCAD, New Age International publishers
2. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication.

3. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education

4. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers.

**CO-PO-PSO Mapping:**

| **CO** | **PO** | | | | | | | | | | | | **PSO** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** | **3** |
| **CO1** | 1 | - | 1 | - | 1 | 1 | - | 2 | 2 | 1 | - | - | 2 | 1 | 1 |
| **CO2** | 2 | 1 | 2 | - | 1 | 1 | - | 2 | 1 | 2 | 1 | 1 | 3 | 2 | 2 |
| **CO3** | 2 | 1 | 3 | 2 | 3 | - | - | 2 | 2 | 2 | 1 | 1 | 3 | 3 | 3 |
| **CO4** | 2 | 1 | 3 | 3 | 3 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 |
| **Overall CO Mapping** | 1.8 | 1 | 2.3 | 2.5 | 2 | 1 | 2 | 2 | 1.8 | 1.8 | 1.3 | 1.3 | **2.8** | **2.3** | **2.3** |

**Course Name: Lang. Lab. and Seminar Presentation**
**Course Code: HU 291**
**Contact: 0:0:2**
**Credit: 1**

**Pre requisites:** Basic knowledge of LSRW skills.

**Course Objective:** To train the students in acquiring interpersonal communication skills by focussing on language skill acquisition techniques and error feedback.

**Course Outcome:**
HU291.1: Able to understand advanced skills of Technical Communication in English through Language Laboratory.
HU291.2: Able to apply listening, speaking, reading and writing skills in societal and professional life.
HU291.3: Able to demonstrate the skills necessary to be a competent Interpersonal communicator.
HU291.4: Able to analyze communication behaviours.
HU291.5: Able to adapt to multifarious socio-economical and professional arenas with the help of effective communication and interpersonal skills.

***Course Content:***

**Module 1: Introduction to the Language Lab**
a. The Need for a Language Laboratory
b. Tasks in the Lab
c. Writing a Laboratory Note Book

***Module 2: Active Listening***
a. What is Active Listening?
b. Listening Sub-Skills—Predicting, Clarifying, Inferencing, Evaluating, Note-taking
c. Academic Listening vs Business Listening
d. Listening in Business Telephony
e. Study of Contextualized Examples based on Lab Recordings

***Module 3: Speaking***
a. Speaking—Accuracy and Fluency Parameters
b. Pronunciation Guide—Basics of Sound Scripting, Stress and Intonation
c. Fluency-focussed activities—JAM, Conversational Role Plays, Speaking using Picture/Audio Visual inputs
d. Accuracy-focussed activities—Identifying Minimal Pairs, Sound Mazes, Open and Closed Pair Drilling, Student Recordings (using software)
e. Group Discussion: Principles and Practice

***Module 4: Lab Project Work***
a. Making a brief Animation film with voice over (5 minutes)OR
b. Making a brief Documentary film (10 minutes)

***Reference Books:***
1. IT Mumbai**, Preparatory Course in English** syllabus

2. IIT Mumbai, **Introduction to Linguistics** syllabus
3. Sasikumar et al. *A Course in Listening and Speaking*. New Delhi: Foundation Books, 2005.
4. Tony Lynch, *Study Listening*. Cambridge: Cambridge UP, 2004.

***CO- PO-PSO Mapping :***

| | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO1 0** | **PO11** | **PO1 2** | **PSO 1** | **PS O2** | **PS O3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | - | - | 3 | - | 3 | 2 | 2 | 3 | 3 | - | 3 | **1** | **-** | **3** |
| **CO2** | 2 | 3 | 3 | 3 | - | 3 | 3 | 3 | 2 | 3 | - | 3 | **-** | **1** | **3** |
| **CO3** | 1 | 3 | 3 | 3 | - | 2 | 2 | 2 | 2 | 3 | - | 2 | **-** | **2** | **3** |
| **CO4** | 1 | 2 | 3 | 3 | - | 2 | 1 | 1 | 2 | 3 | 1 | 2 | **-** | **2** | **3** |
| **CO5** | 3 | 3 | 2 | 3 | - | 2 | 3 | 2 | 2 | 3 | - | 2 | | **2** | **3** |
| **Overall CO Mapping** | 1.8 | 2.75 | 2.75 | 3 | | 2.4 | 2.2 | 2 | 2.2 | 3 | 1 | 2.4 | **1** | **1.7** | **3** |

**Course Name: NSS/Physical Activities/ Meditation & Yoga/ Photography/Nature Club**
**Course Code: MC 281**
**Contact: 0:0:3**

**Course Objectives**:

- To increase student awareness about the weaker and unprivileged sections of society
- To expose students to environmental issues and ecological concerns
- To make students self aware about their participatory role in sustaining society and the environment

## *List of Activities:*

a) Creating awareness in social issues

b) Participating in mass education programmes

c) Proposal for local slum area development

d) Waste disposal

e) Environmental awareness ``

f) Production Oriented Programmes

g) Relief & Rehabilitation work during Natural calamities

Creating awareness in social issues:

1. Women's development – includes health, income-generation, rights awareness.

2. Hospital activities – Eg. writing letters for patients, guiding visitors

3. Old age home – visiting the aging in-mates, arranging for their entertainment.

4. Children's Homes - visiting the young in-mates, arranging for their entertainment

5. Linking with NGOs to work on other social issues. (Eg. Children of sex-workers)

6. Gender issues- Developing an awareness, to link it with Women's Cell of college

Participating in mass education programmes: 1.Adult education 2. Children's education

Proposal for local slum area development : One or two slums to be identified and according to the needs, activities to be developed and proposals and reports are to be submitted.

Environmental awareness

• Resource conservation – Awareness to be developed on water, energy,soil.

• Preservation of heritage monuments- Marches, poster campaigns

• Alternative energy consciousness amongst younger school-children.

• Plantation and beautification- Plantation of trees, their preservation and upkeep, developing NSS parks.

• Waste disposal- Proper methods of domestic waste disposal.

Production Oriented Programmes

5. Working with people and explaining and teaching improved agricultural practices

6. Rodent control land pest control practices;

7. Soil-testing, soil health care and soil conservation;

8. Assistance in repair of agriculture machinery;

9. Work for the promotion and strengthening of cooperative societies in villages;

10. Assistance and guidance in poultry farming, animal husbandry, care of animal health etc.;

11. Popularization of small savings and

12. Assistance in procuring bank loans

Relief & Rehabilitation work during Natural calamities

g) Assisting the authorities in distribution of rations, medicine, clothes etc.;

h) Assisting the health authorities in inoculation and immunization, supply of medicine etc.;

i) Working with the local people in reconstruction of their huts, cleaning of wells, building roads etc.;

j) Assisting and working with local authorities in relief and rescue operation; Collection of clothes and other materials, and sending the same to the affected areas

| 3rd Semester | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Sl No** | **Field** | **Paper Code** | **Theory** | **Contact Hours /Week** | | | | **Credit Points** |
| | | | | **L** | **T** | **P** | **Total** | |
| **A. THEORY** | | | | | | | | |
| 1 | ES | CH(FT) 301 | Environmental Engineering | 2 | 0 | 0 | 2 | 2 |
| 2 | BS | CH(FT) 302 | Chemistry-2 | 2 | 1 | 0 | 3 | 3 |
| 3 | ES | FT 301 | Thermodynamics & Kinetics | 2 | 1 | 0 | 3 | 3 |
| 4 | PC | FT 302 | Food Microbiology | 2 | 1 | 0 | 3 | 3 |
| 5 | PC | FT303 | Chemistry of food | 2 | 1 | 0 | 3 | 3 |
| **Total of Theory** | | | | | | | **14** | **14** |
| **B. PRACTICAL** | | | | | | | | |
| 6 | ES | CH (FT)391 | Environmental Engineering Lab | 0 | 0 | 3 | 3 | 1.5 |
| 7 | BS | CH(FT)392 | Chemistry-2 Lab | 0 | 0 | 3 | 3 | 1.5 |
| 8 | PC | FT391 | Chemistry of Food Lab–I | 0 | 0 | 3 | 3 | 1.5 |
| 9 | PC | FT392 | Food Microbiology Lab | 0 | 0 | 3 | 3 | 1.5 |
| 10 | PROJ | PR 391 | Project-III | 0 | 0 | 2 | 2 | 1 |
| 11 | PROJ* | PR 392 | Innovative activities-II | 0 | 0 | 0 | 1 | 0.5 |
| **C. MANDATORY ACTIVITIES / COURSES** | | | | | | | | |
| 12 | MC | MC 381 | Behavioral and Interpersonal Skills | 0 | 0 | 3 | 3 | |
| **Total of Theory, Practical & Mandatory Activities/Courses** | | | | | | | **32** | **21.5** |

*Students may choose either to work on participation in all the activities of Institute's Innovation Council for eg: IPR workshop/ Leadership Talks/ Idea/ Design/ Innovation/ Business Completion/ Technical Expos etc.

Innovative activities to be evaluated by the Programme Head/ Event coordinator based on the viva voce and submission of necessary certificates as evidence of activities.

## *Syllabus 3rd Sem*

**Course Name: Environmental Engineering**
**Course Code: CH(FT) 301**
**Contact: 2:0:0**
**Total Contact Hours: 24**
**Credit: 2**

**Pre requisites:** 10+2 science with chemistry

### *Course Objective*

Understanding of the fundamentals of environment and its relation with human activities. Learning the environmental laws and regulations to develop guidelines for health and safety issues. Acquiring skills to solve problems related to air, water noise and land pollutions.

### *Course Outcome*

After the completion of the course students will be able to:

**CO1: Understand** the natural environment and its relationships with human activities

**CO2: Apply** the fundamental knowledge of science and engineering toassess environmental and health risk

**CO3: Understand** environmental laws and regulations to develop guidelinesand procedures for health and safety issues.

**CO4:** acquire skills for scientific problem-solving related to air, water,& land pollution.

### *Course Contents:*

**Module I (5L):** Importance of population study in environmental engineering, Mathematics of population growth and associated problems;Definition and type of resource; Sustainable Development.

Materials balance: Steady state conservation system, steady state system with non conservative pollutants, step function.

Elements of ecology: System, open system, closed system, definition of ecology, species, population, community, definition of ecosystem- components types and function; Food chain [definition and one example of each food chain], Food web.

**Module II (6L):** Definition of pollutants and contaminants, Primary and secondary pollutants: emission standard, criteria pollutant.

Energy balance: Conductive and Convective heat transfer, radiation heat transfer, simple global temperature model [Earth as a black body, earth as albedo], Problems.

Green house effects: Definition

Lapse rate: Ambient lapse rate Adiabatic lapse rate, atmospheric stability, temperature inversion (radiation inversion).

Atmospheric dispersion: Maximum mixing depth, ventilation coefficient, effective stack height, smokestack plumes and Gaussian plume model.

Sources and effect of different air pollutants- Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN.

Smog, Photochemical smog and London smog.

Depletion Ozone layer: CFC, destruction of ozone layer by CFC, impact of other green house gases, effect of ozone modification.

Standards and control measures: Industrial, commercial and residential air quality standard, control measure (ESP, cyclone separator, bag house, catalytic converter, scrubber (ventury), Statement with brief reference).

**Module III (8L):** Hydrosphere, Hydrological cycle and Natural water.

Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, thermal application, heavy metals, pesticides, volatile organic compounds.

River/Lake/ground water pollution: River: DO, 5 day BOD test, Seeded BOD test, BOD reaction rate constants, Effect of oxygen demanding wastes on river [deoxygenation, reaeration], COD, Oil, Greases, pH.Lake: Eutrophication [Definition, source and effect].

Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only)

Standard and control: Waste water standard [BOD, COD, Oil, Grease], Water Treatment system [coagulation and flocculation, sedimentation and filtration, disinfection, hardness and alkalinity, softening] Waste water treatment system, primary and secondary treatments

[Trickling filters, rotating biological contractor, Activated sludge, sludge treatment, oxidation ponds] tertiary treatment definition.

Water pollution due to the toxic elements and their biochemical effects: Lead, Mercury, Cadmium, and Arsenic.

**Module IV (3L):** Solid Waste: Municipal, industrial, commercial, agricultural, domestic, pathological and hazardous solid wastes, Recovery and disposal method: Open dumping, Land filling, incineration, composting, recycling.

Hazardous and biomedical wastes

***Revision: 2L***

**Text Books:**

1. Basic Environmental Engg. and Elementary Biology, Gourkrishna Mahapatra

***Reference books:***

1. Basic Environmental Engg. and Elementary Biology, Patra and Singha
2. Basic Course in Environmental Studies, Deswal and Deswal

**COs-POs-PSOs MAPPING:**

| | **PO1** | **PO 2** | **PO3** | **PO 4** | **PO5** | **PO6** | **PO 7** | **PO8** | **PO9** | **P10** | **P11** | **P12** | **PSO1** | **PSO2** | **PSO 3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 3 | - | - | - | 3 | - | - | - | 1 | 2 | **3** | **2** | **1** |
| **CO2** | - | - | 1 | - | - | - | - | - | - | - | - | - | 3 | 2 | 2 |
| **CO3** | 2 | - | 2 | - | 1 | - | **2** | - | - | - | - | - | 3 | 2 | 2 |
| **CO4** | - | - | 2 | - | - | **2** | **2** | - | - | - | - | - | 3 | 3 | 3 |
| **Overall CO Mapping** | 2.5 | 2 | 2 | - | 1 | **2** | **2.3** | - | - | - | - | - | 3 | 2.25 | 2 |

**Course Name: Chemistry-2**
**Course Code: CH(FT) 302**
**Contact : 2:1:0**
**Total Contact Hours: 36**
**Credit: 3**

**Pre requisites:** 10+2 science with chemistry

### *Course Objective*

Understanding of the fundamental theories and applications of the concepts of Dilute solutions , Colligative properties and Ionic Equilibrium and to get an insight into Instrumental Methods of Spectral Analysis. Learning about the Structure reactivity of the Organic molecules, Co-ordination chemistry and Colloid Chemistry.

### *Course Outcome*

After the completion of the course students will be able to:

**CO1: U**nderstand fundamental concepts of Dilute solutions, Colligative properties and Ionic Equilibrium in different engineering applications.
**CO2: A**nalyze the Structures of the molecules by the different spectral techniques.
**CO3:** Synthesize Colloid Systems and emulsions.
**CO4:** Apply the basic concept of Organic Chemistry and knowledge of Chemical reactions to industries , and technical fields.
**CO5:** Analyze different types of co-ordination compounds and their structures with the help of Crystal Field Theory**.**

### *Course Contents:*

**Module I (9L): Dilute solutions – Colligative properties**

Rault's Law, Lowering of vapor pressure of solution, elevation of boiling point, freezing point depression, definition, principles, and laws of osmotic pressure: Vant Hoff's Equation.

**Ionic equilibrium:** Solubility and solubility product, common ion effect, ionic product of water, pH, pOH, hydrolysis of salt solutions: Strong acid and weak base, weak acid and strong base, weak acid and weak base, concepts of buffer. Hydrolysis of salt.

### *Module II (8L): Instrumental methods of spectral analyses*

**UV Spectra**: Electronic transition ($\sigma$-$\sigma^*$, n-$\sigma^*$, $\pi$-$\pi^*$ and n-$\pi^*$), steric effect, solvent effect, hyperchromic effect, hypochromic effect (typical examples).

**IR Spectra**: Modes of molecular vibrations, characteristic stretching frequencies of O-H, C-H, C=C, C=O functions.

**NMR Spectra**: Nuclear spin, NMR active nuclei, principle of proton magnetic resonance, equivalent and nonequivalent protons.

**Photochemistry**: Lambert's law and Beer's Law, Laws of photochemistry, Photochemical processes.

### *Module III (7L):*

**Coordination Chemistry**

Double salt, Complex salt, Werner's Theory, Structures of coordination compounds corresponding to coordination number 6; types of ligands; Elementary idea about Crystal Field Theory (CFT), isomerism (geometrical, optical, ionization, linkage and coordination).

### *Colloid Chemistry*

Definition of colloid, principle of colloid formation, types of colloid, colloid preparation, stability of colloid, association of colloid and emulsion.

### *Module IV (8L):*

Basic concept of organic molecules, tetra covalency of carbon, hybridization, electronic effects.

Reactive intermediates: carbocations (cabenium and carbonium ions), carbanions, carbon radicals, carbenes: structure using orbital picture, electrophilic/nucleophilicbehaviour, stability, generation and fate.

Nucleophilic substitution reactions: $S_N1$, $S_N2$, $S_Ni$ mechanisms.

Addition reaction.

Elimination Reactions: E1, E2, and E1cB mechanisms. Saytzeff and Hofmann rules.Elimination vs substitution reaction. Electrophilic and Activated Nucleophilic substitution reactions of Benzene (Nitration, sulphonation, Halogenation and Friedel Craft reactions).

Chemistry and mechanism of some selective organic name reactions: Aldol condensation, Cannizaro reaction, Reimer-Teiman reaction, Pinacol-pinacolone rearrangement, Keto-enoltautomerism, Benzoin condensation

### *Revision: 4L*

**Text books:**

**1.** Physical Chemistry, P.C. Rakshit

**2.** Inorganic Chemistry, R.L. Dutta

***Reference books***

**1.** Concept of Inorganic Chemistry, J.D.Lee

**2.** Organic Spectroscopy, W. Kemp

**3.** A Guide book to Mechanism in Organic Chemistry, P. Sykes

**COs-POs-PSOs MAPPING:** :

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **P10** | **P11** | **P12** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 1 | - | - | - | - | - | - | - | - | - | - | **3** | **2** | **1** |
| **CO2** | 3 | 2 | 1 | - | - | - | - | - | - | - | - | - | 3 | 2 | 2 |
| **CO3** | - | - | 2 | - | 2 | - | - | - | - | - | - | 1 | 3 | 2 | 2 |
| **CO4** | 2 | - | 1 | - | 2 | - | - | - | - | - | - | - | 3 | 3 | 3 |
| **CO5** | 2 | - | - | - | - | - | 2 | - | - | - | - | 1 | 3 | 2 | 3 |
| **Overall CO mapping** | 2.5 | 1.5 | 1.5 | **-** | **2** | **-** | 2 | **-** | **-** | **-** | **-** | 1 | 3 | 2.2 | 2.2 |

**Course name: Thermodynamics & Kinetics**
**Course Code: FT 301**
**Contact: 2:1:0**
**Total Contact Hours: 36**
**Credit: 3**

**Pre requisites:** Physics, Chemistry and Mathematics

### *Course Objective*

To introduce the principles of chemical engineering thermodynamics and illustrate their applications in the design of chemical process plants and to learn about reaction kinetics for single, multiple, isothermal, non-isothermal reactions

### *Course Outcome*

After the completion of the course students will be able to:

**CO1: Understand** the terminology associated with engineering thermodynamics and contemporary issues related to chemical engineeringthermodynamics
**CO2: Describe** knowledge of phase equilibria in two-component and multi-component systems
**CO3: Estimate** thermodynamic properties of substances in gas or liquid stateof ideal and real mixture
**CO4: Demonstrate** intermolecular potential and excess property behavior ofmulti-component systems
**CO5: Explain** concepts of order and molecularity of chemical reactions.

### *Course Contents:*

**Module I (8L):** Review of $1^{st}$, $2^{nd}$ and $3^{rd}$ law of thermodynamics, PVT behaviour of Pure Substances, Virial Equation of State, , Application of the Virial Equations, Cubic Equations of State, The Nature of Equilibrium, the Phase Rule, Duhem's Theorem

**Module II (8L):** Simple model's for vapour/liquid Equilibrium, Rault's Law, Henry's law, Modified Raoult's Law, Vapour Liquid Equilibrium, K-value correlations; VLE from Cubic Equations of State; Equilibrium and Stability; Liquid/liquid equilibrium

**Module III (8L):** Thermodynamics and its Applications: The Chemical Potential and Phase Equilibria Fugacity and Fugacity, Coefficient: for pure species and solution; Property Changes and Heat Effects of Mixing Processes. The Vapour-Compression Cycle, the Choice of

Refrigerant, Absorption, Refrigeration and liquefaction: Low temperature cycle: Linde and Claude.

**Module IV (8L):** Kinetics: Rate of chemical reaction; Effect of Temperature on Rate Constant, Arrehnius equation, Collision Theory, Transition State Theory, Order and Molecularity of a Chemical reaction, Elementary Reactions, First and Second order reactions, Non Elementary Reactions, Pseudo-first order reaction, Determination of rate constant and order of reaction, Half life method.

***Revision: 4L***

***Text books:***

1. Smith &Vanness, Thermodynamics for Chemical Engineers, MGH

2. Richardson, J.F., Peacock, D.G.Coulson& Richardson's Chemical Engineering- Volume 3

ed., First Indian ed. Asian Books Pvt. Ltd. 1998

***Reference books***

1. Levenspiel.O., Chemical Reaction Engineering, Wiley Eastern Ltd.

2. Bailey & Olis, Biochemical Engg. Fudamentals, MGH, 1990

3. Physical Chemistry: Castellan, Narosa Publishing.

4. Physical Chemistry ; Moore, PHI

**COs-POs-PSOs MAPPING:**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **P10** | **P11** | **P12** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 1 | - | **-** | **-** | **-** | - | - | - | - | - | - | **3** | **2** | **1** |
| CO2 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | - | 3 | 2 | 2 |
| CO3 | 2 | 2 | 2 | - | 2 | - | - | - | - | - | - | 1 | 3 | 2 | 2 |
| CO4 | 2 | 2 | 1 | **2** | 2 | - | - | - | - | - | - | - | 3 | 3 | 3 |
| CO5 | 2 | 2 | 3 | **2** | **1** | - | 2 | - | - | - | - | 2 | 3 | 2 | 3 |
| **Overall CO mapping** | 2.5 | 1.5 | 1.33 | **-** | **2** | **-** | 2 | **-** | **-** | **-** | **-** | 1 | 3 | 2.2 | 2.2 |

**Course Name: Food Microbiology**
**Course Code: FT 302**
**Contact: 2:1:0**
**Total Contact Hours: 36**
**Credit: 3**

**Pre requisites:** Biology, Chemistry

***Course Objective***

To familiarize students with procedures and techniques used to detect and enumerate microorganisms in foods and develop an understanding of spoilage microorganisms and their effects on food and integrate their basic knowledge of microbiology, chemistry, biochemistry, food processing.

***Course Outcome:***

After the completion of the course students will be able to:

**CO1: Classify** different types of microorganism which are present in the environment.
**CO2: Describe** the internal and external factors for food spoilage microorganisms
**CO3: Interpret** the causes of food borne diseases and their etiology.
**CO4: Evaluate** the measures required to control undesired microorganisms infood.
**CO5: Collect** knowledge about disinfection and disinfectants.

***Course Contents:***

**Module I (8L):** Introduction – definition, significance of food microbiology; Microscope; Classification & morphology of microbes including pathogens and non pathogens; Techniques of pure culture; Bacterial growth kinetics; Bacteriology of water; Antimicrobial agents – physical & chemical – mechanism & action

**Module II (8L):** Disinfection & disinfectants; Thermal inactivation of microbes; Concept, determination & importance of TDT, F, Z & D values; Factors affecting heat resistance; Pasteurization and sterilization..

**Module III (8L):** Microbiology of milk & milk products like cheese, butter, Basic microbiology of meat, fish, poultry.

**Module IV (8L):** Microbiology of fruits & vegetable and products like jam, jelly, juice; Microbiology of cereal and cereal products like bread, biscuits, confectionary

***Revision: 4L Text***

***books:***

1. Essentials of Microbiology; K. S. Bilgrami; CBS Publishers, Delhi
2. Food Microbiology; WC Frazier; Tata McGraw Hill, Delhi

***Reference books:***

1. Modern Food Microbiology; James M Jay; CBS Publishers, Delhi
2. Microbiology; Pelczar, Chan and Krieg; Tata McGraw Hill, Delhi
3. Basic Food Microbiology; Bannett, Chapman and Hall
4. Food Microbiology; M. R. Adams
5. Hand Book of Microbiology; Bisen

**COs-POs-PSOs MAPPING:**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **P10** | **P11** | **P12** | **PSO1** | **PSO2** | **PSO 3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 1 | - | - | - | - | - | - | - | - | - | - | **3** | **2** | **1** |
| **CO2** | 3 | 2 | 1 | - | - | **3** | **2** | - | - | - | - | 2 | 3 | 2 | 2 |
| **CO3** | - | - | 2 | - | 2 | **2** | - | - | - | - | - | 1 | 3 | 2 | 2 |
| **CO4** | 2 | - | 1 | - | 2 | **2** | - | - | - | - | - | 2 | 3 | 3 | 3 |
| **CO5** | 2 | - | - | - | - | - | 2 | - | - | - | - | 2 | 3 | 2 | 3 |
| **Overall CO mapping** | 2 | 1.5 | 2 | **-** | **2** | **-** | 2 | **-** | **-** | **-** | **-** | 1 | 3 | 2.2 | 2.2 |

**Course Name: Chemistry of Food**

**Course Code: FT 303**

**Contact: 2:1:0**

**Total Contact Hours: 36**

**Credit: 3**

**Pre requisites:** Biochemistry

***Course Objective***

The main objectives of this course is for students to differentiate chemical interactions and reactions of food components and their effect on sensory, nutritional, and functional properties of foods, and how processing influences these properties.

***Course Outcome:***

After the completion of the course students will be able to:

**CO1: Understand** the structure and composition of different nutrients.
**CO2: Illustrate** the physical and chemical properties of different nutrients.
**CO3**: **Differentiate** the function of the nutrients in different food materials and their practical implications.
**CO4: Analyze** how processing conditions are likely to change the reactivity offood components.
**CO5: Apply** fundamental concepts to know the principles behind analytical techniques associated with food.

***Course Contents:***

**Module I (8L):** Importance of food chemistry; Water in foods and its properties: different types of moisture in food; Water activity, Determination of moisture content, water absorption isotherm.

Carbohydrate: Sources of food carbohydrates; **Classifications**.

Structure, Physico-chemical and functional properties: Monosaccharides, Disaccharides, Oligosaccharides, Polysaccharides, homosachharides and heterosachharides

Starch: Structure, sources, properties (hydrolysis, gelatinization, retrodradation, dextrinisation, crystallization); Glycogen: definition, properties, Cellulose, pectin, gums: Occurrences, properties, uses.

**Module II (8L): Proteins: Sources and physico-chemical and functional properties**: Amphoterism, hydration, binding of ions, precipitation with antibiotics, gel formation, Different types of food proteins.

Purification of proteins (basic concepts):Electrophoresis, Gel filtration, Spectrophotometric analysis, Chromatographic analysis.

Amino acids: Essential and non essential amino acids, their structures, deficiency diseases; Acidic and basic amino acids.

**Module III (8L):** Fats: Sources; Classifications; Fatty acids: Classifications with examples and structure (SAFA, MUFA, PUFA); Omega 3 and Omega 6 fatty acids.

Physico-chemical and functional properties; Rancidity: Definition, types of rancidity of fats and oils; Reversion of fats; Antioxidants: Definition, examples, roles; Saponification number, iodine value, Reichert-Meissl number, Polenske value; Lipids of biological importance like cholesterol and phospholipids.

**Module IV (8L): Minerals and Vitamins: Sources and structures of minerals & vitamins**; Effect of processing and storage of vitamins; Pro vitamins A & D; Vitamins as antioxidants. Food Pigments & Flavouring Agent: Importance, types and sources of pigments (Chlorophyll, carotenoids, anthocyanin, and flavonoids) −their changes during processing and storages.

***Revision: 4L***

***Text Books:***

1. Essentials of Food & Nutrition by Swaminathan, Vol. 1 & 2
2. Food Chemistry by L. H. Meyer

***Reference books:***

1. Hand Book of Analysis of fruits & vegetables by S. Ranganna
2. Chemical changes in food during processing by Richardson
3. Food Science by Norman N. Potter & Joseph H.Hotchkiss
4. Food Chemistry by H. K. Chopra & P. S. Panesar

***CO-PO- PSO Mapping:***

| CO | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO 3 |
| CO1 | 3 | 1 | - | - | - | 3 | 3 | - | - | - | - | 3 | 3 | 2 | 2 |
| CO2 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | - | 3 | 3 | 2 | 2 |
| CO3 | 3 | 3 | 3 | 3 | 1 | - | 2 | - | - | - | - | 3 | 3 | 2 | 2 |
| CO4 | 3 | 3 | 2 | 2 | - | - | 2 | - | - | - | - | 3 | 3 | 3 | 2 |
| CO5 | 2 | - | - | - | - | 3 | 2 | 2 | - | - | - | 3 | 3 | 3 | 2 |
| **Overall CO mapping** | 2.80 | 2.50 | 2.67 | 2.33 | 1.00 | 3.00 | 2.25 | 2.00 | - | - | - | 3 | 3 | 2.4 | 2 |

**Course Name: Environmental Engineering Lab**
**Course Code: CH (FT)391**
**Contact: 0:0:3**
**Credit: 1.5**

**Pre requisites:** 10+2 science with chemistry

***Course Objective:***

Acquiring knowledge on Standard solutions and the various reactions in homogeneous medium. Understanding the basic principles of pH meter for different applications and analyzing water and soil with respect to their various parameters.

***Course Outcome:***

After the completion of the course students will be able to:

**CO1:** Able to operate different types of instruments for estimation of small quantities chemicals used in industries and scientific and technical fields.

**CO2:** Able to apply the fundamental knowledge of science and engineering to assess environmental and health risk.

**CO3:** Able to work as an individual also as a team member.

**CO4:** Able to analyses different parameters of water considering environmental issues.

**CO5:** Able to analyze the different parameters of soil considering environmental issues.

***List of Experiment:***

**Exp 1.**

Physical examination of Sewage/Water:

a. Total Solid

b. Total dissolve solid

c. Total suspended solid

d. pH, color and odor

***Exp 2.***

Chemical estimation of Sewage/Water and soil

a. Determination of Chlorides

b. Estimation of Chemical oxygen Demand

***Exp. 3.***

Microbial examination of Sewage/Water: Biological oxygen demand

***Exp. 4.***

Determination of Soil nitrate and soil phosphate.

***Exp. 5***

Innovative Experiments

***CO-PO-PSO Mapping :***

| CO | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO 9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 1 | - | - | - | 3 | 3 | - | - | - | - | 3 | 3 | 2 | 2 |
| CO2 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | - | 3 | 3 | 2 | 2 |
| CO 3 | 3 | 3 | 3 | 3 | 1 | - | 2 | - | - | - | - | 3 | 3 | 2 | 2 |
| CO 4 | 3 | 3 | 2 | 2 | - | - | 2 | - | - | - | - | 3 | 3 | 3 | 2 |
| CO 5 | 2 | - | - | - | - | 3 | 2 | 2 | - | - | - | 3 | 3 | 3 | 2 |
| Overall CO mapping | 2.80 | 2.50 | 2.67 | 2.33 | 1.00 | 3.00 | 2.25 | 2.00 | - | - | - | 3 | 3 | 2.4 | 2 |

**Course Name: Chemistry-2 Lab**
**Course Code: CH (FT) 392**
**Contact: 0:0:3**
**Credit: 1.5**

**Pre requisites:** 10+2 science with chemistry

## *Course Objective*

Acquiring knowledge on standard solutions and analyzing the various organic and inorganic salts .Applying the knowledge of chemistry to determine the kinetics of the reactions. Synthesis of alum and Nanomaterials.

## *Course Outcome*

After the completion of the course students will be able to:

**CO.1:** operate different types of instruments for estimation of small quantitieschemicals used in industries and scientific and technical fields.

**CO.2:** apply the fundamental knowledge of science and engineering to assess thekinetics of the reactions.

**CO.3:** work as an individual also as an team member.

**CO.4:** analyze different types of organic and inorganic salts.

**CO5:** design innovative experiments applying the fundamentals of chemistrysuch as Nanomaterials, soap etc.

## *List of Experiment:*

**Exp 1.**

Study on kinetics of iodine / ester hydrolysis

### *Exp 2.*

Detection of aldehyde / aliphatic or aromatic alcohol / carboxylic / ester / amino group(s)

### *Exp. 3.*

To identify the following Basic Radicals by dry and wet tests – $Pb^{2+}$ , $Cu^{2+}$ , $Al^{3+}$, $Fe^{3+}$, $Zn^{2+}$ , $Ni^{2+}$ , $Ca^{2+}$, $Mg^{2+}$ , $Na^{+}$ , $K^{+}$ , $NH4^{+}$

### *Exp. 4.*

To identify the following Acid Radicals by dry and wet tests – $Cl^{-}$ , $CO_3^{2-}$, $SO_4^{2-}$, $S^{2-}$ , $NO_3^{-}$

***Exp. 5.***

To identify an unknown water soluble salt containing one basic and one acid radical as mentioned above.

***Exp. 6.***

Preparation of Potash Alum.

***Exp. 7.***

Preparation of nano particles (innovative experiment)

***Exp. 8.***

Innovative Experiments

**COs-POs-PSOs MAPPING:**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **P10** | **P11** | **P12** | **PSO 1** | **PSO 2** | **PSO 3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 1 | 1 | 1 | 1 | - | - | 2 | - | - | - | 3 | 1 | 2 |
| **CO2** | - | - | - | - | - | - | - | - | 3 | - | - | - | 3 | 3 | 2 |
| **CO3** | - | - | - | - | - | 2 | 3 | - | - | - | - | 1 | 3 | 2 | 2 |
| **CO4** | - | - | - | - | 2 | 1 | - | - | - | - | - | - | 3 | 1 | 2 |
| **CO5** | 2 | - | 2 | - | 1 | - | - | - | - | - | - | 1 | 3 | 2 | 2 |
| **Overall mapping** | 2.5 | 2 | 1.5 | **1** | 1.3 | **1.3** | 3 | - | **2.5** | - | - | 1 | 3 | 3 | 2 |

**Course Name: Chemistry of Food Lab I**
**Course Code: FT 391**
**Contact: 0:0:3**
**Credit: 1.5**

**Pre requisites:** Food Chemistry

## *Course Objective:*

To provide an opportunity to the students to define chemistry as the study of the composition, structure, properties of food materials and identify methods and instruments that can be used to study of food chemistry and To focus on the development of skills to control the quality of food by providing an opportunity to the students prioritize different controlling parameters to improve shelf-life of food and to prevent adulteration.

## *Course outcome:*

After the completion of the course students will be able to:

**CO 1: Identify** the composition, structure, properties of food materials, methods and instruments that can be used to study of food chemistry.

**CO 2: Recognize** the importance of proximate analysis.
**CO 3: Develop** skills to control the quality of food and to prevent adulteration.

**CO 4: Recognize** different controlling parameters to improve shelf-life of food.

**CO 5: Evaluate** data generated by experimental methods for chemical characterization of food materials.

## *List of Experiment:*

1. Determination of Moisture in food sample
2. Determination of Protein in food sample
3. Determination of Ash in food sample
4. Determination of Crude Fat in food sample from solid and liquid food(milk) materials
5. Determination of Acidity and pH in food sample/beverages

6. Determination of total, non-reducing and reducing sugars in food sample
7. Determination of Vitamin C in food sample
8. Innovative experiment

### *Text books:*

1. Essentials of Food & Nutrition by Swaminathan, Vol. 1 & 2
2. Food Chemistry by L. H. Meyer

### *Reference books*

1. Hand Book of Analysis of fruits & vegetables by S. Ranganna
2. Chemical changes in food during processing by Richardson
3. Food Science by Norman N. Potter & Joseph H. Hotchkiss
4. Food Chemistry by H. K. Chopra & P. S. Panesar

**COs-POs-PSOs MAPPING:**

| **CO** | **Program Outcomes** | | | | | | | | | | | | **Program Specific Outcomes** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO 12** | **PSO 1** | **PS O2** | **P S O 3** |
| **CO 1** | 2 | 1 | - | - | - | - | 2 | - | 2 | - | - | 2 | 3 | 3 | 3 |
| **CO 2** | 2 | 2 | 1 | - | - | - | 1 | - | 2 | 1 | - | 2 | 3 | 2 | 2 |
| **CO 3** | 2 | 2 | - | - | - | 2 | 2 | 2 | 2 | 1 | - | 2 | 2 | 2 | 2 |
| **CO 4** | 3 | 2 | 2 | - | - | - | - | - | 1 | - | - | 2 | 3 | 2 | 2 |
| **CO 5** | 3 | 2 | 2 | 1 | 3 | - | - | - | - | - | - | 3 | 2 | 3 | 2 |
| **Overall CO mapping** | 2.40 | 1.80 | 1.67 | 1.00 | - | 2.00 | 1.67 | 2.00 | 1.75 | 1.00 | - | 2 | 2.6 | 2.4 | 2.2 |

**Paper Name: Food Microbiology Lab**
**Paper Code: FT 392**
**Contact: 0:0:3**
**Credit: 1.5**

**Pre requisites:** Food Microbiology

***Course Objective***

To help the students understand various methods of isolation, characterization and screening of bacteria, fungi and other related organisms and apply different preservation techniques relative to food safety and spoilage.

***Course outcome:***

After the completion of the course students will be able to:

**CO1: Explain** various methods of isolation, characterization and screening of bacteria, fungi and other related organisms
**CO2: Develop** skills to monitor various food processing operations in food industries.
**CO3: Apply** different preservation techniques relative to food safety and spoilage.
**CO4: Illustrate** the growth requirements of common food borne pathogens and spoilage microorganisms.
**CO5: Identify** which organisms would be likely to grow in a specific food product.

***List of Experiments:***

1. Study of a compound microscope.
2. Simple staining, Gram Staining and Study of morphology of bacterial cells.
3. Study of autoclave, Preparation and sterilization of nutrient broth.
4. Sub-culturing of a bacterial strain in liquid and solid medium.
5. Study of growth of *E. coli* by a spectrophotometer.
6. Study of microbiological quality of milk by MBRT test.
7. Preparation of synthetic medium for the growth of yeast and mould and inoculation with standard strains of yeasts and moulds.
8. Isolation of starch-hydrolyzing organism from soil. Dilution and Plating by spread –plate and pour –plate techniques.
9. Dilution and Plating by spread –plate and pour –plate techniques.
10. Isolation of pure culture.

11. Morphological study of bacteria, yeast & mold and taking of photograph using Binocular Microscope.
12. Innovative Experiments

**COs-POs-PSOs MAPPING:**

| CO | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 2 | 1 | 1 | 1 | - | - | 2 | - | 2 | | - | 3 | 3 | 3 | 2 |
| CO2 | 2 | 2 | 1 | 1 | - | 1 | 2 | - | 1 | 1 | - | 3 | 3 | 3 | 2 |
| CO3 | 2 | 2 | - | - | 2 | - | 3 | 2 | 2 | 2 | - | 2 | 3 | 2 | 3 |
| CO4 | 2 | - | 2 | - | - | 2 | 2 | 2 | 1 | 1 | - | 2 | 3 | 3 | 3 |
| CO5 | 2 | 1 | 1 | - | - | 1 | 2 | 2 | 1 | - | - | 3 | 3 | 3 | 3 |
| Overall CO | 2.00 | 1.50 | 1.00 | 1.00 | - | 1.33 | 2.20 | 2.00 | 1.40 | 1.33 | - | 2.60 | 3 | 2.8 | 2.6 |

**Paper Name: Project III**
**Paper Code: PR 391**
**Contact hours: 0:0:2**
**Credit: 1**

**Prerequisites:** Thermodynamics, Chemistry

**Course Objective:**

- To apply theoretical and laboratory understanding and techniques in realistic implementation
- To help the students to identify the significant issues that need to be resolved for benefit of society
- To learn different verticals of a research and development project

**Course Outcome:**

After completion of Project students will be able to:

**CO1: Identify** the need of socio-economic demand in food of allied sector

**CO2: Apply** the knowledge of theory for innovative product/process design

**CO3: Interpret** the process involved in project for future industrial food and allied sector

**CO4: Summarize** a appropriate report

**CO-PO-PSO Mapping**

| COs | Program outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
| **CO1** | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 2 | 2 | 1 | 3 | 3 | 1 | - | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | - |
| **CO3** | 3 | 3 | 2 | 2 | 3 | 2 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 2 |
| **CO4** | 3 | 3 | 1 | 1 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 |
| **Overall Mapping** | 3 | 3 | 2 | 2 | 3 | 2.75 | 2 | 2.5 | 2.75 | 2.25 | 3 | 3 | 2.25 | 2.67 | 2.33 |

**Course Name: Behavioral & Interpersonal Skills**
**Course Code: MC-381**
**Total Contact Hours: 36**

**Course Objective:** To train the students in acquiring interpersonal communication skills by focusing on language skill acquisition techniques and error rectification through feedback.

***Course Outcome:***

**CO1**: It will equip the student to handle workplace interpersonal communication in an effective manner.

**CO2**: To enable students with strong oral and written interpersonal communication skills.

**CO3**: To prepare students to critically analyze workplace situations and take appropriate decisions.

**CO4**: To make students campus ready through proper behavioral and interpersonal grooming.

**CO5**: Integration of enhanced skill set to design and frame team based Project Report and Presentation.

***MODULE ONE – INTERPERSONAL COMMUNICATON***

1. The skills of Interpersonal Communication.
2. Gender/Culture Neutrality.
3. Rate of Speech, Pausing, Pitch Variation and Tone.
4. Corporate Communication.
5. Branding and Identity.

***MODULE TWO- INTERPERSONAL COMMUNICATION BASED ON WORKPLACE COMMUNICATION***

6. Workplace Communication.
7. Modes of Communication (Telephone, Conference Call, Team Huddle, Public Relation etc.)
8. Communication with Clients, Customers, Suppliers etc.
9. Organizing/Participating in Business Meeting.
10. Note Taking.
11. Agenda.
12. Minutes.

***MODULE THREE – BUSINESS ETIQUETTE AND CORPORATE LIFE***

13. Presenting oneself in the Business Environment.
14. Corporate Dressing and Mannerism.
15. Table Etiquette (Corporate Acculturation, Office parties, Client/Customer invitations etc.)
16. E-mail Etiquette.
17. Activity based Case Study.

## *MODULE FOUR – MOVIE MAKING: CORPORATE BUSINESS MEETING*

18. Team based Brainstorming.
19. Process Planning and Developing Plot.
20. People management.
21. Documentation and Scripting.
22. Shooting the Movie: Location and Camera.
23. Post Production and Editing.
24. Movie Review: Feedback and Analysis

## *LIST OF REFERENCE:*

1. Interpersonal Communication, Peter Hartley, Routledge, 1993.

2.Workplace Vagabonds: Career and Community in Changing Worlds of Work, Christina Garsten, Palgrave Macmillan, 2008.

3. Transnational Business Cultures Life and Work in a Multinational Corporation, Fiona Moore, Ashgate, 2005.

4. Global Business Etiquette: A Guide to International Communication and Customs, Jeanette S. Martin and Lillian H. Chaney, Praeger Publishers, 2006.

5. Making Teams Work: 24 Lessons for Working Together Successfully, Michael Maginn, McGraw-Hill, 2004.

6. Corporate Communications: Convention, Complexity, and Critique, Lars Thøger Christensen, Mette Morsing and George Cheney, SAGE Publications Ltd., 2008.

7. The Business Meetings Sourcebook: A Practical Guide to Better Meetings and Shared Decision Making, Eli Mina, AMACOM, 2002.

8.Moving Images: Making Movies, Understanding Media, Carl Casinghino, Delmar, 2011.

**COs-POs-PSOs MAPPING:**

| COs | Program outcomes | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO 1 | - | - | - | - | - | 1 | - | - | 2 | 1 | 2 | 1 | 1 | 2 | 1 |
| CO 2 | - | - | - | - | - | - | - | 3 | 2 | 1 | 2 | 2 | 2 | 1 | 2 |
| CO 3 | - | - | - | - | - | - | - | - | 2 | 2 | - | 1 | 1 | 1 | 1 |
| CO 4 | - | - | - | - | - | - | - | - | 1 | 2 | - | 1 | 2 | 2 | 2 |
| Overall Mapping | | | | | | 1 | | 3 | 1.75 | 1.5 | 2 | 1.25 | 1.75 | 1.5 | 1.5 |

| 4th Semester | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Sl No** | **Field** | **Paper Code** | **Theory** | **Contact Hours /Week** | | | | **Credit Points** |
| | | | | **L** | **T** | **P** | **Total** | |
| **A. THEORY** | | | | | | | | |
| 1 | ES | M(FT)401 | Numerical Methods | 2 | 0 | 0 | 2 | 2 |
| 2 | PC | FT401 | Biochemistry & Nutrition | 2 | 1 | 0 | 3 | 3 |
| 3 | BS | CH401 | Chemical Stoichiometry | 2 | 1 | 0 | 3 | 3 |
| 4 | PC | FT402 | Principles of Food Preservation | 2 | 1 | 0 | 3 | 3 |
| 5 | HS | HU 401 | Values & Ethics in Profession | 2 | 0 | 0 | 2 | 2 |
| 6 | PE | FT 403 | A. Unit Operation of Chemical Engineering-1<br>B. Transport Phenomena | 3 | 0 | 0 | 3 | 3 |
| **Total of Theory** | | | | | | | **16** | **16** |
| **B. PRACTICAL** | | | | | | | | |
| 6 | PC | FT491 | Biochemistry Lab | 0 | 0 | 3 | 3 | 1.5 |
| 7 | PC | FT 492 | Chemistry of Food Lab-II | 0 | 0 | 3 | 3 | 1.5 |
| 8 | PE | FT 493 | A. Unit operation Lab–I<br>B. Transport phenomena Lab | 0 | 0 | 3 | 3 | 1.5 |
| 9 | PROJ | PR 491 | Project-IV | 0 | 0 | 2 | 2 | 1 |
| 10 | PROJ* | PR 492 | Innovative activities-III | 0 | 0 | 0 | 0 | 0.5 |
| **C. MANDATORY ACTIVITIES / COURSES** | | | | | | | | |
| 11. | MC | MC 401 | Environment Sciences | 3 | 0 | 0 | 3 | |
| | | | | | | | | |
| **Total of Theory, Practical & Mandatory Activities/Courses** | | | | | | | **30** | **22** |

*Students may choose either to work on participation in all the activities of Institute's Innovation Council for eg: IPR workshop/ Leadership Talks/ Idea/ Design/ Innovation/ Business Completion/ Technical Expos etc.

Innovative activities to be evaluated by the Programme Head/ Event coordinator based on the viva voce and submission of necessary certificates as evidence of activities.

**Course Name: Numerical Methods**

**Course Code:** M (FT) 401

**Contact: 2:0:0**

**Total Contact Hours: 24**

**Credit: 2**

**Prerequisite:**

Concept of differential Calculus and Algebra

***Course Objectives:***

The purpose of this course is to provide basic understanding of the derivation and the use of the numerical methods along with the knowledge of finite precision arithmetic.

***Course Outcome:***

On successful completion of the learning sessions of the course, the learner will be able to:

| COs | DESCRIPTIONS |
|---|---|
| CO1 | Recall the distinctive characteristics of various numerical techniques and the associated error measures |
| CO2 | Understand the theoretical workings of various numerical techniques to solve the engineering problems and demonstrate error |
| CO3 | Apply the principles of various numerical techniques to solve various problems |

***Course Content:***

**Approximation in numerical computation:** Truncation and rounding errors, Propagation of errors, Floating-point arithmetic. (2L)

**Interpolation:** Calculus of Finite Differences, Newton forward and backward interpolation, Newton's divided difference interpolation, Lagrange's interpolation. (8L)

Numerical integration: **Trapezoidal rule, Simpson's 1/3 rule, Weddle's rule, Expression for corresponding error terms.** (4L)

**Numerical solution of a system of linear equations:** Gauss elimination method, LU Factorization method, Gauss-Seidel iterative method. (4L)

**Solution of transcendental equations:** Bisection method, Regula-Falsi method, Newton-Raphson method.
(3L)

**Numerical solution of ordinary differential equation:** Euler's method, Modified Euler method, Fourth order Runge-Kutta method.
(3L)

## *Text Books:*


1. Shishir Gupta &S.Dey, Numerical Methods, TMH
2. C.Xavier: C Language and Numerical Methods, New Age International Publishers.
3. Jain, Iyengar & Jain: Numerical Methods (Problems and Solution), New Age International Publishers.
4. S. S. Sastry: Introductory methods of numerical analysis, PHI


## *References:*


1. Balagurusamy: Numerical Methods, McGraw Hill Education.
2. Baburam: Numerical Methods, Pearson Education.
3. N. Dutta: Computer Programming & Numerical Analysis, Universities Press.
4. Soumen Guha & Rajesh Srivastava: Numerical Methods, OUP.
5. Srimanta Pal: Numerical Methods, OUP.
6. Numerical Analysis, Shastri, PHI
7. Numerical Analysis, S. Ali Mollah
8. Numerical Analysis, James B. Scarbarough
9. Numerical Methods for Mathematics,Science & Engg., Mathews, PHI
10. NumericalAnalysis,G.S.Rao,New Age International


**COs-POs-PSOs MAPPING:**

| COs | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **P10** | **P11** | **P12** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | 1 | - | - | - | - | - | - | - | - | 1 | 1 | 1 | 1 |
| CO2 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 1 | 1 | 2 |
| CO3 | 3 | 2 | 2 | - | - | - | - | - | - | - | - | 1 | 2 | 1 | 1 |
| Overall Mapping | 3 | 1.66 | 1.33 | | | | | | | | | 1 | 1.33 | 1 | 1.33 |

**Course Name: Biochemistry & Nutrition**
**Course Code: FT 401**
**Contact: 2:1:0**
**Total Contact Hours: 36**
**Credit: 3**

**Pre requisites:** Chemistry, Biology

***Course Objective***

To introduce the students to the biological basis of nutrition and the mechanisms by which diet can influence health and help them develop laboratory skills required for modern biochemical and molecular studies of nutrition.

***Course Outcome***

After the completion of the course students will be able to:

**CO1: Describe** the major metabolic pathways involved in the metabolism of nutrientsin the human body.

**CO2: Understand** the principles of biochemical methods and be able to use them with appropriate instruction.

**CO3: Interpret** the basis of reactivity of biologically relevant molecules and their interactions.

**CO4: Analyze** experimental data.

**CO5: Explain** the synthesis and regulation of bio-molecules and their role in metabolic pathways.

***Course Contents:***

**Module I (7L):** Introduction to Biochemistry: Proteins and protein structures; Transamination; Metabolism of proteins (digestion and absorption); Nitrogen balance and nitrogen pool; Evaluation of quality of proteins: BV, PER, NPU, Chemical Score.

**Module II (9L):** Enzymes; Definition, function, classification, nomenclature & structure; Co-enzymes and its function; Mechanism of enzyme action: Single, bi and multi substrate reactions;

Lock and Key model, Induced fit model;

Enzyme kinetics: MME, Significance of MM Constant, MME and Allosteric enzyme kintics; Enzyme inhibition: Reversible and Irreversible; LB Plot, Feedback inhibition, Substrate acts as inhibitor, Turn over number.

**Module III (9L):** Carbohydrates; Metabolic pathways for breakdown of carbohydrates: glycolytic pathway and its importance, energy yield; pentose phosphate pathway and its importance, energy yield; citric acid cycle and its importance, energy yield; Gluconeogenesis; Pathway, importance, energy yield, Cori cycle; Electron transport chain: Pathway, importance, Energy yield, Oxidative phosphorylation, ATP balance.

Essential fatty acids, Metabolism of ketone bodies, alpha, beta and omega oxidation of fatty acids; Digestion & absorption of lipids.

**Module IV (7L):** Vitamins & minerals: Physiological function of vitamins and minerals. Introduction to human nutrition; Nutritive values of foods; Basal metabolic rate; Techniques for assessment of human nutrition, Dietary requirements and deficiency diseases of different nutrients, Micronutrients

***Revision: 4L***

***Text books:***

1. Lehninger, Nelson & Cox, Principle of Biochemistry, CBS Publication
2. Modern Experimental Biochemistry, Boyer, Pearson Education
3. Lubert stryer, Biochemistry, Freeman & Co, N.Y.

***Reference books***

1. Voet & Voet, Fundamentals of Biochemistry, Jonh Willey & Sons
2. Instant Notes in Biochemistry by D. Hames & N. Hooper
3. Biochemistry by Debojyoti Das
4. Textbook of Biochemistry by E. S. West & W. R. Tod

**COs-POs-PSOs MAPPING:**

| CO | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO 1** | **PO2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO1 1** | **PO 12** | **PS O1** | **PS O2** | **PSO3** |
| **CO1** | 3 | 2 | 2 | 2 | - | 1 | 1 | - | - | - | - | 3 | 3 | 1 | 2 |
| **CO2** | 3 | 3 | 2 | 1 | - | - | 1 | - | - | - | - | 3 | 3 | 2 | 2 |
| **CO3** | 3 | 3 | 2 | 2 | - | 1 | - | - | - | - | - | 3 | 3 | 3 | 3 |
| **CO 4** | 3 | 2 | 2 | 2 | 2 | - | - | - | 1 | - | - | 2 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 2 | - | 1 | 1 | - | - | - | - | 3 | 3 | 3 | 3 |
| **Overall CO mapping** | 3.00 | 2.60 | 2.20 | 1.80 | 2.00 | 1.00 | 1.00 | - | 1 | - | - | 2.80 | 3 | 2.4 | 2.6 |

**Course Name: Chemical Stoichiometry**
**Course Code: CH401**
**Contact: 2:1:0**
**Total Contact Hours: 36**
**Credit: 3**

**Pre requisites:** Thermodynamics, Engineering Mechanics

***Course Objective:***

To help the students develop the concepts of different unit conversions, material balance and energy balances in different engineering systems by applying different mathematical interpretations.

***Course Outcome(s):***

After the completion of the course students will be able to:

**CO1: Understand** the stoichiometric importance of an engineering process.

**CO2: Analyze** with different systems of units and have the skill to convert units from one system to another.

**CO3: Apply** graphical methods for representation of engineering data.

**CO 4: Calculate** mass and energy balance equations to engineering problems and optimize the process requirements.

**CO 5: Predict** how processing conditions are likely to change with respect to enthalpy requirements of a process.

***Course Contents:***

**Module I (9L):** Small units and dimensions, Dimensional analysis by Buckingham Pi-theorem, Dimensionless groups, Conversion of equations, Solution of simultaneous equations, use of log-log and semi-log graph paper, triangular diagram, Graphical differentiation and graphical integration

**Module II (9L):** Material balance: Introductory Concepts, Simplification of the general mass balance equation for steady processes, Procedure for material balance calculations, Material balance without chemical reactions, Material balance with chemical reaction, Material Balance with recycle, bypass and purge streams.

**Module III (10L):** Energy Balance: General energy balance equation for steady and processes, Without Chemical Reaction, With Chemical Reaction, Enthalpy calculation procedures.

**Module IV (4L):** Combined Material and Energy Balances: Simultaneous material and energy balances, selected industrial process

***Revision: 4L***

**Text books:**

1. K. V. Narayanan and B. Lakshmikutty, Stoichiometry and Process Calculations, PHI

***Reference books***

1. Ghosal, Sanyal and Dutta, Introduction to Chemical Engineering, TMH

2. Hougen and Watson, Chemical Process Principles (Part one): 2nd Ed, John Wiley.

3.. Basic Principles and Calculations in Chemical Engineering: Himmelblau, 6th Ed. Prentice Hall

4.. Bhatt and Bhora, Stoichiometry, 4th Ed., TM

**COs-POs-PSOs MAPPING:**

| CO | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO 8 | PO9 | PO10 | PO11 | PO1 2 | PS O1 | PS O2 | PS O3 |
| CO1 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | - | 3 | 3 | 1 | 2 |
| CO2 | 3 | 3 | 2 | 2 | 2 | 1 | - | - | - | - | - | 3 | 3 | 2 | 2 |
| CO3 | 3 | 3 | 3 | 3 | 2 | 2 | - | - | - | - | - | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | - | 3 | 3 | 3 | 3 |
| Overall CO mapping | 3.00 | 3.00 | 2.60 | 2.40 | 2.00 | 1.50 | - | - | - | - | - | 3 | 3 | 2.4 | 2.6 |

**Paper Name: Principles of Food Preservation**
**Paper Code: FT402**
**Contact: 2:1:0**
**Total Contact Hours: 36**
**Credit: 3**

**Pre requisites:** Food Microbiology, Food Chemistry

***Course Objective:***

To describe students, different principles involved in food preservation and processing and to make them aware about different concepts involved in food spoilage and its prevention by using different food preservation principles and technologies.

***Course Outcome(s):***

After the completion of the course students will be able to:

**CO 1: Describe** actions taken to maintain foods with the desired properties for as long as needed.

**CO 2: Identify** quality-loss mechanisms in terms of biological, chemical, and Physical.

**CO 3: Develop** food handling practices that reduce the potential for food-borneillness.

**CO 4: Apply** preservation methods that make use of heat/cold, drying, acid,added chemicals, controlled air, pressure, and high-energy radiation.

**CO 5: Use** indirect approaches to food preservation – packaging, food hygiene,sanitation, Gas packaging.

***Course Contents:***

**Module I (12L):** Introduction to food preservation – Objectives and techniques of food preservation, Canning: Preservation principle of canning of food items, thermal process time calculations for canned foods, spoilage in canned foods

**Module II (6L):** Dehydration and drying of food items; cold chain, freezing (including cryogenic freezing)

**Module III (7L):** Preservation by fermentation and chemical preservatives, curing, pickling. Bio-preservatives, Antibiotics, lactic acid bacteria.

**Module IV (3L):** Ionization Radiation including UV Radiation.

**Module V (4L):** Other non-conventional preservation methods, Hurdle technology Non-thermal preservation processes (High pressure processing, Osmodehydration, Use of ultrasonic sound).

***Revision: 4L Text books:***

1. Technology of Food Preservation by Desrosier
2. Food Science by Potter

***Reference books:***

1. Fruits and vegetable processing by Cruess
2. Preservation of Fruits & Vegetables by IRRI
3. Principles of Food Preservation- Fennema
4. Handbook of Food Presrevation-M. Shafiur Rahman

**COs-POs-PSOs MAPPING:**

| **CO** | **Program Outcomes** | | | | | | | | | | | | **Program Specific Outcomes** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO1** | **PSO2** | **PSO3** |
| CO 1 | 3 | 2 | 2 | - | - | 2 | - | - | - | - | - | 3 | 3 | 3 | 1 |
| CO 2 | 3 | 3 | 2 | 2 | - | 1 | 1 | - | - | - | - | 3 | 3 | 2 | 1 |
| CO 3 | 3 | 3 | 2 | 2 | - | 2 | 1 | - | - | 1 | - | 3 | 3 | 3 | 3 |
| CO 4 | 3 | 3 | 3 | 2 | 2 | - | 2 | - | - | - | - | 3 | 3 | 3 | 3 |
| CO 5 | 3 | 2 | 2 | - | - | 2 | 3 | 1 | - | - | - | 3 | 3 | 3 | 3 |
| Overall CO mapping | 3.00 | 2.60 | 2.20 | 2.00 | 2 | 1.75 | 1.75 | 1.00 | - | 1 | - | 3 | 3 | 2.8 | 2.2 |

**Paper Name: Values and Ethics in Profession**
**Paper Code: HU 401**
**Contact: 2:0:0**
**Total Contact Hours: 24**
**Credit: 2**

**Pre requisites:** Basic knowledge of management, basics of communication, Knowledge about environment science

**Course Objective:** To create awareness on professional ethics and Human Values

***Course Outcome: On Completion of this course student will be able to***

| | |
|---|---|
| CO1 | Understand the core values that shape the ethical behavior of an engineer and Exposed awareness on professional ethics and human values. |
| CO2 | Understand the basic perception of profession, professional ethics, various moral issues & uses of ethical theories |
| CO3 | Understand various social issues, industrial standards, code of ethics and role of professional ethics in engineering field |
| CO4 | Aware of responsibilities of an engineer for safety and risk benefit analysis, professional rights and responsibilities of an engineer. |
| CO5 | Acquire knowledge about various roles of engineers in variety of global issues and able to apply ethical principles to resolve situations that arise in their professional lives |

**Course contents:**

**Module 1 (4L): Introduction:** Definition of Ethics; Approaches to Ethics: Psychological, Philosophical, Social.

**Module 2 (4L): Psycho-social theories of moral development**: View of Kohlberg; Morality and Ideology, Culture and Morality, Morality in everyday Context.

**Module 3 (4L): Ethical Concerns**: Work Ethics and Work Values, Business Ethics, Human values in organizations: Values Crisis in contemporary society
Nature of values: Value Spectrum of a good life.

***Module 4 (4L): Ethics of Profession:***

Engineering profession: Ethical issues in Engineering practice, Conflicts between business demands and professional ideals.
Social and ethical responsibilities of Technologists. Codes of professional ethics. Whistle blowing and beyond, Case studies.

**Module 5 (4L)**: **Self Development**: Character strengths and virtues, Emotional Intelligence, Social intelligence, Positive cognitive states and processes (Self-efficacy, Empathy, Gratitude, Compassion, and Forgiveness).

***Module 6 (4L): Effects of Technological Growth:***

Rapid Technological growth and depletion of resources, Reports of the Club of Rome. Limits of growth: sustainable development Energy Crisis: Renewable Energy Resources, Environmental degradation and pollution. Eco-friendly Technologies. Environmental Regulations, Environmental Ethics, Appropriate Technology, Movement of Schumacher; Problems of man, machine, interaction.

***Text Books:***

1. Stephen H Unger, Controlling Technology: Ethics and the Responsible Engineers, John Wiley & Sons, New York 1994 (2nd Ed)

***Reference Books:***

1. Deborah Johnson, Ethical Issues in Engineering, Prentice Hall, Englewood Cliffs, New Jersey 1991.
2. A N Tripathi, Human values in the Engineering Profession, Monograph published by IIM, Calcutta 1996.

**COs-POs-PSOs MAPPING:**

| *CO* | *Program Outcomes* | | | | | | | | | | | | *Program Specific Outcomes* | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO1 1** | **PO1 2** | **PSO 1** | **PSO2** | **PSO3** |
| **CO1** | **3** | **2** | **2** | **-** | **-** | **2** | **-** | **-** | **-** | **-** | **-** | **3** | **3** | **3** | **1** |
| **CO2** | **3** | **3** | **2** | **2** | **-** | **1** | **1** | **-** | **-** | **-** | **-** | **3** | **3** | **2** | **1** |
| **CO3** | **3** | **3** | **2** | **2** | **-** | **2** | **1** | **-** | **-** | **1** | **-** | **3** | **3** | **3** | **3** |
| **CO4** | **3** | **3** | **3** | **2** | **-** | **-** | **2** | **-** | **-** | **-** | **-** | **3** | **3** | **3** | **3** |
| **CO5** | **3** | **2** | **2** | **-** | **-** | **2** | **3** | **1** | **-** | **-** | **-** | **3** | **3** | **3** | **3** |
| **Overall CO mapping** | **3.00** | **2.60** | **2.20** | **2.00** | **-** | **1.75** | **1.75** | **1.00** | **-** | **1** | **-** | **3** | **3** | **2.8** | **2.2** |

**Course Name: Unit Operation of Chemical Engineering I**
**Course Code: FT 403A**
**Contact:2:1:0**
**Total Contact Hours: 36**
**Credit: 3**

**Pre requisites:** Engineering Mechanics, Thermodynamics

***Course Objective:***

To introduce history, importance and components of chemical engineering, concepts of unit operations and unit processes, and current scenario of chemical & allied process industries.

***Course Outcome(s):***

After the completion of the course students will be able to:
**CO1: Demonstrate** chemical processes, units, and the corresponding equipment.
**CO2: Explain** the basic principles of fluid mechanics
**CO3: Analyze** pipe flows as well as fluid machinery
**CO4: Solve** conduction, convection and radiation problems
**CO5: Design** the performance of heat exchangers, crushers and grinders.

***Course Contents:***

**Module I (9L):** Introduction Basic Concepts of Fluid Mechanics : Conversion of equations. Basic equations of Fluid Flow, Hagen Poiseille equation, Bernoulli Equation, Fluid Friction. Friction in flow through packed beds, fundamentals of fluidization

**Module II (7L):** Flow measurements and machineries : Flow through pipes and open channels, Orifice and Venturimeters, Pitot Tube, Rotameters. Transportation of fluids, Pipe Fittings and valves, Pumps – classification.

**Module III (9L):** Heat transfer: Classification of heat flow processes, conduction, Thermal conductivity. Heat flow in fluids by conduction and convection. Countercurrent and parallel flow. Enthalpy balance in heat exchange equipment. Individual heat transfer coefficients, overall coefficient, Radiation.

**Module IV (7L):** Mechanical Operations: Principles of comminution, Types of comminuting equipment. Energy and power requirement, Crushers, Grinders, Mixing and Agitations, Mechanical separation, Screening, Types of screen, Filtration, Principle of Constant pressure and constant rate filtration.

***Revision: 4L***

***Text books:***

1. Unit Operations of Chemical Engineering: McCabe, Smith & Harriot, TMH, 5th edition
2. Transport Processes & Unit operations: Geankopolis, PHI, 3rd edition
3. Introduction to Chemical Engineering: Walter L. Badger, Julius T. Banchero, Julius T. Bancheo

***Reference books:***

1. Chemical Engineering, Vol-I & II: Coulson & Richardson, Butterworth Heinemann
2. Heat Transfer: D.Q. Kern, MGH
3. Foust, A.S., Wenzel, L.A., et.al. Principles of Unit Operations, 2nd edition, JWS
4. Perry, Chilton & Green, Chemical Engineers' Handbook, MGH

**COs-POs-PSOs MAPPING:**

| CO | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | P O 11 | PO 12 | PS O1 | PS O2 | PS O3 |
| CO 1 | 3 | 2 | 2 | - | - | 2 | - | - | - | - | - | 3 | 3 | 3 | 1 |
| CO 2 | 3 | 3 | 2 | 2 | - | 1 | 1 | - | - | - | - | 3 | 3 | 2 | 1 |
| CO3 | 3 | 3 | 2 | 2 | - | 2 | 1 | - | - | 1 | - | 3 | 3 | 3 | 3 |
| CO 4 | 3 | 3 | 3 | 2 | - | - | 2 | - | - | - | - | 3 | 3 | 3 | 3 |
| CO 5 | 3 | 2 | 2 | - | 3 | 2 | 3 | 1 | - | - | - | 3 | 3 | 3 | 3 |
| Overall CO mapping | 3.00 | 2.60 | 2.20 | 2.00 | - | 1.75 | 1.75 | 1.00 | - | 1 | - | 3 | 3 | 2.8 | 2.2 |

**Course Name: Transport Phenomena**

**Course Code: FT 403B**

**Contact: 2:1:0**

**Total Contact Hours: 36**

**Credit: 3**

**Pre requisites:** Engineering Mechanics, Thermodynamics

### *Course Objective:*

To be able to analyze various transport processes with understanding of solution approximation methods and their limitations.

### *Course Outcome(s):*

After the completion of the course students will be able to:

**CO1: Understand** the chemical and physical transport processes and their mechanism

**CO2: Demonstrate** heat, mass and momentum transfer analysis

**CO3: Analyze** industrial problems along with appropriate approximations and boundary conditions

**CO4: Develop** steady and time dependent solutions along with their limitations

### *Course Contents:*

**Module I: 8L**

Introduction: Concept of unified approach to Momentum, Heat and Mass Transport through Transport Phenomena - Assumptions of Transport phenomena; Similarity of Mass, Momentum and Energy transfer, Diffusivities, Transport Theorem

### *Module II: 8L*

Momentum Transport: Viscosity, Newton's law of viscosity, calculation of momentum flux, Non-Newtonian fluids – Bingham model, Ostwald-de Waele model, Shell momentum balance and boundary conditions – Flow of a falling film with constant/variable viscosity, Flow through a circular tube, Laminar flow between two flat stationary/moving plates, Shape of the surface of a rotating fluid. Concept of Boundary layer and Boundary layer theory. Concept of turbulence,

***Module III: 8L***

Energy Transport:

Modes of heat transfer; concepts of (a) thermal conductivity – constant and temperature dependent, (b) thermal diffusivity and (c) heat transfer coefficient. Fourier's law of heat conduction. Shell energy balance and boundary conditions – Heat conduction with electrical, nuclear, viscous and chemical heat source, Heat conduction through composite walls

***Module IV: 8L***

Mass Transport: Concentrations, Velocities and Mass and Molar fluxes. Concept of Mass diffusivity and Mass transfer coefficient. Fick's law of diffusion.

Shell mass balance and boundary conditions – Diffusion through stagnant gas film, Diffusion in a falling film, Diffusion with heterogeneous chemical reaction.

***Revision: 4L***

***Text books:***

1. Mass Transfer Operations: Robert E. Treybal, MGH, International student Edition.
2. Transport process and Unit Operations: Geankoplis. 3rd Edn., PHI.
3. Unit Operations in Chemical Engfueering : McCabe, Smith, and Harriot. MGH, Sth Edn.
4. Multicomponent Distillation: Holland, C. D., PHI.

***Reference books:***

1. The Elements of Fractional Distillation: Robinson, C. S. and Gilliland, E. R. MGH.
2.Mass Transfer: Sherwood, Pigford, and Wilke, MGH.
3. Separation Processes: King, C. J. MGH.
4. Design of Equilibrium Stage Processes: Smith, B. D. MGH.
5. Distillation: van Winkle, M., MGH.

**COs-POs-PSOs MAPPING:**

| CO | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | - | 3 | 3 | 3 | 1 |
| CO2 | 3 | 3 | 2 | - | 3 | 1 | - | - | - | - | - | 3 | 3 | 2 | 1 |
| CO3 | 3 | 3 | 1 | 1 | 1 | - | - | - | - | - | - | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 2 | 1 | - | - | - | - | - | 3 | 3 | 3 | 3 |
| Overall CO mapping | 3.00 | 3.00 | 2.00 | 2.00 | 2.00 | 1.00 | - | - | - | - | - | 3 | 3 | 2.75 | 2 |

**Course Name: Biochemistry Lab**
**Course Code: FT491**
**Contact: 0-0-3**
**Credit: 1.5**

**Pre requisites:** Biochemistry

***Course Objective:***

To assist the students develop skills to monitor various enzymatic reactions and to learn about association of food protein structure to help the students point out the threat of possible danger to health from contamination in water from effluent.

***Course outcome(s):***

After the completion of the course students will be able to:

**CO1: Describe** various methods of sugars and amino acids separation.

**CO2: Develop** skills to monitor various enzymatic reaction.

**CO3: Demonstrate** association of food protein structure with solubility, viscosity, gelation,texturization, emulsification and foaming.

**CO4: Point out** the threat of possible danger to health, or the very existence of certain species, it is essential to determine the quality of a water source before water is drawn off for consumption.

**CO5: Examine** of separation of immiscible liquids and solids from liquids.

***Course Contents:***

1. Separation of amino acids/sugars by Ascending Paper Chromatography.
2. Separation of sugars/amino acids by Thin Layer Chromatography.
3. Separation and isolation of proteins/amino acids by Paper Electrophoresis.
4. Preparation of cell-free extract: Bacterial cell by sonication, Chicken liver by homogenization.
6. Assay of enzyme activity (a) Phosphatase assay [Chicken liver] (b) Protease assay
7. Study of an enzymatic reaction.
8. Study on the presence of alkaline phosphatase enzyme in raw and pasteurized milk.
9. Determination of $BOD_5$ of a sample of waste water.

***Text books:***

1. Modern Experimental Biochemistry, Boyer, Pearson Education

***Reference books***

1. An Introduction to Practical Biochemistry, David T Plummer

**COs-POs-PSOs MAPPING:**

| CO | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO1 0 | PO1 1 | PO1 2 | PSO 1 | PSO 2 | PSO 3 |
| CO1 | 3 | 2 | 2 | 2 | 3 | - | 1 | - | 1 | - | - | 2 | 3 | 3 | 2 |
| CO2 | 3 | 2 | 2 | 2 | 3 | - | 1 | - | 1 | - | - | 2 | 2 | 2 | 2 |
| CO3 | 3 | 2 | 2 | 2 | 3 | - | 1 | - | 1 | - | - | 2 | 3 | 1 | 3 |
| CO4 | 2 | 2 | 1 | 1 | - | 2 | 2 | - | 2 | - | - | 2 | 3 | 3 | 3 |
| CO5 | 3 | 2 | 2 | 2 | 3 | - | 1 | - | 1 | - | - | 2 | 3 | 3 | 3 |
| Overall CO mapping | 2.8 | 2 | 1.8 | 1.8 | 3 | 2 | 1.2 | - | 1.2 | - | - | 2 | 2.8 | 2.4 | 2.6 |

**Course name: Chemistry of Food Lab II**
**Course Code: FT492**
**Contact: 0-0-3**
**Credit: 1.5**

**Pre requisites:** Food Chemistry

***Course Objective:***

To help students in developing the concept and to learn various methods of estimation of minerals, pigments, crude fibre, antioxidants, pigments etc. by spectrophotometric and chemical analysis.

***Course outcome:***

After the completion of the course students will be able to:

**CO1: Develop** the concept of estimation of minerals, pigments, crude fibre and antioxidants.

**CO2: Demonstrate** various methods to determination different minerals and antioxidant content of food materials.

**CO3: Explain** different food compositions by spectrophotometric analysis.

**CO4: Evaluate** data generated by experimental methods for chemical characterization of food materials.

**CO5: Analyze** change in pigments of the food materials under different conditions.

***Course Contents:***

1. Determination of pigments in food sample.
2. Estimation of calcium in food sample.
3. Estimation of iron in food products.
4. Estimation of zinc in food sample.
5. Estimation of crude fiber in food sample.
6. Estimation of antioxidant(s) / polyphenol(s) in food sample.
7. Analysis of lysine content in animal /vegetable sources.

8. Innovative Experiments

**COs-POs-PSOs MAPPING:**

| CO | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 2 | 1 | - | - | - | - | 2 | - | 2 | - | - | 2 | 3 | 3 | 2 |
| CO2 | 2 | 2 | 1 | - | - | - | 1 | - | 2 | 1 | - | 2 | 3 | 3 | 2 |
| CO3 | 2 | 2 | - | - | - | 2 | 2 | 2 | 2 | 1 | - | 2 | 3 | 2 | 3 |
| CO4 | 3 | 2 | 2 | - | - | - | - | - | 1 | - | - | 2 | 3 | 2 | 3 |
| CO5 | 3 | 2 | 2 | 1 | - | - | - | - | - | - | - | 2 | 3 | 3 | 3 |
| Overall CO mapping | 2.4 | 1.8 | 1.67 | 1 | - | 2 | 1.67 | 2 | 1.75 | 1 | - | 2 | 3 | 2.6 | 2.6 |

**Course Name: Unit Operation Lab I**
**Course Code: FT 493A**
**Contact: 0:0:3**
**Credit: 1.5**

**Pre requisites:** Unit Operation, Stoichiometry

***Course Objective:***

To learn analytical experimental methods using sophisticated instruments and interpretation of experimental data.

***Course outcome(s):***

After the completion of the course students will be able to:

**CO1: Define** process equipment via hands-on learning.

**CO 2: Analyze** the experiments on flow regime and different flow meter

**CO 3: Interpret** the Overall heat transfer coefficient of heat exchangers

**CO 4: Illustrate** the pressure drop for flow through packed bed.

**CO 5: Examine** the working characteristics of a crusher & grinder.

***Course Contents:***

1. Experiments on Reynolds's Apparatus –Determination of flow regime and construction of friction factor against NRE
2. Experiments on flow measuring device — in closed conduit using (a) Venturimeter, (b) Orifice meter, (c) Rotameter
3. Determination of Pressure drop for flow through packed bed & verification of Ergun Equation, Kozeny-Karman equation, Blake-Plummer Equation
4. To study the working characteristics of a Jaw Crusher, calculate the energy consumption as a function of size reduction and compare it with the actual energy requirements
5. To study the working characteristics of a Ball Mill, calculate the energy consumption as a function of size reduction and determine the critical speed
6. To determine the Overall heat transfer coefficient of a concentric pipe heat exchanger based on the inside diameter of the tube
7. To study the characteristics of film-wise/drop-wise condensation

8. To study the flow characteristics of fluid by Rheometer
9. Innovative Experiments

### *Text books:*

1. Unit Operations of Chemical Engineering: McCabe, Smith & Harriot, TMH, 5th edition
2. Transport Processes & Unit operations: Geankopolis, PHI, 3rd edition

### *Reference books*

3. Chemical Engineering, Vol-I & II: Coulson & Richardson, Butterworth Heinemann
4. Heat Transfer: D.Q. Kern, MGH

**COs-POs-PSOs MAPPING:**

| CO | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 2 | 2 | 2 | 2 | 1 | - | 1 | 2 | - | - | 3 | 3 | 2 | 1 |
| CO2 | 3 | 2 | 2 | 2 | 2 | - | - | 1 | 2 | - | - | 3 | 3 | 2 | 1 |
| CO3 | 3 | 2 | 2 | 2 | 2 | - | - | 1 | 2 | - | - | 3 | 3 | 2 | 1 |
| CO4 | 3 | 2 | 2 | 2 | 2 | - | - | 1 | 2 | - | - | 3 | 3 | 3 | 2 |
| CO5 | 3 | 2 | 2 | 2 | 2 | - | - | 1 | 2 | - | - | 3 | 3 | 3 | 2 |
| Overall CO mapping | 3 | 2 | 2 | 2 | 2 | 1 | - | 1 | 2 | - | - | 3 | 3 | 2.4 | 1.4 |

**Course Name: Transport Phenomena Lab**

**CoursePaper Code: FT 493B**

**Contact: 0:0:3**
**Credit:** 1.5

**Pre requisites:** Transport Phenomenon, Stoichiometry

**Course Objective:**

To learn analytical experimental methods using sophisticated instruments and interpretation of experimental data.

***Course Outcome****:*

After the completion of the course students will be able to:

**CO1: Plan** experiments and present the experimental data meaningfully

**CO2: Apply** theoretical concepts for data analysis and interpretation

**CO3: Describe** chemical engineering unit operations related tofluid and particle mechanics, and mass transfer

**CO4: Explain** the experimental techniques related to chemical reaction engineering

***Course Contents:***

1. Determination of Drag Coefficient
2. Experiments on Tubing, interconnects flow measurement
3. Determination of flow measurement
4. Experiments on Industrial-scale equipment, valving
5. Experiments on Soldering, ice/boiling, thermocouples, multimeter
6. Experiments on Temp and flow control, calibration
7. Experiments on Psychrometric chart, vapor pressure, flow control, humidity sensors
8. Experiments on Dissolved oxygen sensors, spargers

**COs-POs-PSOs MAPPING:**

| CO | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO 1 | PSO2 | PSO3 |
| CO1 | 3 | 2 | 2 | 2 | 2 | - | - | 1 | 2 | - | - | 3 | 3 | 2 | 1 |
| CO2 | 3 | 2 | 2 | 2 | 2 | - | - | 1 | 2 | - | - | 3 | 3 | 2 | 1 |
| CO3 | 3 | 2 | 2 | 2 | 2 | - | - | 1 | 2 | - | - | 3 | 3 | 2 | 1 |
| CO4 | 3 | 2 | 2 | 2 | 2 | - | - | 1 | 2 | - | - | 3 | 3 | 3 | 2 |
| Overall CO mapping | 3 | 2 | 2 | 2 | 2 | - | - | 1 | 2 | - | - | 3 | 3 | 2.25 | 1.25 |

**Paper Name: Project IV**
**Paper Code: PR 491**
**Contact hours: 0:0:2**
**Credit: 1**

**Prerequisites:** Unit Operation, Food Chemistry

**Course Objective:**

- To apply theoretical and laboratory understanding and techniques in realistic implementation
- To help the students to identify the significant issues that need to be resolved for benefit of society
- To learn different verticals of a research and development project

**Course Outcome:**

After completion of Project students will be able to:

**CO1: Identify** the need of socio-economic demand in food of allied sector

**CO2: Apply** the knowledge of theory for innovative product/process design

**CO3: Interpret** the process involved in project for future industrial food and allied sector

**CO4: Summarize** a appropriate report

**CO-PO-PSO Mapping**

| COs | Program outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
| **CO1** | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 2 | 2 | 1 | 3 | 3 | 1 | - | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | - |
| **CO3** | 3 | 3 | 2 | 2 | 3 | 2 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 2 |
| **CO4** | 3 | 3 | 1 | 1 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 |
| **Overall Mapping** | 3 | 3 | 2 | 2 | 3 | 2.75 | 2 | 2.5 | 2.75 | 2.25 | 3 | 3 | 2.25 | 2.67 | 2.33 |

## MANDATORY COURSE

**Course Name: ENVIRONMENTAL SCIENCE**

**Course Code: MC 401**

**Credits: 0**

**Total Lectures: 36**

**Objective(s)**

- Be able to understand the natural environment and its relationships with human activities.
- Be able to apply the fundamental knowledge of science and engineering to assess environmental and health risk.
- Be able to understand environmental laws and regulations to develop guidelines and procedures for health and safety issues.
- Be able to solve scientific problem-solving related to air, water, noise & land pollution.

***Course Outcome(s)***

**CO** 1: To understand the natural environment and its relationships with human activities.
**CO** 2: To apply the fundamental knowledge of science and engineering to assess environmental and health risk.
**CO** 3: To develop guidelines and procedures for health and safety issues obeying the environmental laws and regulations.
**CO** 4: Acquire skills for scientific problem-solving related to air, water, noise & land pollution.

**SYLLABUS**

**1. General** **11 L**

**Natural Resources**: Forest Resource, water resource, mineral resource, energy resources: alternative source of energy

**Population Growth:** Exponential Growth, logistic growth, Maximum sustainable yield, demography

**Disaster Management**: Types of disasters (Natural & Man-made), Floods, Earthquake, Tsunamis, Cyclones, landslides (cause, effect & control)

**Ecology & Ecosystem:** Elements of ecology, definition of ecosystem- components types and function, Food chain & Food web,
Structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems

**Environmental Management**: Environmental impact assessment, Environmental laws and protection act of India( The Environment protection Act, Air pollution Act, Water Act, Wildlife Protection Act) , Hazardous waste(management and Handling) Rules.

### *2. Air pollution and control* *10L*

**Sources of Pollutants**: point sources, nonpoint sources and manmade sources primary & secondary pollutant

**Types of air pollutants:** primary & secondary pollutant ; Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN, Smog (Photochemical smog and London smog),

**Effects on human health & climate:** Greenhouse effect, Global Warming, Acid rain, Ozone Layer Depletion

**Air pollution and meteorology:** Ambient Lapse Rate, Adiabatic Lapse Rate, Atmospheric stability & Temperature inversion control of air pollution (ESP, cyclone separator, bag house, catalytic converter, scrubber (ventury).

### *3. Water Pollution* *9L*

Classification of water (Ground & surface water)

Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, heavy metals, pesticides, volatile organic compounds.

**Surface water quality parameters:** pH, DO, 5 day BOD test, BOD reaction rate constants, COD. Numerical related to BOD

Lake: Eutrophication [Definition, source and effect].

**Ground water:** Aquifers, hydraulic gradient, ground water flow (Definition only),ground water pollution (Arsenic & Fluoride; sources, effects, control)

**Quality of Boiler fed water:** DO, hardness, alkalinity, TDS and Chloride

**3.7 Layout of waste water treatment plant** (scheme only).

### *4. Land Pollution* *3L*

Types of Solid Waste: Municipal, industrial, commercial, agricultural, domestic, hazardous solid wastes (bio-medical), E-waste

Solid waste disposal method: Open dumping, Land filling, incineration, composting, recycling (Advantages and disadvantages).

Waste management: waste classification, waste segregation, treatment & disposal

### *5. Noise Pollution* *3L*

Definition of noise, effect of noise pollution on human health,

Average Noise level of some common noise sources

Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level, $L10$ (18 hr Index) .

Noise pollution control.

### *Text Books*

1. A Textbook of Environmental Studies, Shashi Chawla. Tata McGraw Hill Education Private Limited

### *References Books:*

1. Environmental Studies, Dr. J P Sharma, University Science Press 2.Environmental Engineering, J K Das Mohapatra, Vikas Publication

**COs-POs-PSOs MAPPING:**

| COs | Program outcomes | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
| **CO 1** | - | - | - | - | - | 1 | - | - | 2 | 1 | 2 | 1 | **1** | **2** | **1** |
| **CO 2** | - | - | - | - | - | - | - | 3 | 2 | 1 | 2 | 2 | **2** | **1** | **2** |
| **CO 3** | - | - | - | - | - | - | - | - | 2 | 2 | - | 1 | **1** | **1** | **1** |
| **CO 4** | - | - | - | - | - | - | - | - | 1 | 2 | - | 1 | **2** | **2** | **2** |
| **Overall Mapping** | | | | | | **1** | | **3** | **1.75** | **1.5** | **2** | **1.25** | **1.75** | **1.5** | **1.5** |

| 5th Semester | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Sl No** | **Field** | **Paper Code** | **Theory** | **Contact Hours /Week** | | | | **Credit Points** |
| | | | | **L** | **T** | **P** | **Total** | |
| **A. THEORY** | | | | | | | | |
| 1 | HS | HU 502 | Economics for Engineers | 2 | 0 | 0 | 2 | 2 |
| 2 | PC | FT501 | Food Process Technology–I (Cereals, Fruits, Vegetables, Beverages) | 3 | 0 | 0 | 3 | 3 |
| 3 | PC | FT502 | Food Process Technology–II (Fish, Meat, Poultry) | 3 | 1 | 0 | 4 | 4 |
| 4 | PC | FT503 | Food Process Engineering | 2 | 1 | 0 | 3 | 3 |
| 5 | PE | FT 504 | A. Unit Operations of Chemical Engineering–II<br>B. Separation Process | 2 | 1 | 0 | 3 | 3 |
| **Total of Theory** | | | | | | | **15** | **15** |
| **B. PRACTICAL** | | | | | | | | |
| 6 | PC | FT591 | Food Processing Lab–I | 0 | 0 | 3 | 3 | 1.5 |
| 7 | PC | FT592 | Food Analysis & Quality Control Lab | 0 | 0 | 3 | 3 | 1.5 |
| 8 | PE | FT 593 | A. Unit Operation Lab–II<br>B. Separation Process Lab | 0 | 0 | 3 | 3 | 1.5 |
| 9 | PROJ | PR 591 | Project-V | 0 | 0 | 2 | 2 | 1 |
| 10 | PROJ* | PR 592 | Innovative activities-IV | 0 | 0 | 0 | 0 | 0.5 |
| **C. MANDATORY ACTIVITIES / COURSES** | | | | | | | | |
| 11. | MC | MC 581 | Social Awareness | 0 | 0 | 3 | 3 | |
| **Total of Theory, Practical & Mandatory Activities/Courses** | | | | | | | **29** | **21** |

* Students may choose either to work on participation in Hackathons etc. Development of new product/ Business Plan/ registration of start-up.

Students may choose to undergo Internship / Innovation / Entrepreneurship related activities. Students may choose either to work on innovation or entrepreneurial activities resulting in start-up or undergo internship with industry/ NGO's/ Government organizations/ Micro/ Small/ Medium enterprises to make themselves ready for the industry/ Long Term goals under rural Internship. (Duration 4-6 weeks)

Innovative activities to be evaluated by the Programme Head/ Event coordinator based on the viva voce and submission of necessary certificates as evidence of activities.

# THEORY

**Course Name: ECONOMICS FOR ENGINEERS**
**Course Code: HU 502**
**Contact hour: 2L**
**Total contact hour: 24**
**Credits: 2**

**Prerequisites: NIL**

## Course Objective:

- To develop decision making skills using basic economic Principles
- To educate the students in evaluating various Business Projects

## Course outcome:

After the completion of the course students will be able to:

**CO1: Identify** various uses for scarce resources
**CO2: Understand** key economic concepts and implement in real world problems
**CO3: Apply** critical thinking skills to analyze financial data and their impacts
**CO4: Evaluate** business performance through the knowledge of cost accounting principles

## Course Content:

**Module - 1**: **Introduction to Economics :** Meaning, Nature and Scope of Economics **[2L]**
**Module - 2: Theory of Demand and Supply :** Concept of demand, Determinants of demand, Individual and Market Demand, Exception to the law of demand. Concept of Supply, Shift in Demand and Supply Curve, Movement along the demand and supply curve, Determinants of equilibrium price and quantity, Elasticity of Demand and Supply. **[4L]**
**Module - 3: Theory of Production and Cost :** concept of Production function, types pf Production function, Laws of return to scale and variable Proportion, Cost Function, Types of Cost Function, Different Cost curves, Relation between Average and marginal cost, Relationship between Short Run costs and Long Run costs, Profit maximisation **[6L]**
**Module - 4: Macroeconomic Aggregates and Concepts :** GDP, GNP. Concepts of National Income . Concept of Business Cycle **[3L]**
**Module - 5: Inflation :**Concept , Causes and Remedies of Inflation. **[2L]**
**Module - 6: Accounting:** Basic concept of Journal ,Preparation of Income Statement and Balance Sheet **[4L]**
**Module - 7: Cost Volume Profit Analysis:** Contribution, P/V Ratio, Break-Even Point, Margin of Safety, Short term decision making: Make or Buy, Shut-down point, Export Pricing, Opportunity and Sunk cost. **[3L]**

## Text Books:

1. Economics,by Lipsey and Chrystal, Oxford university Press
2. Modern Accountancy,vol.-I-, by Hanif &Mukherjee,TataMgrowHill

## References:


1. Modern Economic Theory ,by K.K. Dewett, S.Chand
2. Principles of Economics, by H.L. Ahuja, S. Chand
3. Engineering Economics, by R. PaneerSeelvan, PHI
4. Economics for Engineers, by Dr. Shantanu Chakraborty &Dr. Nilanjana singharoy, Law Point Publication


**COs-POs-PSOs MAPPING:**

| COs | Program Outcomes (POs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO1 0 | PO 11 | PO1 2 | PS O1 | PS O2 | PS O3 |
| CO1 | 3 | - | - | - | - | - | - | - | - | - | 2 | - | 1 | 2 | 2 |
| CO2 | - | | - | - | - | 3 | - | - | - | - | 2 | - | 1 | 2 | 2 |
| CO3 | - | - | 2 | 2 | 3 | - | - | - | - | - | 2 | 2 | 1 | - | 2 |
| CO4 | - | - | 3 | | - | - | - | - | - | - | 3 | 2 | 1 | 2 | - |
| Overall Mapping | 3 | | 2.5 | 2 | 3 | 3 | | | | | 2.25 | 2 | 1 | 2 | 2 |

## Course Name: FOOD PROCESS TECHNOLOGY – I (Cereals, Fruits, Vegetables, Beverages)

## Course Code: FT501
## Contact: 3:0:0
## Total Contact Hours: 36

## Credit: 3

**Pre requisites:** Food Chemistry, Food Preservation, Food Microbiology

## Course Objective:

To provide the students an opportunity to gain knowledge about the storage procedure of different cereals, fruits and vegetables and to help students to understanding the different procedure of production of various cereal based, fruit based and vegetable based products.

## Course outcome(s):

After the completion of the course students will be able to:

**CO1: Understand** the Processing and storage of cereals.
**CO2: Demonstrate** the processing methods of some cereal product and potato product.
**CO3: Apply** the principles underpinning the safe and effective production of fruits and vegetables products and beverages.
**CO4**: **Develop** idea about nonalcoholic beverages manufacturing technologies and food additives.

## Course Contents:

### Module I: 8L

Basic composition and utilization of cereals; Drying of grains; Milling of rice and processes for rice-based products; Milling of wheat and processes of wheat based products; Milling and utilization of corn, barley, oat and millets; Common infestation in grains; Principle and practice of storage of cereals; Storage structures.

### Module II: 8L

Feed for livestock from wheat bran and germ; Production of starch, modified starch; Extraction of proteins from cereals; Potato processing (potato chips, flakes, powder).

### Module III: 8L

Handling and quality assessment of fruits & vegetables; Storage of fruits & vegetables; Production of fruits and vegetable juices/puree/nectar, Intermediate moisture foods from fruits ( jam, jelly, marmalade, leathers, candy); Sauce and ketchup from tomato., Dehydrated fruits & vegetables; Utilization of by-products from fruit-based industries – extraction of pectin, fat/oil from peel and seeds, aroma from peel and pomace candied peel.

### Module IV: 8L

Non-alcoholic beverages; Processing of tea, coffee and cocoa, Instant coffee; Production of chocolate and cocoa butter; Extraction of caffeine from tea leaves; Food additives -coloring agents, humectants, anti-caking agents, natural and artificial low calorie sweeteners, pH control agents, thickeners.

### Revision: 4L

## Text Books:

1. Food Science by Potter
2. Food Science by Mudambi
3. Food Science by B. Srilakhsmi
4. Food Additives by Udipi

## Reference Books:

1. Postharvest Technology of Fruits & Vegetables (vol 1 & 2): Handling, Processing, Fermentation and Waste Management – L. R. Verma& V. K. Joshi, Indus Pub, New Delhi, 2000.
2. Handbook of Postharvest Technology: Cereals, Fruits, Vegetables, Tea, and Spices – A. Chakraverty, Arun S. Mujumdar, G. S. V. Raghavan& H. S. Ramaswamy - Marcel Dekker, 2003
3. Postharvest Technology and Food Process Engineering – A Chakraverty& R. Paul Singh, CRC Press, 2014
4. Fruit and Vegetable Preservation by Srivastava and Sanjeev Kumar
5. Principles of Food Science, Vol-I by FennmaKarrel
6. Preservation of Fruits & Vegetables by Girdhari Lal, Sidhapa and Tandon

**COs-POs-PSOs MAPPING:**

| **COs** | **Program Outcomes** | | | | | | | | | | | | **Program Specific Outcomes** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
| **CO1** | 3 | 3 | 3 | 2 | 1 | 1 | 2 | 2 | - | 1 | - | 3 | 3 | 2 | 2 |
| **CO2** | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **Overall mapping** | 3 | 3 | 3 | 2.75 | 2.5 | 2 | 2.75 | 2.75 | 2.66 | 2.25 | 2.66 | 3 | 3 | 2.25 | 2.75 |

## Course name: FOOD PROCESS TECHNOLOGY – II (fish, meat, poultry)

## Course Code: FT502
## Contact: 3:1:0
## Total Contact Hours: 48

## Credit: 4

**Pre requisites:** Food Chemistry, Food Preservation, Food Microbiology

## Course Objective:

To provide an opportunity for students to classify different processing techniques required for preservation of fish, meat, poultry and classify the different by products related to these industries.

## Course outcome(s):

After the completion of the course students will be able to:

**CO1: Identify** the significance of fish processing and classify different processing techniques required for preservation of fish.
**CO2: Classify** the different by products related to fish processing industries and intended their use.
**CO3: Illustrate** various components of the meat muscle and techniques related to meat processing industry including use of meat byproducts
**CO4: Develop** idea on the effective preservation methods of eggs

## Course Contents:

## Module I (12L):

Classification of fresh water fish and marine fish; Commercial handling, storage and transport of fish; proximate composition and nutritive value of fish; Indices of freshness and its quality assessment; Spoilage of fish; Methods of Preservation of fish and fish products: Canning, Freezing, Drying, Curing, Smoking, Fermentation (fish sauce).

## Module II (12L):

Fish byproducts - production of fish meal, fish protein concentrate, and fish protein hydrolysate fish liver oil and fish silage; Production of chitin, chitosan; Production of non-food items from fish; Processing of fish wastes.

## Module III (12L):

Slaughtering of animals; Classification, composition and nutritive value of poultry meat; Post mortem changes of meat; Curing and smoking of meat; Fermented meat products (sausages and sauces); Frozen meat & meat storage; By-products from slaughter houses and meat processing industries and their utilization.

## Module IV (8L):

Structure, composition and nutritive values of eggs; Quality assessment (defects) of eggs; Processing of eggs; Byproduct Utilization – commercial processing of lecithin and other egg solids, Utilization of egg-derived products as food ingredients.

## Revision: 4L

## Text Books:

1. Processed Meats; Pearson AM & Gillett TA; 1996, CBS Publishers.
2. Food Science by B. Srilakhsmi

## Reference Books:

1. Meat Science and Applications - Y H. Hu., Wai-Kit Nip, Robert W. Rogers& Owen A. Young, Marcel Dekker, 2001.
2. Advanced Technologies for Meat Processing - Leo M. L. Nollet& Fidel Toldrá, CRC Press, 2006.
3. Meat; Cole DJA &Lawrie RA; 1975, AVI Pub.
4. Egg and poultry meat processing; Stadelman WJ, Olson VM, Shemwell GA &Pasch S; 1988, Elliswood Ltd.
5. Developments in Meat Science – I & II, Lawrie R; Applied Science Pub. Ltd.
6. Fish & Fisheries of India; Jhingram VG; 1983, Hindustan Pub Corp
7. Fish as Food, Vol. I-IV; George Borgstrom, Academic Press
8. Fish Processing Technology , Rogestein&Rogestein
9. Fish as Food; Vol 1 & 2; Bremner HA; 2002, CRC Press.
10. Egg Science & Technology; Stadelman WJ &Cotterill OJ; 1973, AVI Pub.

**COs-POs-PSOs MAPPING:**

| COs | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PS03 |
| CO1 | 2 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | - | 3 | 2 | 3 | 3 |
| CO2 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | - | 3 | 2 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 3 |
| CO4 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 3 |
| Overall mapping | 2.25 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 2.75 | 3 |

## Course name: FOOD PROCESS ENGINEERING

## Course Code: FT503
## Contact: 2:1:0
## Total Contact Hours: 36

## Credit: 3

**Pre requisites:** Stoichiometry, Unit Operation

## Course Objective:

To help the students design the process parameters for thermal processing, freezing, evaporation, dehydration, separation, extraction and to develop skills in formulating solutions to solve problems in food industry.

## Course outcome(s):

After the completion of the course students will be able to:

**CO1: Describe** the food processing techniques of thermal processing

**CO2: Demonstrate** the functions of different freezers.

**CO3: Identify** the function of different dryers.

**CO4: Explain** function of different types of heat exchangers and extruders.

## Course Contents:

**Module I (8L):**Batch and continuous sterilization processes (including steps and various machineries involved) used in canning of foods; Constructional and operational features of pasteurizer; homogenizer; Constructional features and principles of single effect evaporators (including mass and energy balances) used for concentration of liquid foods.

**Module II (8L):**Constructional features of cold storage and basic design approach; Different types of freezers including plate contact freezer, air blast freezer; Cryogenic freezing; Refrigerated mobile vans.

**Module III (8L):** Theory of drying and mechanism of moisture transfer in drying; Drying kinetics and constant & falling rate periods in drying; Constructional & operational features of various types of cross-flow, through flow and recirculatory dryers – Tray dryer, roller dryer, spray dryer, fluidized bed dryer, freeze dryer and solar dryer, rotary dryer, tunnel dryer, other grain dryers (LSU-type).

**Module IV (8L):**Heat exchangers (Co-current and counter-current heat exchanger); Constructional features of various types of heat exchangers – DPHE, Shell& tube heat exchanger, Plate heat exchanger, extended surface heat exchangers; Theory and operation of extrusion systems used in food industry; Cold extrusion and Extrusion cooking systems; Single and twin-screw extruders – constructional and operational features including advantages/disadvantages.

**Revision: 4L**

## *Text Books:*

1. Fundamentals of Food Process Engineering (3rd Ed.) – R. T. Toledo, Springer, 2007.
2. Unit Operations of Chemical Engineering – W.L. McCabe, J. C. Smith & P. Harriott, McGraw Hill International, 1993.
3. Introduction to Chemical Engineering – S. K. Ghosal, S. K. Sanyal, S.Datta.

## *Reference Books:*

1. Introduction to Food Engineering (5th Ed.) – R. P. Sing & D. R. Heldman, Academic Press, 2014
2. Food Process Engineering & Technology (2nd Ed.) – Z. Berk, Academic Press, 2014
3. Food Process Engineering Operations – G. D. Saravacos& Z. B. Maroulis, CRC Press, 2011.
4. Transport Processes & Separation Process Principles – C. J. Geankoplis, PHI, 2003
5. Introduction to Food Process Engineering – A. Ibraz& G. V. Barbosa-Canovas – CRC Press, 2014.
6. Introduction to Food Process Engineering (2nd Ed.) – P. G. Smith, Springer, 2011.
7. Postharvest Technology and Food Process Engineering- AmalenduChakraverty& R. Paul Singh, CRC Press, 2014.
8. Fundamentals of Food Engineering – D. G. Rao, PHILearning, 2014.
9. Food Process Engineering & Technology – Md. Iffan A. Ansari – Jain Brothers
10. Processing & Food Engineering – M. K. Garg& P. Chandra, Jain Brothers
11. Solved Problems in Food Engineering -StavrosYanniotis, Springer

**COs-POs-PSOs MAPPING:**

| COs | Program Outcomes | | | | | | | | | | | | PSO Mapping | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
| **CO1** | 3 | 1 | 2 | 1 | 3 | 3 | - | - | - | - | - | 3 | 2 | 3 | 3 |
| **CO2** | 3 | 1 | 3 | 2 | 3 | - | - | - | - | - | - | 3 | 2 | 1 | 2 |
| **CO3** | 3 | 1 | 3 | 3 | 3 | - | - | - | - | - | - | 3 | 2 | - | 1 |
| **CO4** | 3 | 1 | 2 | 2 | 3 | - | - | - | - | - | - | 3 | 2 | 1 | - |
| **Overall Mapping** | 3 | 1 | 2.5 | 2 | 3 | 3 | | | | | | 3 | 2 | 2 | 2 |

**Course Name: Unit Operations of Chemical Engineering–II**
**Course Code: FT 504 A**
**Contact: 2:1:0**
**Total Contact Hours: 36**
**Credit: 3**
**Pre requisites:** Thermodynamics, Stoichiometry, Unit Operations
**Course Objective**: The purpose of this course is to introduce the undergraduate students with the most important separation equipment in the process industry, and provide proper understanding of unit operations.

## *Course Outcome*

After the completion of the course students will be able to:

**CO1: Describe** diffusion and absorption operations

**CO2: Design** distillation operation

**CO3: Interpret** the problems of extraction

**CO4: Apply** the knowledge of drying and crystallization

## *Course Contents:*

### Module I: 10L
Introduction to mass transfer: Molecular diffusion in fluids, diffusivity, mass transfer coefficients, inter-phase mass transfer, gas absorption, countercurrent multistage operation, packed tower.

### Module II: 10L
Distillation: Vapor-liquid equilibrium, Rayleigh's equation, flash and differential distillation, continuous rectification, McCabe-Thiele method.

### Module III: 12L
Extraction, Drying and Crystallization: Liquid-liquid equilibrium, liquid extraction, stage-wise contact, liquid-solid equilibria, leaching, batch drying and mechanism of batch drying, preliminary idea of crystallization.

### *Revision: 4L*

## Text Books:

1. Unit Operations of Chemical Engineering; McCabe, Smith &Harriot; 6th ed, TMH.
2. Transport Processes & Unit operations; Geankopolis; 3rd ed, PHI.

## *Reference books:*

1. Chemical Engineering, Vol-I & II, Colson& Richardson; Butterworth Heinemann.
2. Chemical Engineer's Handbook; Perry, Chilton& Green; MGH.
3. Introduction to chemical engineering. Walter L. Badger and Julius T. Banchero. McGraw-Hill book company, Inc.

**COs-POs-PSOs MAPPING:**

| **CO** | **Program Outcomes** | | | | | | | | | | | | **Program Specific Outcomes** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO 1** | ***PSO 2*** | ***PSO 3*** |
| **CO1** | **3** | **3** | **2** | **2** | **2** | **1** | **-** | **-** | **-** | **-** | **-** | **3** | **3** | ***2*** | ***1*** |
| **CO2** | **3** | **3** | **2** | **2** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **3** | ***2*** | ***1*** |
| **CO3** | **3** | **3** | **2** | **-** | **3** | **1** | **-** | **-** | **-** | **-** | **-** | **3** | **3** | ***2*** | ***1*** |
| **CO4** | **3** | **3** | **2** | **2** | **2** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **3** | ***3*** | ***2*** |
| **Overall CO mapping** | **3** | **3** | **2** | **2** | **2.66** | **1** | **-** | **-** | **-** | **-** | **-** | **3** | **3** | ***2.25*** | ***1.25*** |

**Course Name: Separation Process**
**Course Code: FT 504 B**
**Contact: 2:1:0**
**Total Contact Hours: 36**
**Credit: 3**
**Pre requisites:** Thermodynamics, Stoichiometry, Unit Operation
**Course Objective**: To learn conceptual design of separation processes and design ofequipment involved.

## *Course Outcome*

After the completion of the course students will be able to:

**CO1**: **Explain** various chemical engineering separation processes.

**CO2: Demonstrate** appropriate separation technique for intended problem

**CO3: Analyze** the separation system for multi-component mixtures

**CO4: Design** separation system for the effective solution of intended problem

## *Course Contents:*

### Module I: 10L

Principles of molecular diffusion and diffusion between phases, Fick's Law, Diffusivity, Equation of continuity, Diffusion in solids. definition of Mass transfer coefficient, Correlation of mass transfer coefficients, Theories of Mass Transfer, mass transfer across interfaces.

### Module II: 10L

Introduction, Mechanism of absorption, Absorption equipments, Diameter and height calculations for packed columns, Kremser equation, H. E. T. P. , H. T. U. , and N. T. U. concepts, Packed tower design, height of column based on conditions in the gas, liquid film, and overall coefficients, plate type towers, number of plates by use of absorption factor.

### Module III: 12L

Introduction, Vapor-liquid equilibria, Relative volatility, Ideal and non -ideal solutions, Batch, differential and equilibrium distillation, Enthalpy concentration diagram, Rectification of binary systems, Design of rectification column, calculation of number of ideal plates in a distillation column by McCabe-Thiele method, importance of reflux ratio, Azeotropic mixture & Extractive Distillations, Introduction to multi-component distillation.

### *Revision: 4L*

## Text Books:

1. Mass Transfer Operations: Robert E. Treybal, MGH, International student Edition.
2. Transport process and Unit Operations: Geankoplis. 3rd Edn., PHI.
3. Unit Operations in Chemical Engineering : McCabe, Smith, and Harriot. MGH, Sth Edn.

## *Reference books:*

1. Multicomponent Distillation: Holland, C. D., PHI.
2. The Elements of Fractional Distillation: Robinson, C. S. and Gilliland, E. R. MGH.
3. Mass Transfer: Sherwood, Pigford, and Wilke, MGH.
4. Separation Processes: King, C. J. MGH.
5. Design of Equilibrium Stage Processes: Smith, B. D. MGH.
6. Distillation: van Winkle, M., MGH.

**COs-POs-PSOs MAPPING:**

| **COs** | **Program Outcomes** | | | | | | | | | | | | **PSO Mapping** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | ***PSO2*** | ***PSO3*** |
| **CO1** | 3 | 3 | 2 | 2 | - | - | - | - | - | - | - | 3 | **3** | **2** | **1** |
| **CO2** | 3 | 3 | 2 | - | 3 | 1 | - | - | - | - | - | 3 | **3** | **2** | **1** |
| **CO3** | 3 | 3 | 1 | 1 | 1 | - | - | - | - | - | - | 3 | **3** | **2** | **1** |
| **CO4** | 3 | 3 | 3 | 3 | 2 | 1 | - | - | - | - | - | 3 | **3** | **3** | **2** |
| **Overall Mapping** | 3 | 3 | 2 | 2 | 2 | 1 | | | | | | 3 | **3** | **2.25** | **1.25** |

# PRACTICAL

## Course Name: Food Processing Lab I

## Course Code: FT591

## Contact: 0:0:3
## Credit: 1.5

**Pre requisites:** Principles of Food Preservation, Unit Operation

## Course Objectives:

To assist the students in using laboratory techniques common to basic Food Processing and to provide an opportunity to the students to evaluate the effective test methods used in sensory evaluation and analyze the resulting information.

## Course outcome:

After the completion of the course students will be able to:
**CO1: Demonstrate** laboratory techniques common to basic Food Processing.
**CO2: Apply** the principles that make a food product safe for consumption.
**CO3: Interpret** government regulations pertaining to food manufacturing.
**CO4: Explain** the effective sensory evaluation technique.

## *List of Experiments:*

1. Preparation of citrus fruit squash/nectar/concentrated juice.
2. Preparation of fruit jam/mixed jam/marmalade.
3. Preparation of jelly/synthetic jelly.
4. Preparation of tomato ketchup/puree/sauce.
5. Preparation of fruit/vegetable pickles.
6. Preparation of dried vegetable.
7. Preparation of fermented cereal/vegetable (Sauerkraut) food products
8. Preparation of fruit leathers
9. Innovative experiment.

## *Text Books:*

1. Food Science by B. Srilakhsmi
2. Essentials of Food & Nutrition by Swaminathan, Vol. 1 &2

### *Reference Books:*

**1.** Hand Book of Analysis of fruits & vegetables by S. Ranganna

**COs-POs-PSOs MAPPING:**

| **COs** | **Program Outcomes** | | | | | | | | | | | | **Program Specific Outcomes** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
| **CO1** | 2 | 1 | 1 | 3 | 3 | 2 | 2 | - | - | - | 2 | 2 | 1 | 1 | 3 |
| **CO2** | 2 | 1 | 2 | 2 | 2 | 2 | 3 | 2 | - | - | 2 | 3 | 1 | 2 | 2 |
| **CO3** | 2 | 1 | 1 | 3 | - | 2 | 3 | - | - | - | - | 3 | 1 | 1 | 3 |
| **CO4** | 3 | 2 | 2 | 2 | 2 | - | - | - | 3 | - | - | 3 | 2 | 2 | 2 |
| **Overall Mapping** | 2.25 | 1.25 | 1.5 | 2.5 | 2.33 | 2 | 2.66 | 2 | 3 | | 2 | 2 | 1.25 | 1.5 | 2.5 |

## Course Name: Food Analysis and Quality Control Lab

## Course Code: FT592
## Contact: 0:0:3
## Credit: 1.5

**Pre requisites:** Food Chemistry, Biochemistry

## Course Objectives:

To help the students develop practical skill in analyzing various components e.g. carbohydrate, fat, protein, vitamin etc. available in various food materials and to measure the acidity, ash, sugar content, moisture, total solid content, viscosity, unsaturation, volatile fatty acid, hydrolytic rancidity, oxidative rancidity of these food samples.

## Course outcome(s):

After the completion of the course students will be able to:

**CO1: Describe** the various tests to detect adulterant in various food samples.

**CO2: Analyze** different components present in various food materials.

**CO3: Demonstrate** the parameters of different processed and non-processed foods.

**CO4: Develop** processes for intended storage stability of food materials.

## *List of Experiments:*

1. Analysis (acidity, reducing and non reducing sugar content) of jam/jelly/marmalade.
2. Analysis (ash content, moisture content and Polyphenol content) of spices.
3. Analysis (ash content, moisture content, fat content) of milk, milk powder.
4. Analysis (ash content, moisture content, bulk density, Polyphenol content, total extractive) of tea.
5. Analysis (ash content, moisture content, bulk density, Polyphenol content, total extractive, chicory) of coffee.
6. Analysis (ash content, moisture content, crude fibre content, loaf volume only for bread) of wheat flour, bread, biscuits.
7. Analysis (acidity, reducing and non reducing sugar, TSS) of non-alcoholic beverages.
8. Estimation of (a) Iodine value, (b) Saponification value (c) acid value (d) peroxide value, (e) RM value (f) P value, (g) K value of fats and oils Polenske Number, Krishner value of ghee and oil samples.
9. Analysis (lactic acid content) of Sauerkraut.
10. Innovative Experiments

**COs-POs-PSOs MAPPING:**

| COs | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 2 | 2 | 2 | 3 | 2 | 2 | 1 | 2 | 1 | - | 3 | 1 | 1 | 3 |
| CO2 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 1 | - | 3 | 1 | 2 | 2 |
| CO3 | 3 | 3 | 2 | 1 | 3 | 1 | - | 1 | 1 | 1 | - | 3 | 1 | 1 | 3 |
| CO4 | 3 | 2 | 1 | 1 | 2 | - | - | 1 | 1 | 1 | - | 3 | 2 | 2 | 2 |
| Overall mapping | 3 | 2.25 | 1.75 | 1.5 | 2.75 | 2 | 2.5 | 1.25 | 1.5 | 1 | | 3 | 1.25 | 1.5 | 2.5 |

**Course Name: Unit Operation Lab II**

**Course Code: FT 593 A**

**Contact: 0:0:3**

**Credit: 1.5**

**Pre requisites:** Unit Operation of Chemical Engg.

## *Course Objective:*

To learn analytical experimental methods using sophisticated instruments and interpretation of experimental data.

## *Course outcome:*

After completion of the course students will able to:

**CO1**: **Define** process equipment via hands-on learning.

**CO2: Determine** the filter medium resistance & cake resistance

**CO3: Estimate** separation coefficient in centrifugation and vacuum evaporation

**CO4: Compare** drying rates of food using different types of driers

## *List of Experiment:*

1. Determination of filter medium resistance & cake resistance in cake filtration.
2. Determination of separation coefficient in centrifugation.
3. Determination of separation coefficient by vacuum evaporation using Rotary Vacuum Evaporator
4. Determination of drying rates of food using different types of driers ( Tray Drier, Fluidized bed Drier, Freeze Drier, Spray Drier )
5. Measurement of heat flow during freezing of food products
6. Determination of Mass transfer coefficient / kLa
7. Determination of relative volatility of solvent mixtures by distillation.
8. Innovative Experiment

**COs-POs-PSOs MAPPING:**

| COs | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 2 | 2 | 2 | 2 | 1 | - | 1 | 2 | - | - | 3 | 3 | 2 | 1 |
| CO2 | 3 | 2 | 2 | 2 | 2 | - | - | 1 | 2 | - | - | 3 | 3 | 2 | 1 |
| CO3 | 3 | 2 | 2 | 2 | 2 | - | - | 1 | 2 | - | - | 3 | 3 | 2 | 1 |
| CO4 | 3 | 2 | 2 | 2 | 2 | - | - | 1 | 2 | - | - | 3 | 3 | 3 | 2 |
| Overall Mapping | 3 | 2 | 2 | 2 | 2 | 1 | | 1 | 2 | | | 3 | 3 | 2.25 | 1.25 |

**Course Name: Separation Process Lab**

**Course Code: FT 593 B**

**Contact: 0:0:3**

**Credit: 1.5**

**Pre requisites:** Separation Process

## *Course Objective:*

To learn analytical experimental methods using sophisticated instruments and interpretation of experimental data.

## *Course outcome:*

After completion of the course students will able to:

**CO1**: **Explain** instrumental techniques for analysis
**CO2: Plan** experiments and operate several specific instruments
**CO3: Analyze** the experimental data

**CO4: Compare** the drying rates under different conditions

## *List of Experiment:*

1. Determination of diffusivity of volatile liquids in air using Stefan tube.
2. Determine of simple batch distillation to verify Rayleigh's equation.
3. Measurement of mass transfer co-efficient on wetted wall column.
4. Measurement of performance of a rectification column.
5. Measurement of absorption coefficient in a packed tower.
6. Determination of drying characteristics of a material under constant drying air condition.
7. Determination of adsorption isotherms on batch adsorption.
8. Innovative Experiment

**COs-POs-PSOs MAPPING:**

| COs | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 2 | 2 | 2 | 2 | - | - | 1 | 2 | - | - | 3 | 3 | 3 | 2 |
| CO2 | 3 | 2 | 2 | 2 | 2 | - | - | 1 | 2 | - | - | 3 | 3 | 2 | 2 |
| CO3 | 3 | 2 | 2 | 2 | 2 | - | - | 1 | 2 | - | - | 3 | 2 | 2 | 2 |
| Overall Mapping | 3 | 2 | 2 | 2 | 2 | | | 1 | 2 | | | 3 | 2.67 | 2.33 | 2 |

**Paper Name: Project V**
**Paper Code: PR 591**
**Contact hours: 0:0:2**
**Credit: 1**

**Prerequisites:** Food Microbiology, Unit Operation, Food Chemistry, Food Bio chemistry

**Course Objective:**

- To apply theoretical and laboratory understanding and techniques in realistic implementation
- To help the students to identify the significant issues that need to be resolved for benefit of society
- To learn different verticals of a research and development project

**Course Outcome:**

After completion of Project students will be able to:

**CO1: Identify** the need of socio-economic demand in food of allied sector

**CO2: Apply** the knowledge of theory for innovative product/process design

**CO3: Interpret** the process involved in project for future industrial food and allied sector

**CO4: Summarize** a appropriate report

**CO-PO-PSO Mapping**

| COs | **Program outcomes** | | | | | | | | | | | | **Program Specific Outcomes** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
| **CO1** | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 2 | 2 | 1 | 3 | 3 | 1 | - | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | - |
| **CO3** | 3 | 3 | 2 | 2 | 3 | 2 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 2 |
| **CO4** | 3 | 3 | 1 | 1 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 |
| **Overall Mapping** | 3 | 3 | 2 | 2 | 3 | 2.75 | 2 | 2.5 | 2.75 | 2.25 | 3 | 3 | 2.25 | 2.67 | 2.33 |

# MANDATORY ACTIVITIES

## Course Name: SOCIAL AWARENESS
**Course Code: MC 581**
**Contact:** 0:0:3
**Total Contact Hours:** 36

### *Course Objective:*

The purpose of this course is to build up knowledge of some aspects of human development, health, nutrition and behavior, group dynamics, social institutions and social change. It will enable the learners to appreciate social issues, problems and challenges.

### *Course outcome:*

**CO1:** Ability to understand the knowledge and methodologies to better understand the public issues and to act effectively as a citizen.

**CO2**: Ability to employ the knowledge and methodologies to enhance the functional components in their profession.

**CO 3**: Ability to employ the knowledge and methodologies to enhance their interpersonal interactions.

**CO 4**: Ability to prepare project report and give presentation on the social issues.

## Course Content:

**Module I:** Fundamental concept in social science

1. Social structure and social system.
2. Socialization and social stratification.
3. Social control and social change

**Module II:** Industrialization and society

1. Industrial psychology and industrial democracy.
2. Environment in industry.
3. Fatigue of workers.
4. Motivation, selection and training of workers.

**Module III:** Major social problem in India.

1. Over population.
2. Poverty.
3. Slums.
4. Corruption.

**Module IV:** Social awareness activities on food safety

1. Determine the best ways to process foods
2. Analyze food nutrition and ensure compliance with government regulations for those product
3. Different activities to center around the goal of ensuring quality and safety in food consumption.

## Text Books:

1. A New Look into Social Sciences,Sheikh Sabir, A.M.Shiekh and Jaya Dwadshiwar,Sage Publication New Delhi.
2. Social Problems in India, Ram Ahuja, Rawat Publication New Delhi.
3. Food Adulteration..., by Frank Weiss Traphagen, Nabu Press publication

## Reference Books:

1. Labour Problems and Social Welfare,R.C.Saxsena, Prakashan Kendra, Lucknow.
2. Technology of Food Preservation by Desrosier

**COs-POs-PSOs MAPPING:**

| COs | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | - | - | - | - | - | 3 | 2 | 2 | - | 1 | - | 2 | 1 | 1 | 3 |
| CO2 | 1 | - | - | - | - | 3 | 1 | 2 | 2 | 2 | - | 2 | 1 | 2 | 2 |
| CO3 | - | - | - | - | - | - | - | 2 | 3 | 3 | - | 2 | 1 | 1 | 3 |
| CO4 | 3 | 2 | 2 | - | - | - | - | - | 2 | 2 | 3 | - | 2 | 2 | 2 |
| Overall Mapping | 2 | 2 | 2 | | | 3 | 2 | 2 | 2.33 | 2 | 3 | 2 | 1.25 | 1.5 | 2.5 |

| 6th Semester | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Sl No** | **Field** | **Paper Code** | **Theory** | **Contact Hours /Week** | | | | **Credit Points** |
| | | | | **L** | **T** | **P** | **Total** | |
| **A. THEORY** | | | | | | | | |
| 1 | PC | FT601 | Food Process Technology–III (Milk and Milk Products) | 3 | 1 | 0 | 4 | 4 |
| 2 | PC | FT602 | Food Process Technology–IV (Edible Fats and Oils) | 3 | 1 | 0 | 4 | 4 |
| 3 | PC | FT603 | Bakery, Confectionary and Extruded Foods | 3 | 0 | 0 | 3 | 3 |
| 4 | OE | FT604 | A. Microbial Technology & Food Biotechnology<br>B. Environmental Biotechnology | 3 | 0 | 0 | 3 | 3 |
| 5 | OE | FT 605 | A. Data Structure and Algorithm<br>B. Database Management Systems<br>C. Software Engineering | 3 | 0 | 0 | 3 | 3 |
| **Total of Theory** | | | | | | | **17** | **17** |
| **B. PRACTICAL** | | | | | | | | |
| 6 | PC | FT 691 | Food Processing Lab–II | 0 | 0 | 3 | 3 | 1.5 |
| 7 | OE | FT 692 | A. Microbial Technology Lab<br>B. Environmental Biotechnology Lab | 0 | 0 | 3 | 3 | 1.5 |
| 8 | OE | FT 693 | A. Data Structure and Algorithm Lab<br>B. Database Management Systems Lab<br>C. Software Engineering Lab | 0 | 0 | 3 | 3 | 1.5 |
| 9 | PROJ | PR 691 | Project-VI | 0 | 0 | 2 | 2 | 1 |
| 10 | PROJ* | PR 692 | Innovative activities-V | 0 | 0 | 0 | 0 | 0.5 |
| **C. MANDATORY ACTIVITIES / COURSES** | | | | | | | | |
| 11 | MC | MC601 | Constitution of India | 3 | 0 | 0 | 3 | |
| **Total of Theory, Practical & Mandatory Activities/Courses** | | | | | | | **31** | **23** |

*Students may choose either to work on participation in all the activities of Institute's Innovation Council for eg: IPR workshop/ Leadership Talks/ Idea/ Design/ Innovation/ Business Completion/ Technical Expos etc.

Innovative activities to be evaluated by the Programme Head/ Event coordinator based on the viva voce and submission of necessary certificates as evidence of activities.

# THEORY

## Course Name: FOOD PROCESS TECHNOLOGY – III (Milk and Milk products)
## Course Code: FT 601
## Contact: 3:1:0
## Total Contact Hours: 48
## Credit: 4

**Pre requisites:** Chemistry of Food, Food Preservation, Food Microbiology

**Course Objective:** To provide an opportunity for students to classify different processing techniques required for preservation of milk and classify the different by products related to this industry.

## Course outcome(s):

After completion of the course students will able to:

**CO1: Define** milk composition and its varieties; and different testing methods todetect adulterant in milk.
**CO2: Demonstrate** thermal processing of milk, milk products and cleaningand sanitization of milk industry.
**CO3: C**ategorize different dried milk products.
**CO4: Formulate** different milk based products

## Course Content:

### Module I (12 L):

Definition of milk, Composition of milk, Varieties of milk, Nutritional values, Checks for purity of milk and adulteration in milk, Cleaning and sanitization, HACCP of processing unit.

### Module II (12 L):

Thermal processing of fluid milk – Pasteurization (LTLT,HTST & UHT), Packaging of fluid milk, Fermentation of milk and fermented milk products – Cheese, Yogurt, Curd, Kefir, Kumis, Flavored yogurt, Therapeutic value of Fermented Products, concept of Probiotics, prebiotics and probiotics dairy products

### Module III (12 L):

Processing of evaporated and dried milk products – Milk powder, Malted milk and Infant formulae. Manufacturing and standardization of Cream, butter/butter oil, ghee, Ice-cream, Cheese, Simple problem based on milk drying, standardization, etc.

### Module IV (8 L):

Traditional Indian sweets- Kheer, Paneer, Channa, Srikhand, Dairy processing by-products: Fermented, condensed and dried products from whey and Production of lactose and protein from whey.

### Revision: 4L

## Text Books:

1. Outlines of Dairy Technology, De S; Oxford.
2. Milk & Milk Processing; Herrington BL; 1948, McGraw-Hill Book Company.

## Reference Books:

1. Modern Dairy Products, Lampert LH; 1970, Chemical Publishing Company.
2. Developments in Dairy Chemistry – Vol 1 & 2; Fox PF; Applied Science Pub Ltd.
3. Robinson RK; 1996; Modern Dairy Technology, Vol 1 & 2; Elsevier Applied Science Pub.

**COs-POs-PSOs MAPPING:**

| COs | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PS03 |
| CO1 | 2 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | - | 3 | 2 | 3 | 3 |
| CO2 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | - | 3 | 2 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 3 |
| CO4 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 3 |
| Overall mapping | 2.25 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 3 |

**Course Name: FOOD PROCESS TECHNOLOGY – IV (Edible Fats and Oils)**
**Course Code: FT 602**
**Contact: 3:1:0**
**Total Contact Hours: 48**
**Credit: 4**

**Pre requisites:** Chemistry of Food, Principles of Food Preservation

**Course Objective:** To study in depth the chemical, physical and nutritional properties of fats and oils and the technologies involved in the production of vegetable oils/fats and their by-products.

***Course Outcome(s):***
After completion of the course students will able to:

**CO1: Describe** the various properties of fats and oils in processing, non-processing andstorage condition.
**CO2: Demonstrate** the different production and refining processes of vegetable oil.
**CO3: Explain** different technology for manufacture of designer fats.
**CO4: Develop** newer methods for analysis of non-oil constituents of oil bearingmaterials.

## Course Contents:

### Module I (11L):
Importance of fats and oils in foods; Sources, composition and properties of fats and oils (plant and animal origin); Extraction of fats and oils from plant sourcesby Rendering, pressing, solvent extraction, supercritical fluid extraction, enzyme-derived oil extraction.

### Module II (11L):
Processing of oils – Degumming, refining, dewaxing, bleaching, deodorization, fractionation; Pyrolysis of fats, toxicity of frying oil.

### Module III (11L):
Plastic fat –hydrogenation, esterification, inter-esterification and emulsification; Application of plastic fat in bakery, confectionary (including cocoa butter replacers), shortenings, margarine processing.

### Module IV (11L):
By-products of fat/oil processing industries; Oil seed protein isolates; Quality standards of fats and fatty foods; Antioxidants and its mechanism of application.

**Revision**: 4L

## Text books:

1. Bailey's Industrial Oil and Fat Products, Vol 1 & 2; Swern D; 4th ed, 1982, John Wiley & Sons.
2. The Chemistry & Technology of Edible Oils and Fats; Devine J & Williams PN; 1961, Pergamon Press.

## *Reference books:*

1. Food Oils and their Uses; Weiss TJ; 1983, AVI.

**COs-POs-PSOs MAPPING:**

| CO | Program Outcomes | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
| **CO1** | 3 | 3 | 3 | 3 | 1 | - | 2 | - | - | - | - | 3 | 3 | 2 | 2 |
| **CO2** | 3 | 2 | 2 | - | - | 1 | - | - | - | - | - | 3 | 3 | 3 | 2 |
| **CO3** | 3 | 3 | 2 | 2 | - | - | 2 | - | - | - | - | 3 | 2 | 3 | 2 |
| **CO4** | 3 | 2 | 2 | 2 | 2 | - | - | - | - | - | - | 3 | 3 | 2 | 3 |
| **Overall Mapping** | 3 | 2.5 | 2.25 | 2.33 | 1 | 1 | 2 | | | | | 3 | 2.75 | 2.5 | 2.25 |

**Course Name: BAKERY, CONFECTIONARY AND EXTRUDED FOODS**
**Course Code: FT 603**
**Contact: 3:0:0**
**Total Contact Hours: 36**
**Credit: 3**

**Pre requisites:** Chemistry of Food, Food Preservation, Food Microbiology

**Course Objective:** To provide an optimum environment for students to gain knowledge on the different functional properties of the ingredients, processes and machinery involved in production of different bakery and confectionery products. Students can also get idea about the safety, hygiene and maintenance of different bakery industries.

## Course outcome(s):

After completion of the course students will able to:

**CO1: Demonstrate** the ingredients, process and machinery involved in bakery, Confectionery technology and extruded products.
**CO2: Explain** the testing procedures to assess the quality of raw materials.
**CO3: Analyze** production faults and suggest corrective actions to assess product quality
**CO4: Recognize** the technical knowledge for the development of Bakery and Confectionary industry and Extruded products

## Course Contents:

**Module I (8L):** Introduction to baking; Bakery ingredients and their functions; Machines and equipment for batch and continuous processing of bakery products: metering and weighing equipment, mixing, moulding, laminating equipment, different types of ovens, depanner etc.

**Module II (8L):** Testing of flour; Preparation techniques of different baked products: bread, cake and biscuits; Cake icing techniques, wafer manufacture, cookies, crackers, dusting or breading; Analysis of bakery products;

**Module III (8L):** Preparation techniques of confectionary: pies and pastries, doughnuts, chocolates and candies; Coating or enrobing of chocolate (including pan-coating); Maintenance, safety and hygiene of bakery plants.

**Module IV (8L):** Importance and applications of extrusion in food processing; Pre and post extrusion treatments; Manufacturing process of extruded products: Texturized vegetable protein; Change of functional properties of food components during extrusion.

## Revision: 4L

## Text Books:

1. Bakery Technology & Engineering; Matz SA; 1960; AVI Pub.
2. Extrusion of Food, Vol 2; Harper JM; 1981, CRC Press.

## Reference Books:

1. Up to-date Bread Making; Fance WJ &Wrogg BH; 1968, Maclasen& Sons Ltd.
2. Modern Cereal Chemistry; Kent-Jones DW & Amos AJ; 1967, Food Trade Press Ltd.

**COs-POs-PSOs MAPPING:**

| CO | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO 1 | 3 | 2 | - | - | - | - | - | - | - | - | - | 3 | 3 | 2 | 2 |
| CO 2 | 3 | 2 | 2 | - | - | 2 | - | - | - | - | - | 3 | 3 | 2 | 2 |
| CO 3 | 3 | 3 | 2 | 1 | 2 | - | - | 1 | - | - | - | 3 | 3 | 3 | 2 |
| CO 4 | 2 | 2 | - | 3 | 3 | 3 | 2 | 2 | - | - | - | 3 | 3 | 2 | 2 |
| Overall Mapping | 2.75 | 2.25 | 2 | 4 | 2 | 2.5 | 2 | 1.5 | | | | 3 | 3 | 2.25 | 2 |

**Course Name: MICROBIAL TECHNOLOGY & FOOD BIOTECHNOLOGY**
**Course Code: FT 604 A**
**Contact: 3:0:0**
**Total Contact Hours: 36**

**Pre requisites:** Chemistry of Food, Food Preservation, Food Microbiology

**Course Objective:** To provide an opportunity for students to know about the pathogenic & nonpathogenic beneficial organisms and the use of beneficial organisms in food industry along with genetic engineering.

## Course outcome(s):

After completion of the course students will able to:

**CO1: Demonstrate** biotechnology and microbiological quality of water and food.

**CO2: Explain** production method of organic acids, alcoholic beverages and glycerol.

**CO3: Interpret** fermentation method to produce different food and medicines.

**CO4: Describe** genetic engineering and genetically modified crop.

## Course Contents:

### Module I (8L):

Methods for the microbiological examination of water and foods, Coliform bacteria, Coliform test; Food borne illnesses and diseases.

### Module II (8L):

Production of organic acids (vinegar, lacticacid), alcoholic beverages (beer, wine, and distilled alcoholic beverages such as whiskey, rum, vodka).

### Module III (8L):

Propagation of baker's yeasts; Microbial production of vitamins (B2 and B12), antibiotics (penicillin, streptomycin, tetracycline); SCP and mushrooms

### Module IV (8L):

Basics of microbial genetics – Gene, DNA, RNA; Replication, transcription, transformation, transduction, conjugation; Regulation of gene expression; Application in GM foods.

### Revision: 4L

## Text Books:

1. Industrial Microbiology Prescott & Dunn, CBS Publishers
2. Food Microbiology; Frazier WC; 4th ed, Tata-McGrawhill Pub.
3. Modern Food Microbiology by Jay JM, CBS Publishers

4. Microbiology by Pelczar, Chan, and Krieg, TMH

### *Reference Books:*

1. Comprehensive Biotechnology by Murray &Mooyoung, Academic press
2. Industrial Microbiology by Casida L.R., New Age International Pvt. Ltd.
3. Fermentation Biotechnology, Principles, Processed Products by Ward OP, Open University Press.

**COs-POs-PSOs MAPPING:**

| **COs** | **Program Outcomes** | | | | | | | | | | | | **Program Specific Outcomes** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
| **CO1** | 3 | 3 | 2 | 2 | - | 2 | 2 | - | - | - | - | 3 | 3 | 2 | 1 |
| **CO2** | 3 | 3 | - | - | - | 2 | 2 | - | - | - | - | 3 | 3 | 2 | 2 |
| **CO3** | 3 | 3 | - | - | 3 | 1 | - | 3 | - | - | - | 3 | 2 | 3 | 3 |
| **CO4** | 3 | 3 | 1 | - | - | 2 | 3 | 2 | - | - | - | 3 | 3 | 3 | 1 |
| **Overall Mapping** | 3 | 3 | 2 | 2 | | 1.75 | 2.33 | 2 | | | | 3 | 2.75 | 2.5 | 1.75 |

## Course Name: ENVIRONMENTAL BIOTECHNOLOGY

**Course Code: FT 604B**
**Contact: 3:0:0**
**Total Contact Hours: 36**

**Pre requisites:** Chemistry of Food, Food Microbiology, Environmental Engineering
**Course Objective:** To help the students understand various toxic and hazardous substances in environment and food safety and safe environment.

### Course outcome(s):

After completion of the course students will able to:

**CO1: Describe** biotechnology and microbiological quality of water and air.

**CO2: Identify** management methods of wastes.

**CO3: Demonstrate** about marine pollution.

**CO4: Analyze** genetic engineering and genetically modified crop.

### Course Contents:

### Module I (8L):

Toxic chemicals in the environment - air, water & their effects, Pesticides in water, Biochemicals aspects of arsenic, cadmium, lead mercury, carbon monoxide, ozone and PAN pesticide.

### Module II (8L):

Sources, generation, classification & composition of solid wastes. Solid waste management methods. Coliform test of water.

### Module III (8L):

Marine pollution, sources of marine pollution and its control. Effects of pollutants on human beings, plants, animals and climate. .

**Module IV (8L):** Gene, RNA, DNA,Basic techniques in genetic engineering, GM crop.
.

### Revision: 4L

### *Text Books:*

1. Environmental chemistry - Sodhi

2. Principals of Environmental chemistry – Manhan

## Reference Books:

1. Environmental hazards & human health R.B. Philip
2. Toxicology - principles & applications - Niesink& Jon devries
3. Solid Waste Management CPCB. New Delhi.
4. Principles of Biochemistry - Lehninger

**COs-POs-PSOs MAPPING:**

| COs | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO1 0 | PO1 1 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | - | - | - | - | 2 | 3 | 2 | - | - | - | 3 | 3 | 2 | 1 |
| CO2 | 3 | - | - | - | 1 | 1 | 1 | - | - | 2 | - | 3 | 3 | 2 | 2 |
| CO3 | 3 | 2 | 2 | - | - | 2 | 3 | - | 2 | 2 | 1 | 3 | 2 | 3 | 3 |
| CO4 | 3 | - | - | 2 | 2 | 2 | 3 | - | - | - | 1 | 3 | 3 | 3 | 1 |
| Overall Mapping | 3 | 2 | 2 | 2 | 1.5 | 1.75 | 1.75 | 2 | 2 | 2 | 1 | 3 | 2.75 | 2.5 | 1.75 |

**Course Name: DATA STRUCTURE AND ALGORITHM**
**Course Code: FT605A**
**Contact: 3:0:0**
**Total Contact Hours: 36**
**Credits: 3**

## Prerequisites:

1. Familiarity with the fundamentals of C or other programming language
2. A solid background in mathematics, including probability, set theory.

## Course Outcomes:

After completion of the course students will able to:

**CO1: Differentiate** how the choices of data structure & algorithm methods impact theperformance of program.
**CO2: Solve** problems based upon different data structure & also write programs.
**CO3: Identify** appropriate data structure & algorithmic methods in solving problem.
**CO4: Discuss** the computational efficiency of the principal algorithms for sorting, searching,and hashing
**CO5: Contrast** the benefits of dynamic and static data structures implementations.

## Course Contents:

**Module I: Linear Data Structure [10L]**
Introduction (2L):
Concepts of data structures: a) Data and data structure b) Abstract Data Type and Data Type.
Algorithms and programs, basic idea of pseudo-code (1L)
Algorithm efficiency and analysis, time and space analysis of algorithms – order notations (1L)
Array (2L):
Different representations – row major, column major (1L)
Sparse matrix - its implementation and usage, Array representation of polynomials (1L)
Linked List (6L):
Singly linked list – operations, Doubly linked list – operations (4L)
Circular linked list – operations, Linked list representation of polynomial and applications (2L)
**Module II: Linear Data Structure [6L]**
Stack and Queue (4L):
Stack and its implementations (using array and linked list) (1L)
Applications (infix to Postfix, Postfix Evaluation) (1L)
Queue, circular queue, de-queue (1L)
Implementation of queue- linear and circular (using array and linked list) (1L)
Recursion (2L):
Principles of recursion - use of stack, tail recursion. (1L)
Applications - The Tower of Hanoi(1L)
**Module III: Nonlinear Data structures [12L]**
Trees (8L):
Basic terminologies, forest, tree representation (using array and linked list) (1L)
Binary trees - binary tree traversal (pre-, in-, post- order) (1L)
Threaded binary tree (1L)
Binary search tree- operations (creation, insertion, deletion, searching) (1L)
Concept of Max-Heap and Min-Heap (creation, deletion) (1L)

Height balanced binary tree – AVL tree (insertion with examples only) (1L)
Height balanced binary tree – AVL tree (deletion with examples only) (1L)
m –Way Search Tree, B Tree – operations (insertion, deletion with examples only) (1L)
Graphs (4L):
Graph theory review (1L)
Graph traversal and connectivity – Depth-first search (DFS), Breadth-first search (BFS) - concepts of edges used in DFS and BFS (tree-edge, back-edge, cross-edge, and forward-edge) (2L)
Minimal spanning tree – Prim's algorithm, Kruskal's algorithm (basic idea of greedy methods) (1L)

**Module IV: Searching, Sorting [8L]**

Sorting Algorithms (4L):
Bubble sort, Insertion sort, Selection sort – with notion of complexity (1L)
Quick sort, Merge sort – with complexity (2L)
Radix sort – with complexity (1L)
Searching (2L):
Sequential search – with complexity (1L)
Binary search, Interpolation Search– with complexity (1L)
Hashing (2L):
Introduction to Hashing and Hashing functions (1L)
Collision resolution techniques (1L)

## Text Books:

1. Data Structures Through 'C' Language by Samiran Chattopadhyay, Debabrata Ghosh Dastidar, Matangini Chattopadhyay, Edition: 2001, BPB Publications
2. Fundamentals of Data Structures of C by Ellis Horowitz, SartajSahni, Susan Anderson-freed 2nd Edition, Universities Press

## Reference Books:

1. Data Structures, Algorithms, and Software Principles in C by Thomas A. Standish, 1 Edition, Pearson
2. Data Structures by S. Lipschutz, Special Indian Edition, Tata McGraw Hill Education (India) Private Limited
3. Data Structures and Program Design In C by Robert L. Kruse, Bruce P. Leung 2nd Edition, Pearson
4. Data Structures in C by Aaron M. Tenenbaum, 1St Edition, Pearson

**COs-POs-PSOs MAPPING:**

| **CO** | **Progam Outcomes** | | | | | | | | | | | | **Program Specific outcomes** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO 2** | **POP 3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO1 0** | **PO1 1** | **PO12** | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 3 | 2 | 2 | 3 | - | - | - | - | 3 | - | - | 1 | 2 | 2 |
| CO2 | - | - | - | - | - | 2 | 3 | 2 | 2 | - | - | - | 2 | 1 | 2 |
| CO3 | - | - | 1 | - | - | - | - | - | 2 | 3 | - | - | 3 | 1 | 1 |
| CO4 | - | 1 | - | - | - | - | - | - | - | - | - | - | 1 | 1 | 1 |
| CO5 | 3 | - | - | - | - | 3 | - | - | - | - | - | - | 1 | 1 | 2 |
| Overall Mapping | 3 | 2 | 1.5 | 2 | 3 | 1.5 | 3 | 2 | 2 | 3 | | | 1.6 | 1.2 | 1.6 |

**Course Name: DATABASE MANAGEMENT SYSTEM**
**Course Code: FT605B**
**Contact: 3:0:0**
**Total Contact Hours: 36**
**Credits: 3**

## Prerequisites:

1. Logic of programming language
2. Basic concepts of data structure and algorithms

## Course Objectives:

1. To learn the data models, conceptualize and depict a database system
2. To design system using E-R diagram.
3. To learn SQL & relational database design.
4. To understand the internal storage structures using different file and indexing techniques.
5. To know the concepts of transaction processing, concurrency control techniques and recovery procedure.

## Course Outcomes (COs):

After completion of the course students will able to:

CO1: **Apply** the knowledge of Entity Relationship (E-R) diagram for an application.
CO2: **Create** a normalized relational database model
CO3: **Analyze** real world queries to generate reports from it.
CO4: **Determine** whether the transaction satisfies the ACID properties.
CO5: **Create** and maintain the database of an organization.

## Course Contents:

**Module 1:**
**Introduction [3L]**
Concept & Overview of DBMS, Data Models, Database Languages, Database Administrator, Database Users, Three Schema architecture of DBMS.
**Module 2:**
**Entity-Relationship and Relational Database Model [9L]**
Basic concepts, Design Issues, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features, case study on E-R Model. Structure of relational Databases, Relational Algebra, Relational Calculus, Extended Relational Algebra Operations, Views, Modifications Of the Database.

**Module 3:**
**SQL and Integrity Constraints [6L]**
Concept of DDL, DML, DCL. Basic Structure, Set operations, Aggregate Functions, Null Values, Domain Constraints, Referential Integrity Constraints, assertions, views, Nested Subqueries, Database security application development using SQL, Stored procedures and triggers.

**Module 4:**

**Relational Database Design [6L]**

Functional Dependency, Different anomalies in designing a Database., Normalization using functional dependencies, Decomposition, Boyce-Codd Normal Form, 3NF, Normalization using multi-valued dependencies, 4NF, 5NF , Case Study

**Module 5:**
**Internals of RDBMS [6L]**
Physical data structures, Query optimization: join algorithm, statistics and cost bas optimization. Transaction processing, Concurrency control and Recovery Management: transaction model properties, state serializability, lock base protocols; two phase locking, Dead Lock handling

**Module 6:**
**File Organization & Index Structures [6L]**
File & Record Concept, Placing file records on Disk, Fixed and Variable sized Records, Types of Single-Level Index (primary, secondary, clustering), Multilevel Indexes

## Text Books:

1. Henry F. Korth and Silberschatz Abraham, "Database System Concepts", Mc.Graw Hill.
2. ElmasriRamez and NovatheShamkant, "Fundamentals of Database Systems", Benjamin Cummings
Publishing. Company.
3. Ramakrishnan: Database Management System , McGraw-Hill
4. Gray Jim and Reuter Address, "Transaction Processing : Concepts and Techniques", Moragan Kauffman Publishers.
5. Ullman JD., "Principles of Database Systems", Galgottia Publication.

## Reference Books:

1. Jain: Advanced Database Management System CyberTech
2. Date C. J., "Introduction to Database Management", Vol. I, II, III, Addison Wesley.
3. "Fundamentals of Database Systems", RamezElmasri, ShamkantB.Navathe, Addison Wesley Publishing Edition
4. "Database Management Systems", Arun K.Majumdar, PritimayBhattacharya, Tata McGraw Hill

**COs-POs-PSOs MAPPING:**

| CO s | Program Outcome | | | | | | | | | | | | Program Specific Outcome | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 2 | 2 | 2 | 2 | 3 | 2 | 1 | 1 | 2 | 2 | 3 | 3 | 1 | 2 | 2 |
| CO2 | 2 | 3 | 3 | 3 | 3 | 1 | 1 | 1 | 2 | 2 | 3 | 3 | 2 | 1 | 2 |
| CO3 | 3 | 3 | 2 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 1 | 1 |
| CO4 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 1 | 1 | 1 |
| CO5 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 1 | 1 | 2 |
| Overall Mapping | 2.6 | 2.8 | 2.4 | 2.6 | 2.8 | 1.6 | 1.4 | 1.4 | 2.2 | 2.2 | 2.8 | 3 | 1.6 | 1.2 | 1.6 |

**Course Name: SOFTWARE ENGINEERING**
**Course Code: FT605C**
**Contact Hours: 3:0:0**
**Total Contact Hours: 36**
**Credits: 3**

## Prerequisites:

1. An understanding of basic computer software
2. Object Oriented programming skills.

## Course Objectives:

1. To develop basic Knowledge in Software Engineering including software Engineering layered architecture, software process models for software development.
2. To design software requirements and specifications of documents.
3. To understand project planning, scheduling, cost estimation, risk management.
4. To describe data models, object models, context models, behavioral models and coding style and testing issues.
5. To know about the quality checking mechanism for software process and product.

## Course Outcomes:

After completion of the course students will able to:

CO1: To identify, formulate, and solve software engineering problems, including the specification, design, implementation, and testing of software systems that meet specification, performance, maintenance and quality requirements
CO2: **Analyze,** elicit and specify software requirements through a productive working relationship with various stakeholders of the project
CO3: **Design** applicable solutions in one or more application domains using software engineering approaches that integrates ethical, social, legal and economic concerns.
CO4: **Develop** the code from the design and effectively apply relevant standards and perform testing, and quality management and practice.
CO5: **Identify** modern engineering tools necessary for software project management, time management and software reuse, and an ability to engage in life-long learning.

## Course Contents:

**Module I** [**10L]** SoftwareEngineering– Characteristics,Components,Application,Definitions,Software Process models- Waterfall Model, Prototype model, Spiral., Software Project Planning-Feasibility Analysis, Technical Feasibility, Cost-Benefit Analysis, Basics of estimation : COCOMO (Basic, intermediate, Complete) model

**Module II [8L]**
System Analysis: Principle of Structure Analysis, Requirement Analysis, DFD, Entity Relationship Diagram, DataDictionary, Data Modeling, Software Requirements Specification
Software Design Aspects: Objectives, Principles, Concepts, HLD and LLD, Top-Down and Bottom-Updesign; Decision tree, decision table and structured English, Structure chart, Transform analysis Functional Vs. Object-Oriented approach.

**Module III[10L]**
Coding & Documentation–Structured Programming, Modular Programming, Module Relationship-Coupling,Cohesion, Object Oriented Programming, Information Hiding, Reuse, System Documentation.
Testing–Levels of Testing, Integration Testing, System Testing**.**
Test Cases-White Box and Black Box testing Software Quality, Quality Assurance, Software Maintenance, Software Configuration Management.

**Module IV [8L]**
Software Project Management – Project Scheduling, Staffing, Quality Assurance, Risk Management: Reactive vs. Proactive Risk strategies, Software risks, Risk identification, Risk projection, Risk refinement Project Monitoring.

## Text Books:
1. Software Engineering: A practitioner's approach–Pressman(TMH)

## Reference Books:
1. Software Engineering-Pankaj Jalote (Wiley-India)
2. Software Engineering-Rajib Mall(PHI)
3. Software Engineering–Agarwal and Agarwal(PHI)

**COs-POs-PSOs MAPPING:**

| COs | **Program Outcome** | | | | | | | | | | | | **Program Specific Outcome** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 1 | 1 | 2 | 2 | 1 | - | - | - | - | - | - | - | 2 | 1 | 2 |
| CO2 | 2 | 2 | 1 | - | - | - | - | - | - | 1 | - | - | 2 | 2 | 1 |
| CO3 | - | - | - | - | - | 2 | - | 1 | - | 2 | - | - | 1 | 3 | 1 |
| CO4 | - | - | - | - | - | - | - | | 3 | - | 1 | 2 | 1 | 1 | 1 |
| CO5 | - | - | - | - | - | - | - | | 2 | 1 | 2 | 2 | 2 | 1 | 1 |
| Overall mapping | 1.5 | 1.5 | 1.5 | 2 | 1 | 2 | | 1 | 2.5 | 1.33 | 1.5 | 2 | 1.6 | 1.6 | 1.2 |

# PRACTICAL

## Course Name: FOOD PROCESSING LAB II

## Course Code: FT691

## Contact: 0:0:3

## Credit: 1.5

**Pre requisites:** Principles of Food Preservation, Unit Operations, Chemistry of Food

**Course Objective:** To assist the students use laboratory techniques common to basic Food Processing and to provide an opportunity to the students to evaluate the effective test methods used in sensory evaluation and analyze the resulting information.

## Course outcome(s):

After completion of the course students will able to:

**CO1: Demonstrate** laboratory techniques common to basic Food Processing.

**CO2: Apply** the principles that make a food product safe for consumption.

**CO3: Interpret** government regulations pertaining to food manufacturing.

**CO4: Explain** the effective sensory evaluation methods

## *List of Experiment:*

1. Preparation of dry onion/ chilli/ garlic.
2. Preparation of bread
3. Manufacture of macaroni by extruder.
4. Manufacture of potato powder.
5. Manufacture of ice cream.
6. Manufacture of Rosogolla and Sandesh.
7. Manufacture of candied fruits.
8. Production of milk powder by spray drying
9. Preparation of sponge cake.
10. Comparison of shelf life (nutritional Value and sensory test) of slow frozen and quick frozen food.
11. Innovative experiment.

## *Text Books:*

1. Food Science by B. Srilakhsmi
2. Essentials of Food & Nutrition by Swaminathan, Vol. 1 &2

## *Reference Book:*

1. Hand Book of Analysis of fruits & vegetables by S. Ranganna

**COs-POs-PSOs MAPPING:**

| COs | Program outcomes | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 2 | 2 | 1 | 1 | 2 | - | - | - | 2 | - | 2 | 2 | 3 | 2 | 3 |
| CO2 | 2 | 2 | 2 | - | - | 2 | 2 | 2 | - | - | 2 | 3 | 3 | 2 | 2 |
| CO3 | 2 | - | 3 | - | - | 2 | 3 | 1 | - | - | - | 3 | 2 | 2 | 3 |
| CO4 | 3 | 2 | 2 | 2 | 2 | - | - | - | 1 | - | - | 3 | 3 | 3 | 2 |
| Overall Mapping | 2.25 | 2 | 2 | 1.5 | 2 | 2 | 2.5 | 1.5 | 1.5 | | 2 | 2.75 | 2.75 | 2.25 | 2.25 |

## Course Name: MICROBIAL TECHNOLOGY LAB

## Course Code: FT692 A

## Contact: 0:0:3

## Credit: 1.5

**Pre requisites:** Principles of Food Preservation, Unit Operation, Food Microbiology

**Course Objective:** To help the students understand various methods of isolation, characterization and screening of bacteria, fungi and other related organisms and apply different preservation and fermented food productions techniques relative to food safety and spoilage.

## Course outcome(s):

After completion of the course students will able to:

**CO1: Apply** biotechnological processing/engineering principles to varietyof fermented products.
**CO2: Develop** new fermented products.
**CO3: Interpret** data in scientific format.
**CO4: Explain** new development in this field with analytical thinking of the variousaspects of the new technology.

## *List of Experiment:*

1. Alcohol fermentation
2. Organic acid fermentation – Vinegar / citric / lactic acid production
3. Propagation of baker's yeast
4. Fermented dairy products
5. Detection of *E.coli*
6. Enzyme preparation
7. Amino acid production
8. Detection of various types of microorganism in different food items
9. Innovative experiment.

## *Text Books:*

1. Fundamental Principles of Bacteriology – A. J. Salle

## Reference Book:

1. Food Microbiology – M. R. Adams, M. O. Moss.

**COs-POs-PSOs MAPPING:**

| COs | Program Outcomes | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | - | - | - | - | 2 | - | - | 2 | - | - | 3 | 3 | 2 | 3 |
| CO2 | 3 | 2 | 2 | - | - | - | - | - | 2 | - | - | 3 | 3 | 2 | 2 |
| CO3 | 3 | 3 | 2 | 2 | - | - | - | - | 1 | - | - | 3 | 2 | 2 | 3 |
| CO4 | 3 | 2 | - | - | 2 | 2 | - | - | 1 | - | - | 3 | 3 | 3 | 2 |
| Overall Mapping | 3 | 1.75 | 2 | 2 | 2 | 2 | | | 1.5 | | | 3 | 2.75 | 2.25 | 2.5 |

## Course Name: ENVIRONMENTAL BIOTECHNOLOGY LAB

## Course Code: FT692 B

## Contact: 0:0:3

## Credit: 1.5

**Pre requisites:** Environmental Engineering, Unit Operation, Food Microbiology

## Course Objective:

To help the students to measure chemical, and bacteriological parameters of food,water and wastewater. Laboratory methods and interpretation of results with regard to environmental engineering applications such as design and operation of water and wastewater treatment processes, and to the control of the quality of natural water.

## Course outcome(s):

After completion of the course students will able to:

**CO1. Describe** the biochemical processes.

**CO2. Explain** quality of water and food.

**CO3. Interpret** data in scientific format.

**CO4. Identify** development in this field with analytical thinking of the variousaspects of the new technology.

## *List of Experiment:*

1. To determine an unknown protein concentration by plotting a standard graph of BSA using UV-VisSpectrophotometer and validating the Beer- Lambert's Law.
2. To prepare an Acetic-Na Acetate Buffer system and validate the Henderson-Hasselbach equation.
3. Enzyme purification of a crude enzyme.
   a)Ammonium sulphate precipitation.
   b)Dialysis.
4. Estimation of pesticide of a food sample
5. Estimation of heavy metal(s) in food sample.
6. Coliform Test of water.
7. Innovative experiment.

## *Text Books:*

1. An Introduction to Practical Biochemistry – David T. Plummer
2. Fundamental Principles of Bacteriology – A. J. Salle

## Reference Book:

1. Food Microbiology – M. R. Adams, M. O. Moss.

**COs-POs-PSOs MAPPING:**

| COs | Program Outcomes | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 1 | 2 | 1 | 3 | - | 1 | - | 2 | - | - | 3 | 3 | 2 | 3 |
| CO2 | 3 | 3 | 2 | - | 3 | 2 | 2 | - | 2 | - | - | 3 | 3 | 2 | 2 |
| CO3 | 3 | 3 | 3 | 3 | - | - | 1 | - | 2 | 2 | 3 | 3 | 2 | 2 | 3 |
| CO4 | 3 | - | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 |
| Overall Mapping | 3 | 1.75 | 2.5 | 2 | 3 | 2 | 1.5 | 2 | 2.25 | 1.5 | 3 | 3 | 2.75 | 2.25 | 2.5 |

## Course Code: DATA STRUCTURES AND ALGORITHM LAB
## Course Code: FT693A
## Contact: 0:0:3
## Credits: 1.5

## Perquisites:

1. Computer Fundamentals and principal of computer programming Lab

## Course Outcomes:

After completion of the course students will able to:

CO1: Choose appropriate data structure as applied to specified problem definition.

CO2: Handle operations like searching, insertion, deletion, traversing mechanism on various data structures.

CO3: Have practical knowledge on the applications of data structures.

CO4: Able to store, manipulate and arrange data in an efficient manner.

CO5: Able to implement queue and stack using arrays and linked list. Implementation of queue, binary tree and binary search tree.

## List of Experiment:

1. Write a C program to implement Single Link List
2. Write a C program to implement Double Link List
3. Write a C program to implement Single Circular Link List
4. Write a C program to implement Double Circular Link List
5. Write a C program to implement Polynomial addition and Polynomial multiplication using Linked List.
6. Write a C program to convert a given infix expression into its postfix Equivalent.
7. Write C programs to implement a queue ADT using i) array and ii) doubly linked list respectively.
8. Write a C program to implement Binary Search Tree (BST).
9. Write C programs for implementing the following sorting methods to arrange a list of integers in ascending order:
   a. Insertion sort
   b. Merge sort
10. Write C programs for implementing the following sorting methods to arrange a list of integers in ascending order:
    a. Quick sort
    b. Selection sort
11. Write C programs for implementing the following searching methods:
    a. Linear Search
    b. Binary Search

Write a C program to implement all the functions of a dictionary (ADT) using hashing.

12. Write C programs for implementing the following graph traversal algorithms:
    a. Depth first search

b. Breadth first search

**13.** Innovative experiments

## Text Books:

1. Data Structures using C, R. Thareja, 2nd Edition, Oxford University Press.
2. Data Structures Using C E. Balagurusamy, Mcgraw Hill

## Reference Books:

1. Data Structures in C by Aaron M. Tenenbaum, 1st Edition, Pearson
2. Data Structures Through 'C' Language by Samiran Chattopadhyay, Debabrata Ghosh Dastidar, Matangini Chattopadhyay, Edition: 2001, BPB Publications
3. Data structures using C, A.K.Sharma, 2nd Edition, Pearson
4. Fundamentals of Data Structures of C by Ellis Horowitz, SartajSahni, Susan Anderson-freed 2nd Edition, Universities Press

**COs-POs-PSOs MAPPING:**

| CO | Program Outcomes | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | POP3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 3 | 2 | 2 | 2 | - | - | - | - | 1 | - | - | 3 | 2 | 2 |
| CO2 | - | 2 | 2 | - | 2 | - | - | - | - | 1 | - | 2 | 3 | 2 | 3 |
| CO3 | 2 | 1 | 1 | - | - | - | - | - | - | - | - | - | 2 | 3 | 3 |
| CO4 | 3 | 2 | - | 2 | - | - | - | - | - | - | 1 | - | 1 | 1 | 1 |
| CO5 | - | - | 2 | 1 | 2 | - | - | - | - | - | 1 | 2 | 1 | 1 | 1 |
| Overall Mapping | 2.66 | 2 | 1.75 | 1.66 | 2 | | | | | 1 | 1 | 2 | 2 | 1.8 | 2 |

## Course Name: DATABASE MANAGEMENT SYSTEM LAB
## Course Code: FT 693B
## Contacts: 0:0:3
## Credits: 1.5
## Prerequisite:

1. Logic of programming language
2. Basic concepts of data structure and algorithms

## Course Objectives:

After completion of the course students will able to:

1. To learn the data models, conceptualize and depict a database system
2. To learn the fundamental concepts of SQL queries.
3. To understand the concept of designing a database with the necessary attributes.
4. To know the methodology of Accessing, Modifying and Updating data & information from the relational databases
5. To learn database design as well as to design user interface and how to connect with database.

## Course Outcome(s):

On completion of the course students will be able to

**CO1:** Understand the basic concepts regarding database, know about query processing and techniques involved in query optimization and understand the concepts of database transaction and related database facilities including concurrency control, backup and recovery.

**CO2:** Understand the introductory concepts of some advanced topics in data management like distributed databases, data warehousing, deductive databases and be aware of some advanced databases like partial multimedia and mobile databases.

**CO3:** Differentiate between DBMS and advanced DBMS and use of advanced database concepts and become proficient in creating database queries.

**CO4:** Analyze database system concepts and apply normalization to the database.

**CO5:** Apply and create different transaction processing and concurrency control applications.

## Course Contents:

- Structured Query Language

**Module1: [6L]**

Creating Database
Creating a Database
Creating a Table Specifying Relational Data Types
Specifying Constraints Creating Indexes

**Module2: [3L]**

Table and Record Handling
INSERT statement
Using SELECT and INSERT together
DELETE, UPDATE, TRUNCATE statements
DROP, ALTER statements

**Module3: [6L]**

Retrieving Data from a Database
The SELECT statement
Using the WHERE clause
Using Logical Operators in the WHERE clause

Using IN, BETWEEN, LIKE , ORDER BY, GROUP BY and HAVING Clause Using Aggregate Functions
Combining Tables Using JOINS
Sub-queries

**Module 4: [3L]**
Database Management
Creating Views
Creating Column Aliases
Creating Database Users
Using GRANT and REVOKE
**Module 5:[6L]**
PL/SQL
**Module 6:[6L]**
Database design using E-R model and Normalization
**Module 7:[6L]**
Design and implementation of some on line system [Library Management System]

## Text Books:

1) SQL, PL/SQL by Ivan Bayross, BPB Publications
2) Oracle PL/SQL Programming, 6th Edition - O'Reilly Media By Steven Feuerstein, Bill Pribyl

**COs-POs-PSOs MAPPING:**

| **COs** | **Program Outcomes** | | | | | | | | | | | | **PSO** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
| CO1 | 2 | 2 | 2 | 2 | 3 | 2 | 1 | 1 | 2 | 2 | 3 | 3 | 3 | 2 | 2 |
| CO2 | 2 | 3 | 3 | 3 | 3 | 1 | 1 | 1 | 2 | 2 | 3 | 3 | 3 | 2 | 3 |
| CO3 | 3 | 3 | 2 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 3 | 3 |
| CO4 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 1 | 1 | 1 |
| CO5 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 1 | 1 | 1 |
| Overall Mapping | 2.5 | 2.8 | 2.4 | 2.6 | 2.8 | 1.6 | 1.4 | 1.4 | 2.2 | 2.2 | 2.8 | 3 | 2 | 1.8 | 2 |

## Course Name: SOFTWARE ENGINEERING LAB
## Course Code: FT 693C
## Contact Hours: 0:0:3
## Credits: 1.5

### Prerequisites:
For Software Engineering Lab, design a project proposal which will be used throughout the lab for performing different experiments using CASE Tools.

### Course Objectives:
- To learn software development skill through various stages of software life cycle. .
- To ensure the quality of software through software development with various protocol based environment.

### Course Outcomes:
After completion of the course students will able to:

**CO1:** To handle software development models through rational method.
**CO2:** To prepare SRS document, design document, test cases and software configuration management and risk management related document.
**CO3:** To develop function oriented and object oriented software design using tools like rational rose.
**CO4:** To perform unit testing and integration testing
**CO5:** To apply various white box and black box testing techniques

Assignments to be given from the following
1. Preparation of requirement document for standard application problems in standard format. (e.g. Library Management System, Railway Reservation system, Hospital management System, University Admission system) .DFD of standard application problems.
2. Project Schedule preparation. Software Requirement Analysis: Describe the individual Phases/ modules of the project, Identify deliverables.
3. Use Case diagram, Class Diagram, Sequence Diagram, Activity Diagram and prepare Software Design Document using tools like Rational Rose.( For standard application problems)
4. Software Development and Debugging. Estimation of project size using Function Point(FP) for calculation.
5. Design Test Script/Test Plan(both Black box and White Box approach)
6. Compute Process and Product Metrics (e.g Defect Density, Defect Age, Productivity, Cost etc.) Cost Estimation models. COCOMO

### Text Book:
1. Software Engineering: A practitioner’s approach–Pressman(TMH)

### Reference Book:

1. Software Engineering-Pankaj Jalote (Wiley-India)

**COs-POs-PSOs MAPPING:**

| | **Program Outcomes** | | | | | | | | | | | | **PSO** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | **PSO1** | **PSO2** | **PSO3** |
| CO1 | 3 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | 3 | 2 | 2 | 1 |
| CO2 | 3 | 2 | 3 | - | | - | - | - | - | - | - | 2 | 2 | 2 | 3 |
| CO3 | 3 | 2 | 3 | 2 | 3 | - | - | - | - | - | - | - | 2 | 3 | 3 |
| CO4 | 3 | 3 | - | - | - | - | - | - | - | - | - | - | 1 | 1 | 1 |
| CO5 | 3 | 2 | - | - | - | - | - | - | - | - | - | 2 | 1 | 1 | 1 |
| Overall Mapping | 3 | 2.4 | 3 | 2 | 2.5 | | | | | | | 2.33 | 1.6 | 1.8 | 1.8 |

**Paper Name: Project VI**
**Paper Code: PR 691**
**Contact hours: 0:0:2**
**Credit: 1**

**Prerequisites:** Food Microbiology, Food Processing, Unit Operation, Management Principles, Food Chemistry

**Course Objective:**

- To apply theoretical and laboratory understanding and techniques in realistic implementation
- To help the students to identify the significant issues that need to be resolved for benefit of society
- To learn different verticals of a research and development project

**Course Outcome:**

After completion of Project students will be able to:

**CO1: Identify** the need of socio-economic demand in food of allied sector

**CO2: Apply** the knowledge of theory for innovative product/process design

**CO3: Interpret** the process involved in project for future industrial food and allied sector

**CO4: Summarize** a appropriate report

**CO-PO-PSO Mapping**

| COs | Program outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
| **CO1** | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 2 | 2 | 1 | 3 | 3 | 1 | - | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | - |
| **CO3** | 3 | 3 | 2 | 2 | 3 | 2 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 2 |
| **CO4** | 3 | 3 | 1 | 1 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 |
| **Overall Mapping** | 3 | 3 | 2 | 2 | 3 | 2.75 | 2 | 2.5 | 2.75 | 2.25 | 3 | 3 | 2.25 | 2.67 | 2.33 |

# MANDATORY COURSE

## Course Name: CONSTITUTION OF INDIA
## Course Code: MC601
## Contact: 3:0:0
## Total Contact Hours: 36
## Prerequisite: NA

**Course Outcome:** Student will be able to:

**CO1**: Develop human values; create awareness about law ratification and significance of Constitution

**CO2:** Comprehend the Fundamental Rights and Fundamental Duties of the Indian Citizen to implant morality, social values and their social responsibilities.

**CO3:** Create understanding of their Surroundings, Society, Social problems and their suitable solutions.

**CO4**: Familiarize with distribution of powers and functions of Local Self Government.

**CO5:** Realize the National Emergency, Financial Emergency and their impact on Economy of the country.

## Course content:

1. Meaning of the constitution law and constitutionalism (2L)
2. Historical perspective of the Constitution of India (2L)
3. Salient features and characteristics of the Constitution of India (1L)
4. Scheme of the fundamental rights (2L)
5. The scheme of the Fundamental Duties and its legal status (2L)
6. The Directive Principles of State Policy – Its importance and implementation (2L)
7. Federal structure and distribution of legislative and financial powers between the Union and the States (3L)
8. Parliamentary Form of Government in India – The constitution powers and status of the President of India (2L)
9. Amendment of the Constitutional Powers and Procedure (2L)
10. The historical perspectives of the constitutional amendments in India (2L)
11. Emergency Provisions: National Emergency, President Rule, Financial Emergency (3L)
12. Local Self Government – Constitutional Scheme in India (3L)
13. Scheme of the Fundamental Right to Equality (2L)
14. Scheme of the Fundamental Right to certain Freedom under Article 19 (2L)
15. Scope of the Right to Life and Personal Liberty under Article 21. (2L)

## Text Books:

1. Introduction to Constitution of India, D.D. Basu, Lexis Nexus
2. The Constitution of India, PM Bhakshi, Universal Law

**COs-POs-PSOs MAPPING:**

| | Program Outcomes | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
| CO1 | - | - | - | - | - | 3 | 2 | 3 | - | - | - | 2 | 3 | 2 | 2 |
| CO2 | - | - | - | - | - | 3 | 2 | 3 | - | - | - | 2 | 3 | 2 | 3 |
| CO3 | - | - | - | - | - | 3 | 2 | 3 | - | 1 | - | 2 | 2 | 3 | 3 |
| CO4 | - | - | - | - | - | 3 | 2 | 3 | - | 1 | - | 2 | 1 | 1 | 1 |
| CO5 | - | - | - | - | - | 3 | 2 | 3 | - | 1 | - | 2 | 1 | 1 | 1 |
| Overall Mapping | | | | | | 3 | 2 | 3 | | 1 | | 2 | 2 | 1.8 | 2 |

| 7th Semester | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Sl No** | **Field** | **Paper Code** | **Theory** | **Contact Hours /Week** | | | | **Credit Points** |
| | | | | **L** | **T** | **P** | **Total** | |
| **A. THEORY** | | | | | | | | |
| 1 | HS | HU704 | Principles of Management | 2 | 0 | 0 | 2 | 2 |
| 2 | PC | FT701 | Waste Management of Food Industries | 2 | 1 | 0 | 3 | 3 |
| 3 | PE | FT 702 | A. Enzyme Technology<br>B. Renewable Energy Technology<br>C. Plant Maintenance, Safety& Hygiene | 3 | 0 | 0 | 3 | 3 |
| 4 | PE | FT703 | A. Food Packaging Technology<br>B. Functional Foods & Nutraceuticals<br>C. Protein Technology | 3 | 0 | 0 | 3 | 3 |
| 5 | OE | FT 704 | A. Process Instrumentation<br>B. Process Control Systems | 3 | 0 | 0 | 3 | 3 |
| **Total of Theory** | | | | | | | **14** | **14** |
| **B. PRACTICAL** | | | | | | | | |
| 6 | PC | FT791 | Food Engineering Lab | 0 | 0 | 3 | 3 | 1.5 |
| 7 | OE | FT792 | A. Instrumentation Laboratory<br>B. Process Control Systems Laboratory | 0 | 0 | 2 | 2 | 1 |
| 8 | PROJ | PR 791 | Project-VII | 0 | 0 | 0 | 5 | 2.5 |
| 9 | PROJ* | PR 792 | Innovative activities-VI | 0 | 0 | 0 | 0 | 0.5 |
| **C. MANDATORY ACTIVITIES / COURSES** | | | | | | | | |
| 10 | MC | MC781 | Innovation-Project Based-Sc. Tech, Social, Design & Innovation | 0 | 0 | 3 | 3 | |
| **Total of Theory, Practical & Mandatory Activities/Courses** | | | | | | | **27** | **19.5** |

*Students may choose either to work on participation in Hackathons etc. Development of new product/ Business Plan/ registration of start-up.

Students may choose to undergo Internship / Innovation / Entrepreneurship related activities. Students may choose either to work on innovation or entrepreneurial activities resulting in start-up or undergo internship with industry/ NGO's/ Government organizations/ Micro/ Small/ Medium enterprises to make themselves ready for the industry/ Long Term goals under rural Internship. (Duration 4-6 weeks)

Innovative activities to be evaluated by the Programme Head / Event Coordinator based on the viva voce and submission of necessary certificates as evidence of activities.

## THEORY

**Course Name: Principles of Management**

**Course Code: HU 704**

**Contact hour: 2L**

**Total contact hour- 24**

**Credits: 2**

**Prerequisites: NIL**

### Course Objective:

1. To understand and apply management principles in to manufacturing organization.

2. To understand concepts of work study, method study, and Quality control method to improve performance of any organization.

### Course outcome:

After completion of the course students will able to:

**CO1:** recall and identify the relevance of management concepts.

**CO2: Apply** management techniques for meeting current and future management challenges faced by the organization

**CO3: Compare** the management theories and models critically to solve real life problems in an organization.

**CO4: Apply** principles of management in order to execute the role as a manager in an organization.

# Course Content:

**Module-1:** Management Concepts: Definition, roles,functions and importance of Management, Evolution of Management thought-contribution made by Taylor,Fayol,Gilbreth,Elton Mayo,McGregor,Maslow **(4L)**

**Module - 2:Planning and Control:** Planning: Nature and importance of planning, -types of planning, Levels of planning - The Planning Process. –MBO,SWOT analysis,McKinsey's7S Approach. Organising for decision making: Nature of organizing, span of control ,Organisational structure –line and staff authority. Basic control process -control as a feedback system – Feed Forward Control – Requirements for effective control – control **(4L)**

**Module - 3: Group dynamics**: Types of groups, characteristics, objectives of Group Dynamics. Leadership: Definition, styles & functions of leadership, qualities for good leadership, Theories of leadership **(4L)**

**Module – 4:Work Study and work measurement:**Definition of work study**,**Method Study Steps, Tools and Techniques used in the Method Study and Work Measurement Time Study: Aim & Objectives,, Use of stopwatch procedure in making Time Study. Performance rating, allowances and its types. Calculation of Standard Time. Work sampling **(4L)**

**Module-5: Marketing Management**:Functions of Marketing, Product Planning and development,Promotional Strategy **(2L)**

**Module - 6: Quality management**: Quality definition, Statistical quality control, acceptance sampling ,Control Charts –Mean chart, range chart,c chart,p chart,np chart, Zero Defects,Quality circles, , Kaizen & Six Sigma ,ISO -9000 Implementation steps,Total quality management **(6L)**

# Text Books:

1. Essentials of Management, by Harold Kooritz & Heinz Weihrich Tata McGraw
2. Production and Operations Management-K.Aswathapa,K .Shridhara Bhat,Himalayan Publishing House

# References:

1. Organizational Behavior, by Stephen Robbins Pearson Education, New Delhi
2. New era Management, Daft, 11th Edition, Cengage Learning
3. Principles of Marketing, Kotlar Philip and Armstrong Gary, Pearsonpublication

**COs-POs-PSOs MAPPING:**

| COs | Program Outcomes (POs) | | | | | | | | | | | | **PSO** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | - | - | - | - | - | - | - | - | 3 | - | 3 | - | 2 | 1 | 2 |
| CO2 | - | - | - | - | - | 2 | - | 3 | 3 | - | 3 | 3 | 2 | 1 | 1 |
| CO3 | - | - | - | - | - | - | - | - | 2 | - | 3 | 3 | 2 | 1 | 1 |
| CO4 | - | - | - | - | - | 2 | - | - | 3 | - | 3 | - | 2 | 1 | 2 |
| Overall Mapping | | | | | | 2 | | 3 | 2.752 | | 3 | 3 | 2 | 1 | 1.5 |

## Course Name: Waste Management of Food Industries

## Course Code: FT 701

## Contact hour: 2:1:0

## Total contact hour: 36

## Credits: 3

**Pre requisites:** Basic Environmental Engineering, Unit Operations, Thermodynamics and Kinetics.

**Course Objective:** To help the student develop a detailed understanding on waste generated from food industry and its reusability.

## Course outcome(s):

After completion of the course students will able to:

**CO1: Classify** different industrial waste, nature of the waste and its characteristics.

**CO2: Evaluate** different treatment methods for liquid/solid waste and the recoveryof useful material from waste as byproducts

**CO3: Interpret** data regarding different waste treatment method.

**CO4: Determine** different methods in industry and domestic purpose.

## Course Contents:

### Module I: 4L

Introduction: Types of Pollution, Waste disposal methods – physical, chemical and biological. Classification and characterization of food industrial wastes from fruit and vegetable processing industry, beverage industry, fish, meat and poultry industry, sugar industry and dairy industry;

### Module II: 10L

Treatment methods for liquid wastes from food process industries; Design of activated sludge process, Rotating biological contactors, Trickling filters, UASB, Numerical Problem.

### Module III: 8L

Biofilters/bioclarifiers, Biogas plant, Ion exchange treatment of waste water, Bioremediation, Adsorption process in waste treatment, Recovery of useful materials from effluents by different methods.

### Module IV: 10L

Treatment methods of solid wastes: Biological composting, drying and incineration; Design of solid waste management system: Landfill digester, Vermicomposting pit, Biomanure, Numerical Problem.

### Revision: 4L

## Text Books:

3. Environmental Biotechnology; Bhattacharyya B C & Banerjee R; Oxford University Press.
4. Water & Wastewater Engineering; Fair GM, Geyer JC & Okun DA; 1986, John Wiley &

Sons, Inc.

## Reference Books:

1. Food Industry Wastes: Disposal and Recovery; Herzka A & Booth RG; 1981, Applied Science Pub Ltd.
2. Wastewater Treatment; Bartlett RE; Applied Science Pub Ltd.
3. Symposium: Processing Agricultural & Municipal Wastes; Inglett GE; 1973, AVI.
4. Food Processing Waste Management; Green JH & Kramer A; 1979, AVI.
5. Environmental Biotechnology: Principles and Applications; Rittmann BE & McCarty PL; 2001, Mc-Grow-Hill International editions.

**COs-POs-PSOs MAPPING:**

| COs | Program Outcomes | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 2 | - | - | - | 2 | 2 | - | - | - | - | 3 | 3 | 3 | 1 |
| CO2 | 3 | 2 | 2 | - | - | 2 | 2 | - | - | - | - | 3 | 3 | 2 | 1 |
| CO3 | 3 | 3 | 3 | 3 | - | 2 | 2 | - | - | - | - | 3 | 3 | 3 | 3 |
| CO4 | 3 | 2 | - | - | - | 3 | 3 | - | - | - | - | 3 | 3 | 3 | 3 |
| Overall Mapping | 3 | 2.25 | 2.5 | 3 | | 2.25 | 2.25 | | | | | 3 | 3 | 2.75 | 2 |

## Course Name: Enzyme Technology

## Course Code: FT 702A

## Contact: 3:0:0

## Total Contact Hours: 36

## Credit: 3

**Pre requisites:** Chemistry of food, food microbiology, food biotechnology

**Course Objective:** To help student to gain knowledge about different enzyme production, purification and isolation process as well as the use of enzymes in food technology.

## Course outcome(s):

After completion of the course students will able to:

**CO1: Explain** the enzyme kinetics and the effects of different parameters onenzymes.

**CO2: Analyze** the production and purification processes of enzyme.

**CO3: Identify** applications of enzyme in biochemical and foodprocessing industries.

**CO4**: **Apply** the concepts of recombinant DNA Technology and immobilizedenzymes in biochemical engineering.

## Course Contents:

### Module I: 8L

Introduction to enzyme technology; Industrial enzymes – present status and opportunities with special reference to food industries; Catalytic properties of enzymes; Intracellular and extra-cellular enzymes.

### Module II: 10L

Enzyme production technology: Introduction of enzyme reactors and process design. Application of recombinant DNA technique in enzyme technology.

### Module III: 7L

Cell disintegration by physical, chemical and biological methods; Enzyme purification methods: Salting out, organic solvent precipitation, dialysis, reverse osmosis etc.

### Module IV: 7L

Application of enzymes for production in biochemical and food processing industries; Application of immobilized enzymes and cells. Production of Commercial Enzymes.

### Revision: 4L

## Text Books:

1. Biochemical Engg. Fundamentals-Baily, Ollis. MGH
2. Bioprocess Engineering by Michael L. Shuler and Fikret Kargi

## Reference Books:

1. Prescott & Dunn's Industrial Microbiology Macmiller
2. Principles of Fermentation Technology-Wittaker and Stanby
3. Methods in Enzymology, Edited by Dan S. Tawfik, ScienceDirect

**COs-POs-PSOs MAPPING:**

| COs | Program Outcomes | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 2 | 2 | 2 | - | - | - | - | - | - | - | 3 | 3 | 3 | 2 |
| CO2 | 3 | 3 | 3 | 2 | 2 | 1 | 2 | - | - | - | - | 3 | 3 | 3 | 2 |
| CO 3 | 3 | 3 | 3 | - | - | 2 | 2 | - | - | - | 2 | 3 | 3 | 3 | 3 |
| CO 4 | 3 | 3 | 3 | 1 | 3 | 1 | 1 | - | - | - | 3 | 3 | 3 | 2 | 3 |
| Overall Mapping | 3 | 2.75 | 2.75 | 1.66 | 2.5 | 1.33 | 1.66 | | | | 2.5 | 3 | 3 | 2.75 | 2.5 |

## Course Name: Renewable Energy Technology

## Course Code: FT 702B
## Contact: 3:0:0
## Total Contact Hours: 36
## Credit: 3

**Pre requisites:** Basic Environmental Engineering, Food Process Engineering, Unit Operation.

**Course Objective:** To help the students develop an overview on the application of non conventional energy and realize its role in sustainable development.

## Course outcome(s):

After completion of the course students will able to:

**CO1: Describe** the different biological fuels and biomass as a source of renewableenergy
**CO2: Explain** the phenomenon of thermal combustion of biomass and biogasgeneration.
**CO3: Describe** the process of hydrogen production by photosynthetic bacteria.
**CO4: Classify** the different technologies behind the conversion of biomass to cleanfuels and petrochemical substitutes.

## Course Contents:

### Module I: 8L

Biological fuel generation; Biomass as a renewable energy source; Types of biomass: forest, agricultural and animal residues; Industrial and domestic organic wastes; Conversion of biomass to clean fuels and petrochemical substitutes by physicochemical and/or fermentation processes.

### Module II: 8L

Biogas from anaerobic digestion; Thermal energy from biomass combustion; Ethanol from biomass.

### Module III: 8L

Hydrogen production by photosynthetic bacteria, biophotolysis of water and by fermentation; Microbial recovery of petroleum by biopolymers (Xanthum gum), biosurfactants.

### Module IV: 8L

Solar energy; Solar collectors, solar pond, photovoltaic cells, chemical storage; Geothermal energy and wind energy; Use of geothermal energy; Operating principles of different types of wind energy mills; Nuclear energy; Nuclear reactions and power generation; Tidal wave energy.

### Revision: 4L

## Text Books:

1. J. E. Smith – Biotechnology, 3rd edn. Cambridge Univ Press.
2. S. Sarkar – fuels and combustion, 2nd edn., University Press.

### *Reference books:*

1. Biochemical Engg. Fundamentals-Baily, Ollis. MGH
2. Bioprocess Engineering by Michael L. Shuler and Fikret Kargi

**COs-POs-PSOs MAPPING:**

| COs | Program Outcomes | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 2 | 2 | 2 | - | - | 3 | - | - | - | - | 3 | 3 | 3 | 2 |
| CO2 | 3 | 2 | 2 | 1 | - | 1 | 2 | 1 | - | - | - | 3 | 3 | 3 | 2 |
| CO3 | 3 | 3 | 2 | 2 | - | - | 2 | - | - | - | - | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 2 | 1 | - | 3 | 3 | 2 | - | - | - | 3 | 3 | 2 | 3 |
| Overall Mapping | 3 | 2.5 | 2 | 1.5 | | 2 | 2.5 | 1.5 | | | | 3 | 3 | 2.75 | 2.5 |

## Course Name: Plant Maintenance, Safety& Hygiene

## Course Code: FT 702C

## Contact: 3:0:0

## Total Contact Hours: 36

## Credit: 3

**Pre requisites:** Principles of Food Preservation, Food Process Engineering

**Course Objective:** To help the students understand the importance of maintaining safety and hygiene in different food industry.

## Course outcome(s):

After completion of the course students will able to:

**CO1: Apply** safety levels in different food industries.
**CO2: Identify** different industrial parameters that affect the environment in food processingunits.
**CO3: Design** the HACCP protocols in food industries.
**CO4: Create** an overall safe environment for food processing industries and safetyfrom adulterated food.

## Course Contents:

### Module I: 8L

Plant maintenance program; Role of maintenance staff and plant operators; Preventive maintenance; Guidelines for good maintenance & safety precautions; Lubrication & lubricants; Work place improvement through '5S'.

### Module II: 8L

The objective of safety, health & environment; Cost of safety; Accident investigation report; Safety promotional activity; Environmental pollution and its control.

### Module III: 8L

Indian Factories Act on safety; HACCP; Desirable safety features of some food processing equipment; Personal protective equipment; Safety from adulteration of food.

### Module IV: 8L

Hygiene and sanitation requirement in food processing and fermentation industries; Cleaning, sanitizing & pest control in food processing; storage and service areas.

### Revision: 4L

## Text Books:

1. Basic Concepts of Industrial Hygiene, Ronald M Scott, CRC Press.
2. Safety design criteria for industrial plants. Maurizio Cumo & Antonio Naviglia.CRC Press.

## *Reference books:*

1. Industrial Hygiene & Toxicology by Josef Brozek-1948.
2. Food Hygiene, Microbiology & HACCP. S J Forsythe, P R Hayes. Springer.

**COs-POs-PSOs MAPPING:**

| COs | Program Outcomes | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 2 | - | - | - | 1 | 1 | 1 | - | - | 2 | 3 | 3 | 2 | 2 |
| CO2 | 3 | 2 | - | - | - | 2 | 3 | - | - | - | 2 | 3 | 3 | 2 | 2 |
| CO3 | 2 | - | - | - | - | 3 | 3 | 1 | - | 2 | 2 | 3 | 3 | 2 | 3 |
| CO4 | 3 | 2 | 2 | 1 | - | 2 | 3 | 3 | 2 | - | 2 | 3 | 2 | 2 | 3 |
| Overall Mapping | 2.75 | 2 | 2 | 1 | | 2 | 2.5 | 1.33 | 1 | 2 | 1 | 3 | 2.75 | 2 | 2.5 |

## Course Name: Food Packaging Technology

## Course Code: FT 703A

## Contact: 3:0:0

## Total Contact Hours: 36

## Credit: 3

**Pre requisites:** Chemistry of Food, Food Process Engineering, Principles of Food Preservation

**Course Objective:** To help the students identify the importance of packaging in food industry and understand the recent developments in food packaging.

## Course outcome(s):

After completion of the course students will able to:

**CO1: Explain** food packaging and its function.

**CO2: Differentiate** between different packaging materials like metals, glass, plasticsand papers and their methods of production.

**CO3: Recognize** the potential of bio composite and biodegradable materials for food packaging.

**CO4: Apply** the role of different regulatory bodies in food packaging and disposalprotocols for food packaging.

## Course Contents:

### Module I: 8L

Functions of packaging; Type of packaging materials; Selection of packaging material for different foods; Selective properties of packaging film; Methods of packaging and packaging equipment

### Module II: 8L

Mechanical strength of different packaging materials; Printing of packages; Barcodes & other marking; Interactions between packaging material and foods; Environmental and cost consideration in selecting packaging materials.

### Module III: 8L

Manufacture of packaging materials; Potential of biocomposite materials for food packaging;

Packaging regulations; Packaging and food preservation; Disposal of packaging materials.

## Module IV: 8L

Testing of packaging; Rigid and semi rigid containers; Flexible containers; Sealing equipment; Labelling; Aseptic and shrink packaging; Secondary and transport packaging.

## Revision: 4L

## Text Books:

1. Food Packaging: Principles and Practice by G. L. Robertson. Taylor & Francis Inc.
2. Food Packaging Technology by Richard Coles, Derek MC Dowell and Mark J. Kirwan. Blackwell Publishing, CRC press.
3. Food and Packaging Interactions by Joseph H. Hotchkiss, (ACS symposium series -365, April 5-10, 1987, American chemical society, Washington DC, 1988.)

## Reference Books:

1. Food and Packaging Interactions by Joseph H. Hotchkiss, (ACS symposium series -365, April 5-10, 1987, American chemical society, Washington DC, 1988.)
2. Packaging foods with plastics by winter A. Jenkins & James P Harrington – Technomic publishing co. Inc, Lancaster. Basel.
3. Flexible food packaging (Question & Answers) by Arthur Hirsch VNB – Van Nostrand Reinhold, New York (An AVI Book), ISBN 0-442-00609-8.
4. Food Packaging and Preservation (theory & practice) by M.Mathlouthi-Elsevier Applied science publisher, London and New York.
5. Food Packaging Materials (Aspect of Analysis & Migration of contaminants) by N.T.crosby applied science publishers LTD. London.
6. Plastics in Packaging by A.S Athlye, TMGH, New Delhi.
7. Packaging (specifications, purchasing & Quality Control) 3rd edition by Edmond A Leonard- Marcel Dekker, INC- Newyork & Basel.
8. Plastics in packaging by forwarded by H.B Ajmera & M.R Subramanium – Indian institute of packaging. Published by A.P.Vaidya, Secretary II, E2, MIDC, Industrial Area (Andheri (East), Bombay-400093.
9. Food Packaging- Stanley Sacharois & Roger C. Griffin- The AVI Publishing company Inc. 1970.
10. Principles of packaging development- Griffin & Sacharow. (The AVI Publishing company, Inc. 1972).

**COs-POs-PSOs MAPPING:**

| COs | Program Outcomes | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 1 | - | - | - | 1 | 1 | - | - | - | - | 3 | 3 | 3 | 2 |
| CO2 | 3 | 2 | 2 | - | - | 1 | 1 | - | - | - | - | 3 | 3 | 3 | 2 |
| CO 3 | 3 | 2 | 2 | - | 1 | 1 | 1 | - | - | - | - | 3 | 3 | 3 | 3 |
| CO 4 | 3 | 1 | 1 | - | - | 2 | 3 | - | - | - | - | 3 | 3 | 2 | 3 |
| Overall Mapping | 3 | 1.5 | 1.25 | | 1 | 1.25 | 1.5 | | | | | 3 | 3 | 2.75 | 2.5 |

## Course Name: Functional Foods & Nutraceuticals

### Course Code: FT 703B

### Contact: 3:0:0

### Total Contact Hours: 36

### Credit: 3

**Pre requisites:** Basic biology, food chemistry, biochemistry, nutrition, food processing, quality control and food regulations

### Course Objective:

1. To develop the understanding of the concept of Nutraceuticals & Functional Foods
2. To enable the students to learn about the health beneficial properties of Nutraceuticals & Functional Foods
3. To enable the students to learn about the manufacturing processes, regulatory challenges and market trends of Nutraceuticals & Functional Foods.

### Course outcome(s):

After completion of the course students will able to:

**CO1: Describe** fundamental concept of Nutraceuticals & Functional Foodson their origin, presence and functionality.
**CO2: Explain** disease preventing and health enhancing properties ofNutraceuticals & Functional Foods.
**CO3: Apply** the basic knowledge to comprehend the manufacturing of various fortified, value-added functional foods and nutraceuticals in different forms for consumption
**CO4: Analyze** the toxicological aspect, related risks in formulating dosage and defining consumption patterns of Nutraceuticals & Functional Foods.

### Course Contents

### Module I: 8L

Definitions of Functional Foods and Nutraceuticals, Types of functional foods and Nutraceutcals, Components like nutrients such as lipids, fibers, amino acids, spices, herbs, polyphenols and bioactive properties, Vitamins and Health, Minerals and Health, Concepts and of Probiotic, prebiotics, synbotics, Supplements like antioxidants and their biochemical functions

### Module II: 8L

Nutritional significance: Role of nutraceutical / functional foods in cardiovascular health, diabetes, obesity, immunity, neurodegenerative and age related muscular degeneration, stress management; Nutrition and nutraceuticals for targeted population such as children, woman,

adults and elderly.

## Module III: 8L

Enrichment, value addition, fortification, supplementation, Sources, Significance, Fortification and Enrichment in different foods (MSG; Bakery and confectionary products e.g. bread, biscuit and cookies; Breakfast and ready to eat cereals; Infant formulas; Protein mixes; Vegetable Mixes; Dairy product e.g. ice cream; Beverages including diet beverages, Sports drink, Value addition in processed food products

## Module IV: 8L

Functional ingredients: Extraction / purification of lycopene, essential oils, isoflavonoids, prebiotics and probiotics glucosamine, phytosterols, and their stability in processing conditions, Manufacturing of dietary supplements in the form of liquid, rehydration powder, tablet, pill, capsule or mix. Principles of toxicology and risk assessment of Nutraceuticals, Dosage levels; adverse effects and toxicity of nutraceuticals

## Revision: 4L

## Text Books:

1. Handbook of Nutraceuticals and Functional Foods, Robert E.C. Wildman, CRC Pres

2. Nutraceutical and Functional Food Components, Charis Galanakis, Academic Press

## Reference Books:

1. Functional Foods and Nutraceuticals (Food Science Text Series), Rotimi E. Aluko, Springer; 2012 edition

**COs-POs-PSOs MAPPING:**

| COs | Program Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO1** | 2 | 1 | - | - | 1 | 1 | 2 | - | - | - | - | 3 |
| **CO2** | 3 | 2 | 2 | 1 | - | 1 | 1 | - | - | - | - | 3 |
| **CO3** | 3 | 2 | 2 | - | 1 | 1 | 1 | - | 1 | - | 1 | 3 |
| **CO4** | 3 | 1 | 1 | - | 1 | 2 | 3 | 1 | - | - | - | 3 |
| **Overall Mapping** | 2 | 1.5 | 1.66 | 1 | 1 | 1.25 | 1.75 | 1 | 1 | - | 1 | 3 |

**Course Name: Protein Technology**

**Course Code: FT 703C**

**Contact: 3:0:0**

**Total Contact Hours: 36**

**Credit: 3**

**Pre requisites:** Engineering Chemistry, Chemistry of Food

**Course Objective:** To help the students develop an advanced idea about protein utilization in food and its importance in our daily diet.

**Course outcome(s):**

After completion of the course students will able to:

**CO1**: **Define** protein structure and properties and to analyze different sources ofprotein.

**CO2**: **Describe** protein concentrate and isolate and their functions.

**CO3**: **Outline** manufacturing of protein hydrolysates and to develop textured protein.

**CO4**: **Apply** different technique to detect and estimate protein.

## Course Contents:

### Module I: 8L

Determination of protein structure; Nutritional and commercial importance of proteins; Physical, chemical and functional properties of proteins; Folding of proteins; Commercial sources of proteins; Creation of new proteins by bio-composite synthesis technique.

### Module II: 8L

Process of making protein isolates and concentrates; Factors affecting quality of isolates and concentrates; Treatment to isolate and concentrate; Packaging of protein isolates and concentrates; Food and non food uses of isolates and concentrates.

### Module III: 8L

Methods of manufacturing protein hydrolysates; Factors affecting quality of hydrolysates; Food uses of hydrolysates; Fibre spinning process of proteins; Textured protein gels and expanded products; Simulated milk products; Restructured protein; Nonconventional sources of protein.

### Module IV: 8L

Centrifugation; Cell disruption; Protein precipitation and its recovery; Aqueous two-phase separation; Ion exchange chromatography; Gel filtration; Affinity chromatography; Electrophoresis; Cross filtration; Ultra filtration.

**Revision: 4L**

## Text Books:

1. Altschul, A.M and Wilcke, , H.L Ed 1978. new protein Foods. Vol III. Academic Press, New York
2. Bodwell, C.E.Ed. 1977. evaluation of proteins for Humans. AVI, Westport
3. Milner,M., Scrimshaw, N.S and Wang, D.I.C.Ed. 1978. Protein Resources and Technology. AVI, Westport
4. Salunkhe, O.K and Kadam, S.S Eds. 1999. Handbook of world legumes; Nutritional Chemistry, Processing Technology and Utilization. Volume I to III, CRC Press, Florida
5. Salunkhe, D.K. Chavan, J.K.,Adsule, R.N Kadam, S.S 1992. World Oilseeds: Chemistry, Technology and Utilization, Van Nostrand Reinhold, New York

## Reference Books:

1. Bioseparation Engineering: Principles, Practise and Economics, M.Ladish; Wiley Inter science
2. Proteolytic enzymes: a practical approach, Beynon, R.J and Bond, J.S; IRL Press, Oxford
3. Protein Biotechnology, Franks, F.; Humana Press

**COs-POs-PSOs MAPPING:**

| COs | Program Outcomes | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | 2 | 1 | 3 |
| CO2 | 3 | 2 | - | - | - | 2 | - | - | - | - | - | 3 | 2 | 2 | 1 |
| CO 3 | 3 | 2 | - | - | - | 2 | - | - | - | - | - | 3 | 2 | 2 | 2 |
| CO 4 | 3 | 3 | 2 | 2 | 1 | - | - | - | - | - | - | 3 | 2 | 1 | 2 |
| Overall Mapping | 3 | 1.75 | 2 | 2 | 1 | 2 | | | | | | 3 | 2 | 1.5 | 2 |

## Course Name: PROCESS INSTRUMENTATION

## Course Code: FT 704A

## Contact: 3:0:0

## Total Contact Hours: 36

## Credit: 3

**Pre requisites:** Unit Operation of Chemical Engineering

**Course Objective**: This course helps the student

1. To understand the importance of different industrial instruments.
2. To understand the working principle of different measuring instruments.
3. To measure different physical parameters like pressure, temperature, flow rate, level etc
4. To install the different instruments.

## Course outcome(s):

After completion of the course students will able to:

**CO1**: **Explain** working principle of different measuring instruments.
**CO2**: Able to find the specification of different instruments.

**CO3**: Able to Measure different physical parameters like pressure, temperature, flow rate, level etc

**CO4**: Able to apply the knowledge of measurement in different practical field.

## Course Contents:

## Module I: 5L

**Introduction to Process Instrumentation:**
Operational aspect of instrument system, Principle of measurement, Static and dynamic characteristics of instrument, Error analysis and its calibration. Principle of operation of transducer and sensor, Types & classification, applications of transducer elements.

## Module II: 10L

**Temperature& Pressure Measurement**
Temperature measurement: Resistance thermometers, thermistors and thermocouples.Radiation and optical pyrometers. Pressure Measurement**:** Pressure gauge, Elastic deformation elements, Basic concept of pneumatic pressure transmitter,. Low pressure measurement by McLeod Gage and Pirani Gauge
Electrical strain gauges: Types ,Gauge Factor, strain gauge type load cell.

## Module III: 8L

**Flow & Level Measurement:**

Flow measurement – orifice meter, venturimeter, rotameter turbine meter, ultrasonic flow meter, magnetic flow meters;

Level measurements- float actuated devices, electrical method, sonic methods.

## Module IV: 8L

**Moisture & Viscosity Measurement:**

Moisture: Definition, Electrical methods of measurement, hygrometer, Moisture measurement cells for granular material, infrared transmission measurement of moisture, Viscosity Measurement.

## Text Books:


1. D. Patranabis, 'Principles of industrial Instrumentation', TMH, New Delhi, 2nd Ed
2. Arun Kumar Ghosh: 'Introduction to Measurement & Instrumentation', PHI, New Delhi, 4th edition.
3. K.Krishnaswamy, S.Vijayachitra: 'Industrial Instrumentation',New age International Publishers, 2nd edition.
4. B. G. Liptak: 'Instrument Engineers Handbook', vol-I and vol-II, Chilton Book Co. Philadelphia
5. Ernest O. Doeblin, 'Measurement Systems – Application and Design', Tata-McGraw Hill
6. 7.S.K.Sen, 'Measurement Techniques in Industrial Instrumentation',New Age International.


**COs-POs-PSOs MAPPING:**

| COs | Program Outcomes | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 2 | 1 | 1 | - | - | 2 | - | - | - | - | 1 | 2 | 1 | 2 |
| CO2 | 2 | 2 | 3 | - | - | - | - | 1 | - | - | - | - | 1 | 2 | 1 |
| CO 3 | 2 | 2 | 2 | - | 3 | - | - | - | - | - | - | - | 2 | 2 | 2 |
| CO 4 | 1 | 2 | 2 | 1 | 1 | - | - | - | - | - | 2 | 3 | 1 | 3 | 3 |
| Overall Mapping | 2 | 2 | 2 | 1 | 2 | | 2 | 1 | | | 1 | 2 | 1.5 | 2 | 2 |

## Course Name: PROCESS CONTROL SYSTEMS
## Course Code: FT 704B

## Contact: 3:0:0

## Total Contact Hours: 36

## Credit: 3

**Pre requisites:** Unit Operation of Chemical Engineering

**Course Objective**: This course helps the student

1. To have a knowledge on basic process control loop & characteristics
2. To understand the different controller modes
3. To have a knowledge of final control element & different actuators
4. To apply the knowledge of Cascade, Ratio, Feed forward control to control a complex process

## Course outcome(s):

After completion of the course students will able to:

**CO1**: **Demonstrate** the fundamentals of control systems
**CO2**: Calculate controller parameters of different controller
**CO3**: Describe different advanced control strategy.
**CO4**: State the operation and use of final control element

## Course Contents:

## Module I: 8L

**Introduction to Control System**

Control system, Open and closed loop system, transfer function of open loop and closed loop control systems; Block diagrams, Simplification of a control system using block diagram reduction.

## Module II: 15L

**Control actions & process controllers**

Process control system – Basic block diagram, elements, Process characteristics, Role of controllers in process industry controllers

Control actions: discontinuous & continuous modes; on off controllers: neutral zone, time proportional controller, proportional controllers, integral & derivative controllers; composite controllers; PI, PD, PID controllers

## Module III: 13L

**Final Control Element & Advanced control strategies**

Final control element, control valve, actuators
Feed forward control, ratio control, cascade control, applications
Revision

## Text Books:

1) Control Systems: Engineering, 5th Edition [I. J. Nagrath, M. Gopal]
2) D. Patranabis, Principles of Process Control, TMH , New Delhi, 2nd Ed.
3) D. P. Eckman, Automatic Process control, John Wiley, New York
4) Surekha Bhanot, Process Control Principal & Application , Oxford
5) G. Stephanopoulos, Chemical process Control, PHI
6) C. D. Johnson, Process Control Instrumentation Technology, PHI

**COs-POs-PSOs MAPPING:**

| COs | Program Outcomes | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 1 | 2 | - | 3 | - | - | - | - | - | - | - | - | 2 | 1 | 2 |
| CO2 | 3 | 2 | 2 | 1 | 2 | - | - | - | - | - | - | - | 1 | 2 | 1 |
| CO 3 | 2 | 1 | 1 | - | 1 | - | 1 | 1 | - | - | 2 | - | 2 | 2 | 2 |
| CO 4 | 1 | 1 | - | - | - | - | - | - | - | - | 1 | - | 1 | 3 | 3 |
| Overall Mapping | 1.75 | 1.5 | 1.5 | 2 | 1.5 | | 1 | 1 | | | 1.5 | | 1.5 | 2 | 2 |

# PRACTICAL

## Course Name: FOOD ENGINEERINGLAB

## Course Code: FT791

## Contact: 0:0:3

## Credit: 1.5

**Pre requisites:** Food Process Engineering, Unit Operations, Principles of Food Preservation

**Course Objective:** To help the students develop a practical idea about different operations related to food engineering.

## Course outcome(s):

After completion of the course students will able to:

**CO1: Define** the practical implication of the theoretical ideas regarding basic food engineering phenomenon.

**CO2: Interpret** practical application of the extraction phenomenon related to food processing and to explain the different separation techniques that are used in food industries.

**CO3: Analyze** and operate the driving principles of different types of driers

**CO4: Explain** the practical use of rheological study in a food based industry

## *List of Experiment:*

1. Extraction of oil from different seeds by using Soxhlet apparatus.
2. Study of Drying efficiency :
   i) spray dryer
   ii) tray dryer
   iii) drum dryer
   iv) fluid bed dryer
   v) freeze dryer
3. Characterization of fruit juice concentrates based on refractive index.
4. Optimization of Concentrating Process Using Rotary Vacuum Evaporation for fruit juice.
5. Rheological Study for food materials with different consistency.
6. Separation using a Centrifuge
7. Comparison of Separation efficiency using normal centrifuge and cold centrifuge.
8. Separation by Filtration
9. Comparison of Filtration efficiency using paper filtration and vacuum filtration.
10. Innovative Experiment

### *Text Books:*

1. *Bioprocess Engineering by Michael L. Shuler and Fikret Kargi*

### *Reference Book:*

1. Separation Processes: King, C. J. MGH

**COs-POs-PSOs MAPPING:**

| **COs** | **Program Outcomes** | | | | | | | | | | | | **PSO** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
| **CO1** | 3 | 2 | 2 | - | - | - | - | 1 | 2 | 2 | - | 3 | 2 | 2 | 3 |
| **CO2** | 3 | 2 | 2 | 2 | - | - | - | 1 | 2 | 2 | - | 3 | 2 | 3 | 1 |
| **CO3** | 3 | 2 | 2 | 2 | - | - | - | 1 | 2 | - | - | 3 | 3 | 2 | 1 |
| **CO4** | 3 | 2 | 2 | 2 | - | - | - | 1 | 2 | 2 | 3 | 3 | 1 | 1 | 3 |
| **Overall Mapping** | 3 | 2 | 2 | 2 | | | | 1 | 2 | 2 | 3 | 3 | 2 | 2 | 2 |

## Course Name: INSTRUMENTATION LAB

## Course Code: FT792A

## Contact: 0:0:2

## Credit: 1

**Pre requisites:** Unit Operation of Chemical Engineering

## Course outcome(s):

After completion of the course students will able to:

**CO1: Describe** the working principle of different instruments

**CO2: Examine** the calibration of different instruments

**CO3: Analyze** different physical parameters like pressure, temperature, flow rate,level etc

**CO4: Choose** the suitable instrument for measuring different process parameter.

## *List of Experiment:*

1. Calibration of Pressure Gauge using Dead Weight Tester
2. Study of Thermocouple characteristics and Measurement of Temperature.
3. Study of Thermistor characteristics and Measurement of Temperature.
4. Study of RTD characteristics and Measurement of Temperature.
5. Measurements of flow rate and velocity of fluid flow by head type flow meter.
6. Measurements of flow rate and velocity of fluid flow by Variable Area type flow meter
7. Measurement of level using capacitive type level instrument.
8. Measurement of moisture using moisture analyzer
9. Measurement of viscosity

Extramural Experiment

**COs-POs-PSOs MAPPING:**

| COs | Program Outcomes | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
| **CO1** | 1 | 2 | 1 | - | - | - | - | - | - | - | - | - | 2 | 2 | 3 |
| **CO2** | 2 | 3 | 3 | 1 | 2 | - | - | 1 | 1 | - | - | - | 2 | 3 | 1 |
| **CO3** | 1 | 2 | 1 | - | - | - | - | - | - | - | - | - | 3 | 2 | 1 |
| **CO4** | 2 | 2 | 2 | 1 | 3 | - | - | - | - | - | - | - | 1 | 1 | 3 |
| **Overall Mapping** | 1.5 | 2.25 | 1.75 | 1 | 2.5 | | | 1 | 1 | | | | 2 | 2 | 2 |

**Course Name: PROCESS CONTROL SYSTEM LAB**
**Course Code: FT792B**

**Contact: 0:0:2**

**Credit: 1**

**Pre requisites:** Unit Operation of Chemical Engineering

**Course outcome(s):**

After completion of the laboratory course students will be able to:

**CO1: Explain** basic process control loop elements via hands on experiment

**CO2: Recognize** different process control element via hands on experiment

**CO3:** Control different process variable (flow, pressure, level & temperature) using differentcontroller mode

**CO4:** Determine controller parameters for good control through experiment

## *List of Experiment:*

1. Study of Flow, Level, Pressure, Temperature processes and construction of the P&I diagrams in accordance with ISA guidelines / standards
2. Study of a Temperature Control Loop having Furnace, suitable final control element, Temperature transmitter, conventional PID controller/Control System, and data logger/recorder
3. Study of a Pressure Control Loop having Pressure source, Pressure Transmitter, Motorized/Pneumatic control valve, and conventional PID controller/Control System
4. Study of a Flow Control Loop having suitable Flow meter, Motorized/ Pneumatic control valve, and conventional PID controller/Control System
5. Study of a Level Control Loop having Level Transmitter, Motorized/ Pneumatic control valve,and conventional PID controller/Control System
6. Study of a typical Air Duct Flow Monitoring and Control
7. Extra Mural Experiment

**COs-POs-PSOs MAPPING:**

| COs | Program Outcomes | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 2 | 2 | 1 | - | - | - | - | - | - | - | - | - | 2 | 2 | 1 |
| CO2 | 2 | 2 | 1 | - | - | - | - | - | - | - | - | - | 3 | 1 | 3 |
| CO3 | 2 | 2 | 1 | 1 | 2 | - | - | - | 2 | - | - | - | 2 | 2 | 1 |
| CO4 | 2 | 2 | 2 | 3 | 2 | - | - | - | - | - | 1 | - | 1 | 3 | 3 |
| Overall mapping | 2 | 2 | 1.25 | 2 | 2 | | | | 2 | | 1 | | 2 | 2 | 2 |

**Paper Name: Project-VII**
**Paper Code: PR 791**
**Contact hours: 0:0:5**
**Credit: 2.5**

**Prerequisites:** Food Microbiology, Food Processing, Unit Operation, Management Principles, Food Chemistry

**Course Objective:**

- To apply theoretical and laboratory understanding and techniques in realistic implementation
- To help the students to identify the significant issues that need to be resolved for benefit of society
- To learn different verticals of a research and development project

**Course Outcome:**

After completion of Project students will be able to:

**CO1: Identify** the need of socio-economic demand in food of allied sector

**CO2: Apply** the knowledge of theory for innovative product/process design

**CO3: Interpret** the process involved in project for future industrial food and allied sector

**CO4: Summarize** a appropriate report

**CO-PO-PSO Mapping**

| COs | Program outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
| **CO1** | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 2 | 2 | 1 | 3 | 3 | 1 | - | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | - |
| **CO3** | 3 | 3 | 2 | 2 | 3 | 2 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 2 |
| **CO4** | 3 | 3 | 1 | 1 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 |
| **Overall Mapping** | 3 | 3 | 2 | 2 | 3 | 2.75 | 2 | 2.5 | 2.75 | 2.25 | 3 | 3 | 2.25 | 2.67 | 2.33 |

# MANDATORY ACTIVITIES

## Course Name: INNOVATION-PROJECT BASED-SC. TECH, SOCIAL, DESIGN & INNOVATION

**Course Code: MC 781**
**Contact:** 0:0:3
**Total Contact Hours:** 36

### *Course Objective:*

The purpose of this course is to subject the students towards the exposure of several societal problems to make them aware of their duties to the society based on their subject based knowledge. The students will be motivated and encouraged to find amenable solutions to those through design and conduction of innovative projects at the institute level involving combined application of science, technology, social understanding and subject based innovation.

### *Course outcome:*

**CO1:** Ability to understand the role of food technologists in societal welfare.

**CO2:** Ability to take up projects which are aimed at providing solutions to societal problems concerning food sector.

**CO3**: Ability to take up projects for improving efficiency in rural work, green technologies, utilization of rural and urban waste

**CO4**: Ability to think about the causes of different societal problems and find out implementable solutions at the institute level

## Course Content:

**Module I: Societal problems in the eyes of a food technologist**

1. Economic structure of the Indian society
2. Distribution of food through the societal layers of India
3. Identification of the major hurdles of non-uniformity of access to food
4. Adulteration of food in India

**Module II: Rural and urban India**

1. Status of society structure in rural India
2. Rural-urban connections and communications
3. Identification of the rural resources
4. Scopes and measures for improvement of rural economy

**Module III: Clean and green rural India**

1. Patterns of domestic and field waste generation in rural areas
2. Identification of reusable wastes and disposable wastes
3. Routes of utilizing reusable wastes
4. Decentralized systems for handling rural-urban wastes

**Module IV: Technologies ready to be implemented in the Institute through innovative projects**

1. Development of technical aids for detecting and diminishing adulteration in foods
2. Identification and use of non-conventional energy sources from the surroundings
3. Collection of institute-wastes to find reusable fractions and conversion to eco-friendly products
4. Development of novel products (food based, any) for implementing societal benefits
5. Value chain management to link backward phase to forward phase

## Text Books:

1. Food Policy and the Indian State: The Public Distribution System in South India, Jos E. Mooij,

Oxford University Press, 1999.

2. Integrated Waste Management in India Status and Future Prospects for Environmental Sustainability, Prashanthi, Marimuthu, Sundaram, Rajakumar (Eds.)

## Reference Books:

1. Non-Conventional Energy Sources and Utilisation (Energy Engineering) Paperback – 3 November 2014 by Rajput R.K. (Author)

**COs-POs-PSOs MAPPING:**

| COs | Program Outcomes | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | | | |
| CO1 | - | - | - | - | - | 3 | 2 | 2 | 2 | - | - | 2 | 1 | 2 | 2 |
| CO2 | - | - | - | - | - | 3 | 3 | 2 | 2 | - | 2 | 1 | 2 | 1 | 2 |
| CO3 | - | - | - | - | - | 3 | 3 | 2 | 2 | - | | 1 | 1 | 2 | 2 |
| CO4 | - | - | - | - | - | 2 | 3 | 2 | 3 | - | 1 | 1 | 1 | 2 | 3 |
| Overall Mapping | | | | | | 2.75 | 2.75 | 2 | 2.25 | | 1.5 | 1.25 | 1.25 | 1.75 | 2.25 |

| 8th Semester | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Sl No** | **Field** | **Paper Code** | **Theory** | **Contact Hours /Week** | | | | **Credit Points** |
| | | | | **L** | **T** | **P** | **Total** | |
| **A. THEORY** | | | | | | | | |
| 1 | OE | FT 801 | B. Entrepreneurship Development & start-up management<br>B. Project Engineering & Plant Layout | 3 | 0 | 0 | 3 | 3 |
| 2 | PE | FT802 | A. Principles of Biochemical Engineering<br>B. Modeling & Simulation of Food Processing | 3 | 0 | 0 | 3 | 3 |
| **Total of Theory** | | | | | | | **6** | **6** |
| **B. PRACTICAL** | | | | | | | | |
| 3 | PC | FT891 | Product Development & Quality Assurance Lab | 0 | 0 | 3 | 3 | 1.5 |
| 4 | PROJ | PR 891 | Project-VIII | 0 | 0 | 8 | 8 | 4 |
| **C. MANDATORY ACTIVITIES / COURSES** | | | | | | | | |
| 5 | MC | MC801 | Essence of Indian Knowledge Tradition | 3 | 0 | 0 | 3 | |
| **Total of Theory, Practical & Mandatory Activities/Courses** | | | | | | | **20** | **11.5** |

***Mandatory Credit Point=160***

**For Honors additional 20 Credit Point is to be earned (1st Sem to 8th Sem) through MOOCs courses. All the Certificates received by the students across all semester for MOOCs Courses from approved organization (Appendix A) is to be submitted to CoE office prior to 8th Semester Examination.**

# THEORY

## Course Name: Entrepreneurship Development & start-up management

## Course Code: FT801A

**Contact: L-T-P= 3-0-0**
**Total Contact Hours: 36**
**Credit: 3**

**Prerequisites:** Food Process Engineering, Unit Operations in Food Technology, Food Processing Technology.

## Course Objective:

1. Acquire knowledge in Entrepreneurship Development
2. Able to study and prepare the business plan for any organization
3. Classify and study the organizational structure between small, medium, and large scale manufacturing industries

## Course outcome(s):

After completion of the course students will able to:

**CO1: Identify** opportunities to set-up Food processing industries

**CO2: Point out** the market competitors and conduct and prepare survey reports accordingly.

**CO3: Design** the finance, human resource, and operation strategy for effective market growth

**CO4: Develop** the effective business ecosystem

## Course Contents:

### Module I 10L

Entrepreneurship concept- Entrepreneurship as a Career- Entrepreneur Personality Characteristics- Knowledge- Skills- Attitude Requirement; Business Environment- Role of Family and Society- Entrepreneurship Development Training and Other Support Organizational Services- Central and State Government Industrial Policies and Regulations, MoFPI scheme and support to budding food entrepreneurs, Skill Development by Central Government, International Business.

### Module II 9L

Sources of Product for Business- Prefeasibility Study- Criteria for Selection of Product- Ownership- Capital- Budgeting Project Profile Preparation- Matching Entrepreneur with the Project- Feasibility Report

Preparation and Evaluation Criteria; legal aspect; Selection of land and factory sheds

## Module III 5L

Finance and Human Resource Mobilization- Operations Planning- Market and Channel Selection- Growth Strategies- Product Launching

## Module IV 8L

Monitoring and Evaluation of Business- Preventing Sickness and Rehabilitation of Business Units- Effective Management of small Business, Overview of Startup food business and challenges.

## Revision: 4L

## Textbooks/ References:


1) Hisrich, "Entrepreneurship", Tata McGraw Hill, New Delhi, 2005.
2) Saravanavel, P., 'Entrepreneurial Development', Ess Pee key publishing House, Chennai, 2005.
3) Khanka, S S., "Entrepreneurial Development", S.Chand and Co Limited, New Delhi, 2001.
4) Jain, P C., "Handbook for New Entrepreneurs", Second Edition, Oxford University Press, New Delhi, 2002.


**COs-POs-PSOs MAPPING:**

| **COs** | **Program Outcomes** | | | | | | | | | | | | **PSO** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
| **CO1** | 3 | 3 | 3 | - | - | 1 | - | - | 2 | - | 3 | 3 | 2 | 3 | 2 |
| **CO2** | - | - | - | - | - | 2 | - | 2 | - | - | 1 | 3 | 2 | 3 | 3 |
| **CO3** | 3 | 3 | 3 | 1 | 2 | - | - | 2 | - | 2 | 2 | 3 | 2 | 1 | 1 |
| **CO4** | - | - | - | - | - | - | - | 2 | 2 | - | 1 | 3 | 2 | 1 | 2 |
| **Overall Mapping** | 3 | 3 | 3 | 1 | 2 | 1.5 | | 2 | 2 | 2 | 1.75 | 3 | 2 | 2 | 2 |

**Course Name: Project Engineering & Plant Layout**
**Course Code: FT801B**

**Contact: L-T-P= 3-0-0**
**Total Contact Hours: 36**
**Credit: 3**

**Prerequisites:** Basic mathematics, food processing, quality control, and food regulations

## Course Objective:

1. To develop the knowledge of plant design and layout of specific food industries
2. To enable the students to learn about the regulations governing food plant design
3. To enable the students to learn how to scale up plant designs

## Course outcome(s):

After completion of the course students will able to:

**CO 1: Apply** the concept and different aspect required for food plant design

**CO 2: Identify** appropriate requirement of design and layout for the specific food industrywith compliance with FSSAI

**CO 3: Analyze** the function of PERT, CPM, ISO and HACCP in food plant design

**CO 4: Develop** a plant layout

## Course Contents:

## Module 1: 10L

Basic concepts of plant layout and design including a basic understanding of equipment layout, ventilation; Design consideration for the location of food plants. The material of Construction for food processing equipment; Specifications of processing equipments and accessories; provision for waste disposal, and safety arrangements aspects of plant layout and design

## Module 2: 9L

Layout and design aspects of pilot and semi-commercial food processing plants; Reference to the design of bakery and biscuit, fruits, vegetable, and beverage processing, and dairy industries; Hygienic Design of Food Plants; specific FSSAI requirements in food plant layout and design

## Module 3: 5L

Application of Program Evaluation and Review Technique (PERT) and Critical Path Method (CPM) in

project planning and monitoring; application of ISO, HACCP in food plant

## Module 4: 8L

Introduction to project engineering; Process design development: Optimum economic design, Feasibility Survey; Preparation of flow sheets for material movement and utility consumption in food plants; Cost estimation for a Food Plant; Scale-up.

## Revision: 4L

## Text and reference books:

1. Manufacturing Facilities Design and Material Handling by Fred E. Meyers, and Matthew P. Stephens, 3rd Edition, Pearson Prentice Hall, 2000
2. James M Moore, "Plant Layout and Design", Mcmillan& Co., (1959)
3. Bolz, Harold A George E., "Material Handling Handbook.
4. J M Apple, "Plant layout and Material Handling", John Willey & Sons, (1977)

**COs-POs-PSOs MAPPING:**

| COs | Program Outcomes | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
| **CO1** | 3 | 2 | 2 | 1 | - | 2 | 2 | 2 | - | - | 2 | - | 2 | 3 | 1 |
| **CO2** | 3 | 2 | 2 | 2 | - | - | 2 | - | - | - | - | 3 | 2 | 1 | 2 |
| **CO3** | 3 | 2 | 2 | - | - | - | 2 | - | - | - | 2 | 3 | 3 | 2 | 2 |
| **CO4** | 3 | 3 | 2 | - | - | 3 | 3 | 1 | 1 | 1 | 3 | 3 | 1 | 2 | 3 |
| **Overall Mapping** | 3 | 2.25 | 2 | 1.5 | | 2.5 | 2.25 | 1.5 | 1 | 1 | 1.75 | 2.25 | 2 | 2 | 2 |

**Course Name: Principles of Biochemical Engineering**
**Course Code: FT802A**
**Contact: 2:1:0**
**Total Contact Hours: 36**
**Credit: 3**

**Pre requisites:** Food Engineering, Food Processing, Unit Operations

**Course Objective:** To help the students understand the basic principles of various biochemical processes and realize the importance of different design parameters in bioreactor operation

## Course outcome(s):

After completion of the course students will able to:

**CO1: Predict** the industrial implication of biochemical engineering.

**CO2: Interpret** the kinetics of microbial reactions.

**CO3: Develop** the design parameters for a bioreactor.

**CO4: Illustrate** the importance of downstream processing in bioprocess industries and design considerations in a fermentation plant.

## Course Contents:

### Module 1: 8L

Introduction to biochemical process industries; Industrial alcohols, antibiotics, acids, alcoholic beverages, vitamins, enzymes, single cell protein, dairy products

### Module 2: 8L

Bioreactor design: Mechanisms and kinetics (Monod model), Fermentation - types of fermenters, chemostat, chemostat with recycle, turbidostat, PFR, fluidized bed reactor, air lift fermenter, Fed Batch reactions; Mass transfer in microbial reactors

### Module 3: 10L

Bioproduct recovery: Downstream processing - separation process for cell mass and product, filtration, centrifuging, membrane processes (reverse osmosis, ultrafiltration, chromatographic separation); Extraction

### Module 4: 6L

Scale-up of bioprocess; Bioprocess economics, Cost analysis of alcohol production plant, Fermentation plant design project, Bio-product regulation

### Revision: 4L

## Text Books:

1. Biochemical Engineering Fundamentals: J.E Bailey, D F Olli, MGH
2. Biochemical Engineering: Aiba S; Academia press, NY
3. Michael L. Shuler and Fikret Kargi: Bioprocess Engineering: Basic Concepts, 2nd Edition

## *Reference Books:*

1. Bioprocess Engineering Principles, Pauline M. Doran
2. Principles of Bioseparation Engineering, Raja Ghosh

**COs-POs-PSOs MAPPING:**

| **COs** | **Program Outcomes** | | | | | | | | | | | | **PSO** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
| **CO1** | 3 | 2 | 2 | - | - | 2 | 1 | - | - | - | - | 3 | 2 | 3 | 2 |
| **CO2** | 3 | 2 | 2 | 1 | - | - | 1 | - | - | - | - | 3 | 2 | 1 | 3 |
| **CO3** | 3 | 3 | 3 | 2 | - | - | - | - | - | - | - | 3 | 3 | 2 | 2 |
| **CO4** | 3 | 3 | 2 | 2 | - | 2 | - | - | - | - | - | 3 | 1 | 2 | 3 |
| **Overall Mapping** | 3 | 2.5 | 2.25 | 1.66 | | 2 | 1 | | | | | 3 | 2 | 2 | 2.5 |

**Course Name: Modeling & Simulation of Food Processing**

**Course Code: FT802B**

**Contact: L-T-P = 2 – 1 – 0**
**Total Contact Hours: 36**
**Credit: 3**

**Pre requisites:** Food Process Engineering, Unit Operations of Chemical Engineering I & II

**Course Objective:** To help the students understand the basic principles of food processing operations and represent the processes in terms f mathematical models and performing simulations for validation of the mathematical models.

## Course outcome(s):

After completion of the course students will able to:

**CO 1: Interpret** the importance of mathematical modeling of food processing operations.

**CO 2: Develop** of mathematical models and to design errorfree traditional food process operations.

**CO 3: Demonstrate** the basic concepts of advanced food processes.

**CO 4: Select** variables of mathematical processesand process optimization regarding performance enhancement.

## Course Contents:

### Module 1: 10L

Introduction to mathematical modeling of food processes; Food process analysis and simulation; Model building; Classification and uses of mathematical models in food processes; Fundamental laws and formulation of mathematical models.

### Module 2: 7L

Batch processes in food industry; Equilibriation in batch processes; Steady state flow processes of non reacting systems; Mixing in food processes involving flow.

### Module 3: 7L

Advanced food processing operations; Simultaneous heat and mass transfer in packed tower systems of food processing; Immobilized enzyme systems of food processing.

### Module 4: 8L

Modelling and simulation of food fermentation processes; Significance of process optimization; Parameter selection and optimization of food processes.

**Revision: 4L**

## Text books:

1. Biochemical Engineering Fundamentals: J.E Bailey, D F Olli, MGH
2. Michael L. Shuler and Fikret Kargi: Bioprocess Engineering: Basic Concepts, 2nd Edition

## Reference books:

1. Biochemical Engineering: Aiba S; Academia press, NY

**COs-POs-PSOs MAPPING:**

| COs | Program Outcomes | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 2 | 2 | - | - | 2 | 1 | - | - | - | - | 3 | 2 | 3 | 2 |
| CO2 | 3 | 2 | 2 | 1 | - | - | 1 | - | - | - | - | 3 | 2 | 1 | 3 |
| CO3 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | - | 3 | 3 | 2 | 2 |
| CO4 | 3 | 3 | 2 | 2 | - | 2 | - | - | - | - | - | 3 | 1 | 2 | 3 |
| Overall Mapping | 3 | 2.5 | 2.25 | 1.66 | | 2 | 1 | | | | | 3 | 2 | 2 | 2.5 |

# PRACTICAL

## Paper Name: Product Development & Quality Assurance Lab

## Paper Code: FT892

## Contact: L-T-P= 0-0-3
## Credit: 1.5

**Pre requisites:** Food Processing Technology, Food Microbiology, Principles of Food Preservations.

**Course Objective:** To help the students realize how to build products with sustainable competitive advantage with understanding of complete product development process.

## Course outcome(s):

After completion of the course students will able to:

**CO 1: Explain** the different process controlling parameters that influence a food product development.
**CO 2: Develop** an innovative product or a processing flow
**CO 3: Identify** the importance of shelf life study and perform varied tests to determine thenutritional aspect of the newly developed product.
**CO 4: Design** HACCP in the product development process and quality assurance protocols.

**COs-POs-PSOs MAPPING:**

| COs | Program Outcomes | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO 1 | 3 | 2 | 2 | 2 | - | - | - | - | 1 | - | - | 3 | 3 | 2 | 3 |
| CO 2 | 3 | 2 | 2 | - | 2 | 1 | - | - | - | - | 1 | 3 | 3 | 3 | 2 |
| CO 3 | 2 | 1 | - | - | - | 1 | 2 | 2 | - | - | - | 3 | 3 | 2 | 3 |
| CO 4 | 2 | - | - | - | - | 3 | 3 | 2 | - | 2 | - | 3 | 3 | 3 | 2 |
| Overall Mapping | 2.5 | 1.66 | 2 | 2 | 2 | 1.33 | 2.5 | 2 | 1 | 2 | 1 | 3 | 3 | 2 | 2 |

**Paper Name: Major Project-VIII**
**Paper Code: PR 891**
**Contact hours: 0:0:8**
**Credit: 4**

**Prerequisites:** Food Microbiology, Food Processing, Unit Operation, Management Principles, Food Packaging

**Course Objective:**

- To apply theoretical and laboratory understanding and techniques in realistic implementation
- To help the students to identify the significant issues that need to be resolved for benefit of society
- To learn different verticals of a research and development project

**Course Outcome:**

After completion of Project students will be able to:

**CO1: Identify** the need of socio-economic demand in food of allied sector

**CO2: Apply** the knowledge of theory for innovative product/process design

**CO3: Interpret** the process involved in project for future industrial food and allied sector

**CO4: Summarize** a appropriate report

**CO-PO-PSO Mapping**

| COs | Program outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
| **CO1** | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 2 | 2 | 1 | 3 | 3 | 1 | - | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | - |
| **CO3** | 3 | 3 | 2 | 2 | 3 | 2 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 2 |
| **CO4** | 3 | 3 | 1 | 1 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 |
| **Overall Mapping** | 3 | 3 | 2 | 2 | 3 | 2.75 | 2 | 2.5 | 2.75 | 2.25 | 3 | 3 | 2.25 | 2.67 | 2.33 |

# MANDATORY ACTIVITIES / COURSES

## Course Name: Essence of Indian Knowledge Tradition
## Course Code: MC 801

## Total Contact Hours: 3h /Week
## Non-Credit Mandatory Course

**Course Objectives:**

The course aims at imparting basic principles of thought process, reasoning and inferencing. Sustainability is at the core of Indian Traditional Knowledge Systems connecting society and nature. Holistic life style of yogic science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions. Part-I focuses on introduction to Indian Knowledge Systems, Indian perspective of modern scientific world-view, and basic principles of Yoga and holistic health care system.

## Course Outcomes:

**CO 1:** Identify the concept of Traditional knowledge and its importance.
**CO 2:** Explain the connection between Modern Science and Indian Knowledge System.
**CO 3:** Understand the importance of Yoga for health care.
**CO 4:** Interpret the effect of traditional knowledge on environment.

## Module 1: Basic structure of Indian Knowledge System

Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, Indigenous Knowledge (IK), characteristics, traditional knowledge vis-a-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge

## Module 2: Modern Science and Indian Knowledge System

Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge

## Module 3: Yoga and Holistic Health care

Yoga for positive health, prevention of stress related health problems and rehabilitation, Integral approach of Yoga Therapy to common ailments.

## Module 4: Traditional Knowledge and Environment

Traditional knowledge and engineering, Traditional medicine system, Importance of conservation and sustainable development of environment, Management of biodiversity

## Text books/References:


1. V. Sivaramakrishnan (Ed.), Cultural Heritage of India-course material, Bharatiya Vidya Bhavan, Mumbai. 5th Edition, 2014
2. Swami Jitatmanand, Modern Physics and Vedant, Bharatiya Vidya Bhavan
3. Swami Jitatmanand, Holistic Science and Vedant, Bharatiya Vidya Bhavan
4. Fritzof Capra, The Wave of life
5. VN Jha (Eng. Trans.), Tarkasangraha of Annam Bhatta, International Chinmay Foundation, Velliarnad, Arnakulam
6. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkata
7. RN Jha, Yoga-darshanam with Vyasa Bhashya, Vidyanidhi Prakashan, Delhi 2016 RN Jha, Science of Consciousness Psychotherapyand Yoga Practices, Vidyanidhi Prakashan, Delhi 2016


**COs-POs-PSOs MAPPING:**

| COs | Program outcomes | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO 1 | - | - | - | - | - | 1 | - | - | 2 | 1 | 2 | 1 | 1 | 2 | 1 |
| CO 2 | - | - | - | - | - | - | - | 3 | 2 | 1 | 2 | 2 | 2 | 1 | 2 |
| CO 3 | - | - | - | - | - | - | - | - | 2 | 2 | - | 1 | 1 | 1 | 1 |
| CO 4 | - | - | - | - | - | - | - | - | 1 | 2 | - | 1 | 2 | 2 | 2 |
| Overall Mapping | | | | | | 1 | | 3 | 1.75 | 1.5 | 2 | 1.25 | 1.75 | 1.5 | 1.5 |