

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE.

Dr. Babasaheb Ambedkar Technological University
(Established as a University of Technology in the State of Maharashtra)
(Under Maharashtra Act No. XXIX of 2014)
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**National Education Policy (NEP) 2020 for the session
2025-26**

For

Second Year B.Tech. Food Technology (11503)
(Affiliated Institutes)

With effect from the Academic Year 2025-2026

B.TECH Food Technology

Credit Framework under Four-Years UG Engineering Programme with Multiple Entry and Multiple Exit Options:

- The Four-year Bachelor's Multidisciplinary Engineering Degree Programme allows the students to experience the full range of holistic and multidisciplinary education in addition to a focus on the chosen major and minors as per their choices and the feasibility of exploring learning from different institutions.
- The minimum and maximum credit structure for different levels under the Four-year Bachelor's Multidisciplinary Engineering UG Programme with multiple entry and multiple exit options are as given below:

Credit Framework

| Levels | Qualification Title | Credit Requirements | | Semester | Year |
|--------|--|---------------------|---------|----------|------|
| | | Minimum | Maximum | | |
| 4.5 | One Year UG Certificate in Engg./ Tech. | 40 | 44 | 2 | 1 |
| 5.0 | Two Years UG Diploma in Engg./ Tech. | 80 | 88 | 4 | 2 |
| 5.5 | Three Years Bachelor's Degree in Vocation (B. Voc.) or B. Sc. (Engg./ Tech.) | 120 | 132 | 6 | 3 |
| | 4-Years Bachelor's degree | | | | |

- There are multiple exit options at each level. The student will be given a specific Qualification mentioned in the table depending on the level at which he/she decide to have an exit. Ex. If a student decides to exit after completion of two years (level 5.0) of the program, he will be given a Diploma in Engineering with specific exit condition mentioned in the syllabus of the specific branch. He/she can rejoin the program with the multiple entry option at the level next where he/she chose to exit previously. (Student can join at level 5.5 if successfully completed level 5.0 previously at the time of exit).
- Minimum credit requirements of each level are mentioned in the credit framework table.
- There are 4 distinct options available at level 6.0.
- First one is basic level 6.0 option where a minimum 160-maximum 176 credits are mandatory which can be completed as per the Semester-wise Credit distribution structure mentioned in the table given below.

Here, the Bachelor’s Engineering Degree in chosen Engg./ Tech. Discipline with multidisciplinary minor (min.160-max.176 Credits) i.e. “**B. Tech in Food Technology with MINOR**” (160-176 credits) enables students to take up five-six or required additional courses of 14 credits in the discipline other than Food Technology distributed over semesters III to VIII. Here in the case of “**B. Tech in Food Technology with MINOR**” (160-176 credits) student is supposed to take up 50% or more courses to complete the 50% or more credits (from assigned 14 credits) from **minor bucket**. The remaining courses to complete the assigned 14 credits can be covered from other discipline’s minor buckets. Remaining three level 6.0 options are the advanced options where the student is given an opportunity to get extra qualification by earning some extra credits (18-20 extra credits). These three options are given below:

| Levels | Qualification Title | Credit Requirements | | Semester | Year |
|--------|--|---------------------|---------|----------|------|
| | | Minimum | Maximum | | |
| 6.0 | (B.E./ B.Tech. or Equivalent) in Engg./ Tech. with Multidisciplinary Minor | 160 | 176 | 8 | 4 |
| 6.0 | 4-Years Bachelor’s degree (B.E./ B.Tech. or Equivalent) in Engg./ Tech.- Honors and Multidisciplinary Minor | 180 | 194 | 8 | 4 |
| 6.0 | 4-Years Bachelor’s degree (B.E./ B.Tech. or Equivalent) in Engg./ Tech.- Honors with Research and Multidisciplinary Minor | 180 | 194 | 8 | 4 |
| 6.0 | 4-Years Bachelor’s degree (B.E./ B.Tech. or Equivalent) in Engg./ Tech.- Major Engg. Discipline with Double Minors (Multidisciplinary and Specialization Minors) | 180 | 194 | 8 | 4 |

- Level 6.0: The **Bachelor's Engineering Degree with Honors in** chosen Major Engg./ Tech. Discipline i.e. in Food Technology and Management with Honours with Multidisciplinary Minor (180-194 credits) enables students of Food Technology to take up five-six additional courses of 18 to 20 credits in the Food Technology and Management discipline distributed over semesters III to VIII. The decision regarding the mechanism of distribution of these 18- 20 credits over semesters III to VIII, which are over and above the minimum 160-maximum 176 Credits prescribed for the duration of our years will be taken by the Academic Authorities of the University. **Student must have CGPA equal to or greater than 7.5 at the end of the second semester to go for this option.**
- Level 6.0: The **Bachelor's Engineering Degree with Research** in i.e. in Food Technology with Research with Multidisciplinary Minor (180-194 credits) enables students of Food Technology to take up a research project of 18 to 20 credits in the Food Technology discipline distributed over semesters VII to VIII. **A student must have CGPA equal to or greater than 7.5 at the end of sixth semester to go for this option.**
- Level 6.0: The **Bachelor's Engineering Degree in chosen Engg. / Tech. Discipline with Double Minor** (Multidisciplinary and Specialization Minor, 180-194 credits), i.e. "**B. Tech in Food Technology with *other selected discipline in Engineering (as MDM) with Specialization Minor***"- 194 credits) enables students to take up five-six additional courses of 14 credits in the discipline other than Food Technology (for completion of multidisciplinary minor) and 18 to 20 extra credits in the **MINOR discipline** distributed over semesters III to VIII. Here, the ***other selected discipline in Engineering should be different from the Specialization Minor***. This enables students to take up five-six or required additional courses of 18 to 20 credits in the **MINOR** discipline distributed over semesters III to VIII, which are over and above the min.160-max.176 Credits. The decision regarding the mechanism of distribution of these 18-20credits over semesters III to VIII, prescribed for the duration of four years will be taken by Academic Authorities of the University. **Student must have CGPA equal to or greater than 7.5 at the end of the second semester to go for this option.**
- Students need to follow the Semester-wise Credit distribution structure for Four Year UG Engineering Program as prescribed in the table given above.
- There are seven vertical categories with specific credits distributed in specific semesters.
- The student can choose a Program Elective Course (PEC) in that specific semester from the given subjects.
- Multidisciplinary courses (MDM) and Open Elective (OE) courses can be chosen from the MDM and OE Buckets depending on students choice. Completion of total credits given in the last column of the table for each vertical is mandatory.
- Students can complete 40% of the courses through online platforms like NPTEL/SWAYAM. The NPTEL SWAYAM course content should be at least 80% similar to the course content in the syllabus.

**Semester-wise Credit distribution structure for Four Year UG Engineering
Program - One Major, One Minor**

| Semester | | I | II | III | IV | V | VI | VII | VIII | Total Credits |
|--|---|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|----------------|
| Basic Science Course | BSC/ESC | 06-08 | 08-10 | | -- | -- | -- | -- | -- | 14-18 |
| Engineering Science Course | | 10-08 | 06-04 | | -- | -- | -- | -- | -- | 16-12 |
| Programme Core Course (PCC) | Program Courses | -- | 02 | 08-10 | 08-10 | 10-12 | 08-10 | 04-06 | 04-06 | 44-56 |
| Programme Elective Course (PEC) | | -- | -- | -- | -- | 04 | 08 | 02 | 06 | 20 |
| Multidisciplinary Minor (MD M) | Multidisciplinary Courses | | - | 02 | 02 | 04 | 02 | 02 | 02 | 14 |
| Open Elective (OE) Other than a particular program | | -- | -- | 04 | 02 | 02 | -- | -- | -- | 08 |
| Vocational and Skill Enhancement Course (VSEC) | Skill Courses | 02 | 02 | -- | 02 | -- | 02 | -- | -- | 08 |
| Ability Enhancement Course (AEC -01, AEC-02) | Humanities Social Science and Management (HSSM) | 02 | -- | -- | 02 | -- | -- | -- | -- | 04 |
| Entrepreneurship/Economics/Management Courses | | -- | | 02 | 02 | -- | -- | -- | -- | 04 |
| Indian Knowledge System (IKS) | | | 02 | | -- | -- | -- | -- | -- | 02 |
| Value Education Course (VEC) | | -- | -- | 02 | 02 | -- | -- | -- | -- | 04 |
| Research Methodology | | -- | -- | -- | -- | -- | -- | | 04 | 04 |
| Comm. Engg. Project (CEP)/Field Project (FP) | Experiential Learning Courses | -- | -- | 02 | -- | -- | -- | - | - | 02 |
| Project | | -- | -- | -- | -- | -- | -- | | 04 | 04 |
| Internship/ OJT | | -- | --- | | | -- | -- | 12 | - | 12 |
| Co-curricular Courses (CC) | Liberal Learning Courses | 02 | 02 | | -- | -- | -- | -- | - | 04 |
| Total Credits (Major) | | 20-22 | 20-22 | 20-22 | 20-22 | 20-22 | 20-22 | 20-22 | 20-22 | 160-176 |

General Rules and Regulations

1. The normal duration of the course leading to B. Tech degree will be EIGHT semesters.
2. The normal duration of the course leading to M. Tech. degree will be FOUR semesters.
3. Each academic year shall be divided into 2 semesters, each of 20weeks duration, including evaluation and grade finalization, etc. The Academic Session in each semester shall provide for at least 90 Teaching Days, with at least 40 hours of teaching contact periods in a five to six days session per week. The semester that is typically from Mid-July to November is called the ODD SEMESTER, and the one that is from January to mid-May is called the EVEN SEMESTER. Academic Session may be scheduled for the Summer Session/Semester as well. For 1st year B. Tech and M. Tech the schedule will be decided as per the admission schedule declared by Government of Maharashtra.
4. The schedule of academic activities for a Semester, including the dates of registration, mid- semester examination, end-semester examination, inter-semester vacation, etc. shall be referred to as the Academic Calendar of the Semester, which shall be prepared by the Dean (Academic), and announced at least TWO weeks before the Closing Date of the previous Semester.
5. The Academic Calendar must be strictly adhered to, and all other activities including co-curricular and/or extra -curricular activities must be scheduled so as not to interfere with the Curricular Activities as stipulated in the Academic Calendar.

Registration:

1. Lower and Upper Limits for Course Credits Registered in a Semester, by a Full- Time Student of a UG/PG Programme:
A full time student of a particular UG/PG programme shall register for the appropriate number of course credits in each semester/session that is within the minimum and maximum limits specific to that UG/PG programme as stipulated in the specific Regulations pertaining to that UG/PG programme.
2. Mandatory Pre-Registration for higher semesters: In order to facilitate proper planning of the academic activities of a semester, it is essential for the every institute to inform to Dean (Academics) and COE regarding details of total no. of electives offered (Course-wise) along with the number of students opted for the same. This information should be submitted within two weeks from the date of commencement of the semester as per academic calendar.
3. PhD students can register for any of PG/PhD courses and the corresponding rules of evaluation will apply.
4. Under Graduate students may be permitted to register for a few selected Post Graduate courses, in exceptionally rare circumstances, only if the DUGC/DPGC is convinced of the level of the academic achievement and the potential in a student.

Course Pre-Requisites:

1. In order to register for some courses, it may be required either to have exposure in, or to have completed satisfactorily, or to have prior earned credits in, some specified courses.
2. Students who do not register on the day announced for the purpose may be permitted LATE REGISTRATION up to the notified day in academic calendar on payment of late fee.
3. REGISTRATION IN ABSENTIA will be allowed only in exceptional cases with the approval of the Dean (Academic) / Principal.
4. A student will be permitted to register in the next semester only if he fulfills the following

conditions:

- i) Satisfied all the Academic Requirements to continue with the programme of Studies without termination
- ii) Cleared all Institute, Hostel and Library dues and fines (if any) of the previous semesters;
- iii) Paid all required advance payments of the Institute and hostel for the current semester;
- iv) Not been debarred from register in gon any specific ground by the Institute.

Evaluation System:

1. Absolute grading system based on absolute marks as indicated below will be implemented from academic year 2023-24, from I year B. Tech.

| Percentage of marks | Letter Grade | Grade Point |
|---------------------|--------------|-------------|
| 91-100 | EX | 10.0 |
| 86-90 | AA | 9.0 |
| 81-85 | AB | 8.5 |
| 76-80 | BB | 8.0 |
| 71-75 | BC | 7.5 |
| 66-70 | CC | 7.0 |
| 61-65 | CD | 6.5 |
| 56-60 | DD | 6.0 |
| 51-55 | DE | 5.5 |
| 40-50 | EE | 5.0 |
| <40 | EF | 0.0 |

2. Class is awarded based on CGPA of all eighth semester of B. Tech Program.

| CGPA for pass is minimum 5.0 | |
|---------------------------------|--------------|
| CGPA up to <5.50 | Pass class |
| CGPA \geq 5.50 & <6.00 | Second Class |
| CGPA \geq 6.00 & <7.5 | First Class |
| CGPA $>$ 7.50 | Distinction |
| [Percentage of Marks=CGPA*10.0] | |

3. A total of 100 Marks for each theory course are distributed as follows:

| | |
|-------------------------------------|----|
| Mid Semester Exam (MSE)Marks | 20 |
| Continuous Assessment Marks | 20 |
| End Semester Examination (ESE)Marks | 60 |

4. A total of 100 Marks for each practical course are distributed as follows

| | | |
|----|--------------------------------------|----|
| 1. | Continuous Assessment Marks | 40 |
| 2. | End Semester Examination (ESE) Marks | 60 |

- It is mandatory for every student of B. Tech to score a minimum of 40 marks out of 100, M. Tech to score a minimum of 45 marks out of 100 with a minimum of 20 marks out of 60 marks in End Semester Examination for theory course.
- This will be implemented from the first year of B. Tech starting from Academic Year 2023-24

5. Description of Grades

EX Grade: An EX grade stands for outstanding achievement.

EE Grade: The EE grade stands for minimum passing grade.

The students may appear for the remedial examination for the subjects he/she failed for the

current semester of admission only and his/her performance will be awarded with EE grade only.

If any of the students remain absent for the regular examination due to genuine reason and the same will be verified and tested by the Dean (Academics) or committee constituted by the University Authority.

FF Grade: The FF grade denotes very poor performance, i.e. failure in a course due to poor performance. The students who have been awarded „FF“ grade in a course in any semester must repeat the subject in next semester.

6. Evaluation of Performance

a. Semester Grade Point Average(SGPA)

The performance of a student in a semester is indicated by Semester Grade Point Average (SGPA) which is a weighted average of the grade points obtained in all the courses taken by the student in the semester and scaled to a maximum of 10. (SGPI is to be calculated up to two decimal places). A Semester Grade Point Average (SGPA) will be computed for each semester as follows:

$$SGPA = \frac{[\sum_{i=1}^n c_i g_i]}{[\sum_{i=1}^n c_i]}$$

Where

“ n “ is the number of subjects for the semester,

“ c_i “ is the number of credits allotted to a particular subject, and

“ g_i “ is the grade-points awarded to the student for the subject based on his performance as per the above table.

SGPA will be rounded off to the second place of decimal and recorded as such.

b. Cumulative Grade Point Average (CGPA):

An up to date assessment of the overall performance of a student from the time he entered the Institute is obtained by calculating Cumulative Grade Point Average (CGPA) of a student. The CGPA is weighted average of the grade points obtained in all the courses registered by the student since s/he entered the Institute. CGPA is also calculated at the end of every semester (upto two decimal places). Starting from the first semester at the end of each semester (S), a Cumulative Grade Point Average (CGPA) will be computed as follows:

$$CGPA = \frac{[\sum_{i=1}^m c_i g_i]}{[\sum_{i=1}^m c_i]}$$

Where, s

“ m ” is the total number of subjects from the first semester onwards up to and including the semester S ,

“ c_i ” is the number of credits allotted to a particular subject, and

“ g_i ” is the grade-points awarded to the student for the subject based on his/ her performance as per the above table.

CGPA will be rounded off to the second place of decimal and recorded as such.

7. Attendance Requirements:

- a. All students must attend every lecture, tutorial and practical classes.
- b. To account for approved leave of absence (eg. representing the Institute in sports, games or athletics; placement activities; NCC/NSS activities; etc.) and/or any other such contingencies like medical emergencies, etc., the attendance requirement shall be a minimum of 75% of the classes actually conducted. If the student failed to maintain 75% attendance, he/she will be detained for appearing the successive examination. The Dean (Academics)/ Principal is permitted to give 10% concession for the genuine reasons as such the case may be. In any case the student will not be permitted for appearing the examination if the attendance is less than 65%.
- c. The course instructor handling a course must finalize the attendance 3 calendar days before the last day of classes in the current semester and communicate clearly to the students by displaying prominently in the department and also in report writing to the head of the department concerned.
- d. The attendance records are to be maintained by the course instructor and he shall show it to the student, if and when required.

8. Transfer of Credits:

The courses credited elsewhere, in Indian or foreign University/Institutions/ Colleges/Swayam Courses by students during their study period at DBATU may count towards the credit requirements for the award of degree. The guidelines for such transfer of credits are as follows:

- a. 20% of the total credit will be considered for respective calculations.
- b. Credits transferred will be considered for the overall credits requirements of the programme.
- c. Credits transfer can be considered only for the course at same level, i.e UG, PG etc.
- d. A student must provide all details (original or attested authentic copies) such as course contents, number of contact hours, course instructor /project guide and evaluation system for the course for which he is requesting a credits transfer. He shall also provide the approval or acceptance letter from the other side. These details will be evaluated by the concerned Board of Studies before giving approval. The Board of Studies will then decide the number of equivalent credits the student will get for such course(s) in DBATU. The complete details will then be forwarded to the Dean for approval.
- e. A student has to get minimum passing grades/ marks for such courses for which the credits transfers are to be made.
- f. Credits transfers availed by a student shall be properly recorded on academic record(s) of the student.
- g. In exceptional cases, the students may opt for higher credits than the prescribed.

Semester-wise Credit distribution structure for Four Year UG Engineering Program - One Major, One Minor

| Semester | | I | II | III | IV | V | VI | VII | VIII | Total Credits |
|--|---|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|----------------|
| Basic Science Course | BSC/ESC | 06-08 | 08-10 | | -- | -- | -- | -- | -- | 14-18 |
| Engineering Science Course | | 10-08 | 06-04 | | -- | -- | -- | -- | -- | 16-12 |
| Programme Core Course (PCC) | Program Courses | -- | 02 | 08-10 | 08-10 | 10-12 | 08-10 | 04-06 | 04-06 | 44-56 |
| Programme Elective Course (PEC) | | -- | -- | -- | -- | 04 | 08 | 02 | 06 | 20 |
| Multidisciplinary Minor (MD M) | Multidisciplinary Courses | | - | 02 | 02 | 04 | 02 | 02 | 02 | 14 |
| Open Elective (OE) Other than a particular program | | -- | -- | 04 | 02 | 02 | -- | -- | -- | 08 |
| Vocational and Skill Enhancement Course (VSEC) | Skill Courses | 02 | 02 | -- | 02 | -- | 02 | -- | -- | 08 |
| Ability Enhancement Course (AEC -01, AEC-02) | Humanities Social Science and Management (HSSM) | 02 | -- | -- | 02 | -- | -- | -- | -- | 04 |
| Entrepreneurship/Economics/ Management Courses | | -- | | 02 | 02 | -- | -- | -- | -- | 04 |
| Indian Knowledge System (IKS) | | | 02 | | -- | -- | -- | -- | -- | 02 |
| Value Education Course (VEC) | | -- | -- | 02 | 02 | -- | -- | -- | -- | 04 |
| Research Methodology | | -- | -- | -- | -- | -- | -- | -- | 04 | 04 |
| Comm. Engg. Project (CEP)/Field Project (FP) | Experiential Learning Courses | -- | -- | 02 | -- | -- | -- | - | - | 02 |
| Project | | -- | -- | -- | -- | -- | -- | 04 | 04 | |
| Internship/ OJT | | -- | --- | | | -- | -- | 12 | - | 12 |
| Co-curricular Courses (CC) | Liberal Learning Courses | 02 | 02 | | -- | -- | -- | -- | - | 04 |
| Total Credits (Major) | | 20-22 | 20-22 | 20-22 | 20-22 | 20-22 | 20-22 | 20-22 | 20-22 | 160-176 |

Teaching & Evaluation Scheme for Program B.Tech. Food Technology (11503) Second Year

| SEMESTER-III | | | | | | | | | | |
|---------------------|--------------------|--|------------------------|----------|----------|--------------------------|------------|------------|--------------|---------------|
| Sr. No. | Course Code | Course Title | Teaching Scheme | | | Evaluation Scheme | | | | Credit |
| | | | L | T | P | ISE | MSE | ESE | Total | |
| 1 | 25AF1503PC301 | Principles of Food Preservation | 3 | 0 | 0 | 20 | 20 | 60 | 100 | 3 |
| 2 | 25AF1503PC302 | Food Biochemistry | 3 | 0 | 0 | 20 | 20 | 60 | 100 | 3 |
| 3 | 25AF1503PC303 | Food Microbiology | 3 | 0 | 0 | 20 | 20 | 60 | 100 | 3 |
| 4 | 25AF1503PC304 | Food Process Engineering-I | 3 | 0 | 0 | 20 | 20 | 60 | 100 | 3 |
| 5 | 25AF1LAWOEM05C | OPEN ELECTIVE- I A. Environmental studies B. Right To Information and Good Governance C. Fluid Mechanics D. Public health management | 3 | 0 | 0 | 20 | 20 | 60 | 100 | 3 |
| 6 | 25AF1504MD306 | MDM-I (Unit Operations in Food Processing) | 2 | 1 | 0 | 20 | 20 | 60 | 100 | 3 |
| 7 | 25AF1COIVE307 | Constitution of India | 0 | 2 | 0 | - | - | - | - | AU |
| 8 | 25AF1503PCL308 | Food Biochemistry Lab | 0 | 0 | 2 | 60 | - | 40 | 100 | 1 |
| 9 | 25AF1503PCL309 | Food Microbiology Lab | 0 | 0 | 2 | 60 | - | 40 | 100 | 1 |
| 10 | 25AF1503HM310 | Basics of Finance and Economics | 0 | 2 | 0 | 50 | - | - | 50 | 2 |
| 11 | 25AF1503CP311 | Community Engineering Project/Field Project | 0 | 0 | 2 | 60 | - | 40 | 100 | 1 |
| TOTAL | | | 17 | 5 | 6 | 350 | 120 | 480 | 950 | 23 |

SEMESTER-IV

| Sr. No. | Course Code | Course Title | Teaching Scheme | | | Evaluation Scheme | | | | Credit |
|--------------|--|---|-----------------|----------|----------|-------------------|------------|------------|-------------|-----------|
| | | | L | T | P | ISE | MSE | ESE | Total | |
| 1 | 25AF1503PC401 | Food Process Engineering – II | 3 | 0 | 0 | 20 | 20 | 60 | 100 | 3 |
| 2 | 25AF1503PC402 | Food Additives | 3 | 0 | 0 | 20 | 20 | 60 | 100 | 3 |
| 3 | 25AF1503PC403 | Human Nutrition and Nutraceuticals | 3 | 0 | 0 | 20 | 20 | 60 | 100 | 3 |
| 4 | 25AF1503PCL404 | Food Additives and Nutrition Lab | 0 | 0 | 2 | 60 | - | 40 | 100 | 2 |
| 5 | 25AF10THOEM05 | OPEN ELECTIVE-II A. Heat and mass transfer B. ICT C. Chemical Reaction Engineering | 3 | 0 | 0 | 20 | 20 | 60 | 100 | 3 |
| 6 | 25AF1503MD406 | MDM Bucket* (Technology of Spices and Plantation crops) | 3 | 0 | 0 | 20 | 20 | 60 | 100 | 3 |
| 7 | 25AF1503PCL407 | Food Process Engineering Lab | 0 | 0 | 2 | 60 | - | 40 | 100 | 1 |
| 8 | 25AF1000VE408A | Life of Chatrapati Shivaji Maharaj | 1 | 0 | 0 | 50 | - | - | 50 | 1 |
| 9 | 25AF1UHVVE409 | Universal Human Values | 2 | 1 | 0 | 20 | 20 | 60 | 100 | 3 |
| 10 | 25AF1000AE410A 25AF1000AE410B 25AF1000AE410C | Modern Indian Language A) Marathi B) Hindi C) Sanskrit | 1 | 0 | 0 | 20 | 20 | 60 | 100 | 1 |
| 11 | 25AF1000HM411 | Intellectual Property Rights | 1 | 0 | 0 | 20 | 20 | 60 | 100 | 1 |
| TOTAL | | | 20 | 1 | 4 | 370 | 140 | 540 | 1050 | 24 |

List of Multidisciplinary minor courses offered by Department of Food Technology

| Sem | Course Title | Teaching Scheme | | | Evaluation Scheme | | | | |
|-----|---|-----------------|----------|----------|-------------------|------------|------------|------------|----------------|
| | | L | T | P | CA | MSE | ESE | Total | No. of Credits |
| III | Unit Operations in Food Processing | 2 | - | - | 20 | 20 | 60 | 100 | 2 |
| IV | Technology of Spices and Plantation Crops | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| V | Food Supply Chain Management | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| VI | Food by-products and waste utilization | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| VII | Applied Statistics | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| | Total | 14 | - | - | 100 | 100 | 300 | 500 | 14 |

Teaching & Evaluation Scheme for Program B.Tech. Food Technology (11503) Second Year

| SEMESTER-III | | | | | | | | | | |
|---------------------|--------------------|--|------------------------|----------|----------|--------------------------|------------|------------|--------------|---------------|
| Sr. No. | Course Code | Course Title | Teaching Scheme | | | Evaluation Scheme | | | | Credit |
| | | | L | T | P | ISE | MSE | ESE | Total | |
| 1 | 25AF1503PC301 | Principles of Food Preservation | 3 | 0 | 0 | 20 | 20 | 60 | 100 | 3 |
| 2 | 25AF1503PC302 | Food Biochemistry | 3 | 0 | 0 | 20 | 20 | 60 | 100 | 3 |
| 3 | 25AF1503PC303 | Food Microbiology | 3 | 0 | 0 | 20 | 20 | 60 | 100 | 3 |
| 4 | 25AF1503PC304 | Food Process Engineering-I | 3 | 0 | 0 | 20 | 20 | 60 | 100 | 3 |
| 5 | 25AF1LAWOEM05C | OPEN ELECTIVE- I A. Environmental studies B. Right To Information and Good Governance C. Fluid Mechanics D. Public health management | 3 | 0 | 0 | 20 | 20 | 60 | 100 | 3 |
| 6 | 25AF1504MD306 | MDM-I (Unit Operations in Food Processing) | 2 | 1 | 0 | 20 | 20 | 60 | 100 | 3 |
| 7 | 25AF1COIVE307 | Constitution of India | 0 | 2 | 0 | - | - | - | - | AU |
| 8 | 25AF1503PCL308 | Food Biochemistry Lab | 0 | 0 | 2 | 60 | - | 40 | 100 | 1 |
| 9 | 25AF1503PCL309 | Food Microbiology Lab | 0 | 0 | 2 | 60 | - | 40 | 100 | 1 |
| 10 | 25AF1503HM310 | Basics of Finance and Economics | 0 | 2 | 0 | 50 | - | - | 50 | 2 |
| 11 | 25AF1503CP311 | Community Engineering Project/Field Project | 0 | 0 | 2 | 60 | - | 40 | 100 | 1 |
| TOTAL | | | 17 | 5 | 6 | 350 | 120 | 480 | 950 | 23 |

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Detailed Syllabus

III Semester B. Tech. (Food Technology)

| | |
|-----------------------|---------------------------------|
| Course Code : | 25AF1503PC301 |
| Title of the Course : | PRINCIPLES OF FOOD PRESERVATION |

| Course Scheme | | | | | Evaluation Scheme | | | | |
|---------------|---|---|-------|---------|------------------------|-----|-----|-----|-------|
| L | T | P | Total | Credits | Paper Duration in Hrs. | ISE | MSE | ESE | Total |
| 3 | 0 | 0 | 3 | 3 | 3 | 20 | 20 | 60 | 100 |

COURSE OBJECTIVES

1. To provide students with a comprehensive understanding of the fundamental principles of food science.
2. To develop knowledge of the composition and properties of different food groups.
3. To introduce the concepts of food spoilage, preservation, and processing techniques.
4. To enhance students' ability to relate food science with food quality, safety, and nutrition.
5. To build a foundation for advanced courses in food technology and food processing.

COURSE OUTCOMES (CO)

| | |
|------|---|
| CO-1 | Explain the composition and properties of various food components. |
| CO-2 | Understand the physical, chemical, and functional properties of foods. |
| CO-3 | Identify different types of food spoilage and preservation techniques. |
| CO-4 | Apply the basic concepts of food science in food processing and product development. |
| CO-5 | Correlate food science principles with food quality, nutrition, and safety standards. |

| Unit | Contents | Hrs. |
|------|---|------|
| I | Introduction to Food Science <ul style="list-style-type: none"> • Definition, scope, and importance of food science • Historical development and milestones in food science • Relationship of food science with nutrition, Microbiology, and Food engineering • Food safety, quality assurance, and regulatory aspects (FSSAI, Codex, HACCP basics) | 06 |
| II | Food Components – Carbohydrates, Proteins, and Lipids <ul style="list-style-type: none"> • Carbohydrates: Classification, properties, reactions (gelatinization, retrogradation, browning) • Proteins: Types, denaturation, functional properties (solubility, emulsification, foaming) • Lipids: Structure, properties, rancidity, role in food quality • Vitamins and Minerals | 10 |
| III | Water, Pigments, Enzymes, and Flavor Compounds <ul style="list-style-type: none"> • Water activity and its role in food stability • Natural pigments in food (chlorophylls, carotenoids, anthocyanins, myoglobin) • Enzymes in food: desirable and undesirable changes • Flavor compounds in foods and factors affecting flavor | 08 |
| IV | Food Microbiology and Spoilage <ul style="list-style-type: none"> • Introduction to food microbiology • Types and causes of food spoilage (biological, chemical, physical) • Food-borne pathogens and toxins • Principles of food preservation • Methods of Food Preservation | 08 |
| V | Rheological and Physical Properties of Food Materials <ul style="list-style-type: none"> • Introduction to rheology: Definition, importance in food science and processing • Viscosity and flow behavior: Newtonian and Non-Newtonian fluids, measurement methods • Textural properties of foods: Elasticity, plasticity, brittleness, chewiness, and their | 08 |

| | | |
|--------------|---|-----------|
| | evaluation <ul style="list-style-type: none">• Factors affecting rheological properties: composition, temperature, moisture, processing conditions• Practical applications: role in product development, quality control, and sensory perception | |
| Total | | 40 |

Suggested readings:

1. Potter, N.N. & Hotchkiss, J.H. (2019). *Food Science*. Springer.
2. Fellows, P.J. (2017). *Food Processing Technology: Principles and Practice*. Woodhead Publishing.
3. Manay, S.N. & Shadaksharaswamy, M. (2018). *Foods: Facts and Principles*. New Age International.
4. Srilakshmi, B. (2021). *Food Science*. New Age International Publishers.
5. Fennema, O.R. (2017). *Food Chemistry*. CRC Press.

Reference Books:

1. Toledo, R. (2018). *Fundamentals of Food Process Engineering*. Springer.
2. Smith, J.S. & Hui, Y.H. (2016). *Food Processing: Principles and Applications*. Wiley-Blackwell.
3. Meyer, L.H. (2016). *Food Chemistry*. New Age International.
4. Ranganna, S. (2019). *Handbook of Analysis and Quality Control for Fruit and Vegetable Products*. Tata McGraw-Hill.
5. Damodaran, S., Parkin, K.L., & Fennema, O.R. (2017). *Fennema's Food Chemistry*. CRC Press.

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Detailed Syllabus

III Semester B. Tech. (Food Technology)

| | |
|-----------------------|-------------------|
| Course Code : | 25AF1503PC302 |
| Title of the Course : | FOOD BIOCHEMISTRY |

| Course Scheme | | | | | Evaluation Scheme | | | | |
|---------------|---|---|-------|---------|------------------------|-----|-----|-----|-------|
| L | T | P | Total | Credits | Paper Duration in Hrs. | ISE | MSE | ESE | Total |
| 3 | 0 | 0 | 3 | 3 | 3 | 20 | 20 | 60 | 100 |

COURSE OBJECTIVES

1. To Build a foundational understanding of biomolecules, their structure, and their functional roles in sustaining life processes.
2. To Develop the ability to explain metabolic pathways and their regulation in living organisms.
3. To Cultivate skills to relate biochemical principles to physiological functions and clinical conditions.
4. To Equip learners with the competence to apply biochemical knowledge in Food analysis, pharmacy, nutrition, medicine, and biotechnology contexts.
5. To promote scientific thinking, problem solving, and analytical reasoning in biochemical investigations in Food analysis.

COURSE OUTCOMES

| | |
|-------------|---|
| CO-1 | Explain the structure and functional behaviour of biomolecules in foods, including carbohydrates, proteins, lipids, vitamins, and minerals. |
| CO-2 | Illustrate the biochemical pathways involved in food metabolism. |
| CO-3 | Apply biochemical principles to evaluate nutritional quality, bioavailability, and functional properties of food components. |
| CO-4 | Use laboratory techniques such as chromatography, electrophoresis, and spectrophotometry |
| CO-5 | Analyze biochemical constituents in food. |

| Unit | Contents | Hrs. |
|--------------|--|-----------|
| I | CARBOHYDRATES Classification, Functions, sources, Glycolysis (EMP) pathway, TCA cycle, Role of carbohydrates in food industry. | 08 |
| II | PROTEINS Classification, Functions, sources of Proteins, structure and classification of amino acids, General metabolism of amino acids – deamination, transamination, Urea cycle. Role of Proteins in food industry. | 08 |
| III | LIPIDS Classification, Functions, sources, Cholesterol transporters, synthesis of cholesterol. Role of Lipids in the Food Industry. | 08 |
| IV | VITAMINS Sources, functions and metabolism of Fat-soluble vitamins Sources, functions and metabolism of Water-soluble vitamins Role of Vitamins in food industry. | 08 |
| V | MINERALS Sources, functions, efficiency and deficiency disorder of Sodium, Potassium, Calcium, Magnesium, Phosphorous, Iron, Iodine. Role of Minerals in food industry. | 08 |
| Total | | 40 |

Suggested readings :

1. Sunetra Roday. Food Science and Nutrition. Oxford Education/Oxford University Press, 2 nd Edition, 2012.
2. Shubhangini AJ. Nutrition and Dietetics. McGraw Hill education, 4th Edition, 2015.
3. Avantina Sharma. Principles of Therapeutic and Nutrition Dietetics. CBS Publishers and Distributors, 1st Edition, 2017.
4. Ambika Shanmugam. Fundamentals of Biochemistry for Medical Students. Nagaraj and Company Pvt Ltd. 7th Edition (reprinted), 2005.
5. Vasudevan DM and Sreekumari S. Textbook of Biochemistry. Jaypee Brothers Medical Publishers Pvt Ltd. New Delhi, 3rd Edition, 2001

Reference Books :

1. Lehninger A L, Nelson D L and Cox M M (2009). Principles of Biochemistry, 6th Ed. CBS Publishers and Distributors.
2. Murray R.K, Granner D K, Mayes P A and Rodwell V W (2009). Harper's Biochemistry, 28th Ed, Lange Medical Book.
3. Hawk PB, Oser BL and Summerson WH (1954). Practical Physiological Chemistry, Mcgraw Hill, New York.
4. Sundararaj P and Siddhu A (2006). Qualitative Tests and Quantitative Procedures in Biochemistry. Elite Publishing House Pvt. Ltd., New Delhi
5. Human Nutrition and Dietetics –Davidson S. Passmore 3. Normal and Therapeutic Nutrition- Corinne. H.Robinson & Marilyn Lawler
6. Contemporary Nutrition - Gordon M. Wardlaw, Paul Insel et, al., (2000) Mosby,Chicago.
7. Nutrition- concepts and controversies- Eleanor Whitney –Eighth Edition (2000) 6. Basic principles of Nutrition- Seema Yadav, First edition (1997)
8. Essentials of Nutrition and Diet therapy -Sue Rodwell Williams, fifth edition, Times Mirror Mosby College Publishing, 1990.

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III Semester B. Tech. (Food Technology)

| | |
|-----------------------|-------------------|
| Course Code : | 25AF1503PC303 |
| Title of the Course : | FOOD MICROBIOLOGY |

| Course Scheme | | | | | Evaluation Scheme | | | | |
|---------------|---|---|-------|---------|------------------------|-----|-----|-----|-------|
| L | T | P | Total | Credits | Paper Duration in Hrs. | ISE | MSE | ESE | Total |
| 3 | 0 | 0 | 3 | 3 | 3 | 20 | 20 | 60 | 100 |

COURSE OBJECTIVES :

1. To provide fundamental knowledge of microorganisms associated with food, including their characteristics, growth, and behavior in different food environments.
2. To develop understanding of microbial spoilage, food-borne diseases, and the role of microorganisms in food fermentation.
3. To train students in essential microbiological techniques, including isolation, identification, enumeration, and detection of food-borne pathogens.
4. To familiarize students with food safety concepts, preservation methods, microbial control, and regulatory standards related to microbiological quality of foods.
5. To enhance students' analytical and problem-solving skills for evaluating microbial hazards, conducting microbiological testing, and ensuring food quality and safety in the food industry.

COURSE OUTCOMES

| | |
|------|---|
| CO-1 | Explain the contribution of pioneering scientists to microbiology and describe the structure of prokaryotic and eukaryotic cells. |
| CO-2 | Demonstrate knowledge of microbial nutrition, media preparation, growth, and isolation techniques. |
| CO-3 | Explain the role of microorganisms in food fermentation and the microbiology of fermented and dairy products. |
| CO-4 | Discuss microorganisms responsible for food spoilage and food-borne diseases, infections, and intoxications. |
| CO-5 | Apply methods for detection and enumeration of microorganisms in food and interpret microbiological criteria. |

| Unit | Contents | Hrs. |
|--------------|--|-----------|
| I | Fundamentals of Microbiology Introduction to Microbiology and its historical background. Contributions of A.V. Leeuwenhoek, Louis Pasteur, Robert Koch, Edward Jenner. Structure and function of prokaryotic and eukaryotic cells. Major classes of microorganisms: Bacteria, Viruses, Algae, Fungi, Protozoa. Structure and function of microbial cell. | 08 |
| II | Microbial Nutrition, Growth and Isolation Nutritional requirements of microorganisms; composition and types of nutritional media; preparation of media. Microbial culture: concept, types—pure and mixed. Isolation of pure cultures: pour-plate, spread-plate, streak-plate methods. Bacterial growth curve, generation time, and factors affecting microbial growth. | 08 |
| III | Food and Dairy Microbiology Scope and definition of food microbiology; history and importance. Microbes associated with food—bacteria, yeasts and molds. Fermentation: Definition and its types. Dairy microbiology: definition and composition of milk, microorganisms in milk, sources and contamination. Microbial fermentation of milk; microbiology of curd, cheese, yoghurt, butter. Microbial spoilage of milk and milk products. | 08 |
| IV | Food Spoilage and Food-Borne Diseases and Intoxications Food spoilage: factors responsible, classification of foods by perishability, biochemical changes (lipolysis, putrefaction, etc.). Introduction and classification of food-borne diseases: infection and intoxication. Bacterial infections: Salmonella, Coliforms, Shigella, Vibrio cholerae, Staphylococcus, Clostridium botulinum, Listeria monocytogenes. Fungal and viral infections. | 08 |
| V | Microbiological Analysis of Food Detection and enumeration of microorganisms in food; indicator organisms and microbiological criteria. Detection methods for bacteria: E. coli, Staphylococcus, Yersinia, Campylobacter, Bacillus, Clostridium, Salmonella, Shigella. Detection methods for viruses: Rotavirus, Hepatitis A & E, Poliovirus. Standard analytical tests for milk and foods: Breed's method, MBRT, serial dilution techniques | 08 |
| Total | | 40 |

Suggested readings:

1. W.C. Frazier & D.C. Westhoff, Food Microbiology, Tata McGraw-Hill.
2. M.J. Pelczar Jr., E.C.S. Chan, N.R. Krieg, Microbiology, TMH.
3. G.J. Banwart, Modern Food Microbiology, AVI Publication.
4. M.R. Adams, Food Microbiology.
5. 5 M.P. Doyle, Food Borne Bacterial Pathogens.
6. S.S. Purohit, Microbiology: Fundamental and Application.
7. R. Johnson & Christine L. Benjamin, Laboratory Experiments in Microbiology, Cummings.

Reference Books:

1. Bibek Ray & Arun Bhunia, Fundamental Food Microbiology.
2. Michael P. Doyle, Francisco Diez-Gonzalez, Colin Hill, Food Microbiology: Fundamentals and Frontiers.
3. Y. Salfinger (Ed.), Compendium of Methods for the Microbiological Examination of Foods
4. John Harley, Microbiology Lab Manual, 8th Ed., Tata McGraw-Hill.
5. Naveena Varghese, Microbiology Lab Manual, Pineapple Research Station Kerala.

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III Semester B. Tech. (Food Technology)

| | |
|-----------------------|-----------------------------|
| Course Code : | 25AF1503PC304 |
| Title of the Course : | FOOD PROCESS ENGINEERING- I |

| Course Scheme | | | | | Evaluation Scheme | | | | |
|---------------|---|---|-------|---------|------------------------|-----|-----|-----|-------|
| L | T | P | Total | Credits | Paper Duration in Hrs. | ISE | MSE | ESE | Total |
| 3 | 0 | 0 | 3 | 3 | 3 | 20 | 20 | 60 | 100 |

COURSE OBJECTIVES

1. To provide fundamental knowledge of engineering principles.
2. To develop the ability to analyze and solve basic food engineering problems.
3. To familiarize students with food processing equipment and systems.
4. To enable students to apply mathematical and scientific tools.
5. To prepare students for higher studies and professional careers.

COURSE OUTCOMES

| | |
|------|--|
| CO-1 | Analyze crushing and screening principles and equipment's used for them. |
| CO-2 | Awareness of different screening equipment and sieve analysis |
| CO-3 | Understand basic principles of filtration and centrifugation and design of related equipment's. |
| CO-4 | Understand construction of psychometric chart and basic principles of drying |
| CO-5 | Understand principles of evaporation and design of evaporators based on Industrial requirements. |

| Unit | Contents | Hrs. |
|--------------|---|-----------|
| I | Size reduction: Size reduction, classification, principle and mechanism of food, types of equipment, application to food industries, laws of crushing and grinding power requirements. Screening equipment, effectiveness of screens, sieve analysis, Particle size distribution | 08 |
| II | Mixing: Solid-solid mixing, liquid-liquid mixing, Basic theory of agitation, equipment, mixing characteristics, power consumption in agitator vessels, mixing index, rate of mixing, applications in food industries. | 08 |
| III | Filtration: Theory of filtration, industrial filters, equipment, applications to food industries, filter calculations and filter aids. Centrifugation :Theory of centrifugation, equipment, applications in food industries. | 08 |
| IV | The psychrometric chart: construction and use of psychrometric chart for food unit operations. Drying: Principles of drying, drying rate kinetics, Dehydration systems, and dehydration system design by mass and energy balance, drying time prediction. | 08 |
| V | Evaporation: Principle of evaporation, types and selection of evaporators, Mass and energy balance, Design of single and multiple effect evaporators, Application in food industries | 08 |
| Total | | 40 |

Suggested readings :

1. ZekiBerk.(2018).Food Process Engineering and Technology.3rd Edition. Academic Press.
2. Earle,R.L,” Unit Operations in Food Processing”, Pergamon Press,Oxford,U.K,1985.
3. Geankoplis, C. J. (2002). Transport processes and unit operations.3rd Edition. Prentice Hall of India.
4. Oulsonand Richardsons.(1998).Chemical Engineering, Vol. II, Asiali Books Pvt. Ltd.
5. McCabe and Smith, “Unit Operations,”McGraw-Hill,New York
6. Rao,D.G.(2012).Fundamentals of Food Engineering.PHIL earning Private Limited, New Delhi.
7. Albert I barzand Gustavo V.Barbosa-Cánovas.2003.Unit Operations in Food Engineering. CRC Press, Boca Raton, FL, USA.

8. J. F. Richardson, J. H. Harker and J. R. Backhurst. 2002. Coulson & Richardson's Chemical Engineering, Vol.2, Particle Technology and Separation Processes, 5th Ed. Butterworth–Heinemann, Oxford, UK.

Reference Books :

1. Treybal, R.E. (1981). Mass Transfer Operations, 3rd edition. McGraw-Hill.
2. Dennis, R.H. (1981). "Food Process Engineering. Academic Publishing and Press, King Saud University.
3. Rao, M.A., Syed S.H., Rizvi, and Ashim K. Datta. (2008). Engineering properties of foods.
4. Sahay, K.M. and Singh, K.K. (2003). UNIT Operations in Agricultural Processing.

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III Semester B. Tech. (Food Technology)

| | |
|-----------------------|---|
| Course Code : | 25AF1LAWOEM05C |
| Title of the Course : | RIGHT TO INFORMATION AND GOOD GOVERNANCE |

| Course Scheme | | | | | Evaluation Scheme | | | | |
|---------------|---|---|-------|---------|------------------------|-----|-----|-----|-------|
| L | T | P | Total | Credits | Paper Duration in Hrs. | ISE | MSE | ESE | Total |
| 3 | 0 | 0 | 3 | 3 | 3 | 20 | 20 | 60 | 100 |

COURSE OBJECTIVES :

| |
|--|
| 1. To understand the concept, evolution, and significance of the Right to Information Act, 2005. |
| 2. To familiarize students with the structure, powers, and functions of Information Commissions. |
| 3. To enable learners to analyze the principles of good governance. |
| 4. To develop practical skills for drafting RTI applications, appeals, and complaints. |
| 5. To inculcate ethical values and responsible citizenship. |

COURSE OUTCOMES (CO) :

| | |
|------|--|
| CO-1 | Students will be able to explain the key provisions, objectives, and significance of the RTI Act, 2005, and its role in ensuring transparency in public administration. |
| CO-2 | Students will be able to identify and interpret the powers, functions, and procedures of Central and State Information Commissions. |
| CO-3 | Students will be able to critically analyze the principles of good governance and evaluate how |
| CO-4 | Students will be able to draft RTI applications, first appeals, and second appeals effectively. |
| CO-5 | Students will be able to assess the challenges, limitations, and contemporary issues related to RTI implementation and propose measures to strengthen good governance practices. |

| Unit | Contents | Hrs. |
|--------------|--|-----------|
| I | History and Background to RTI, Legislating RTI, Official Secrets Act and RTI, Role of NGOs and activist in RTI, Mis-use of RTI. | 08 |
| II | Important SC and HC judgments in RTI., Constitution and RTI, Salient Features of RTI-1, Salient features of RTI-2. | 08 |
| III | Powers and Functions of Information Commission, Public Authority, Exempted Information, RTI & Its interface, Public Records Act. | 08 |
| IV | Whistleblowers Protection Act, Judiciary and RTI, Ecological perspective on RTI Lessons from RTI: Sakaala: Public Service Guarantee Act Week. | 08 |
| V | RTI: A comparative perspective, Comparative Constitutional and Comparative FOI regime RTI in Srilanka, How to Draft RTI Application and Appeals: Do it yourself. | 08 |
| Total | | 40 |

Suggested readings :

1. Right to Information Act, 2005 – Bare Act (Government of India) – For understanding the full legal text.
2. Second Administrative Reforms Commission Report – “*Right to Information: Master Key to Good Governance.*”
3. UNDP Report on Good Governance – Principles and global perspectives.
4. World Bank Governance Indicators – Transparency, accountability, rule of law, and participation.
5. Commonwealth Human Rights Initiative (CHRI) Publications on RTI – Guides for practical application and case studies.

Reference Books :

1. “Right to Information” – by Dr. S.R. Mynen
2. “Right to Information Act: A Practical Guide” – by P.K. Das
3. “Good Governance: Concept, Meaning and Practice” – by S.K. Agrawal.
4. “Right to Information and Good Governance” – by B.P. Sharma
5. “Governance in India” – by M. Laxmikanth

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III Semester B. Tech. (Food Technology)

| | |
|-----------------------|---|
| Course Code : | 25AF1504MD306 |
| Title of the Course : | UNIT OPERATIONS IN FOOD PROCESSING |

| Course Scheme | | | | | Evaluation Scheme | | | | |
|---------------|---|---|-------|---------|------------------------|-----|-----|-----|-------|
| L | T | P | Total | Credits | Paper Duration in Hrs. | ISE | MSE | ESE | Total |
| 2 | 0 | 0 | 2 | 2 | 3 | 20 | 20 | 60 | 100 |

COURSE OBJECTIVES:

1. Course objectives for Mechanical Operations in Food Technology focus on enabling students to apply engineering principles to food processing.
2. Understand and use various food processing equipment.
3. Analyze and select appropriate methods for different food materials.
4. Design and modify processing lines to improve product quality and efficiency.

COURSE OUTCOMES (CO)

| | |
|-------------|---|
| CO-1 | Students will understand the physical, mechanical, and textural properties of various food materials. |
| CO-2 | They will be able to describe the chemical composition of food and relate it to its functional properties. |
| CO-3 | Students will be able to apply the principles of sieving, filtration, and centrifugal separation to separate solids, liquids, and gases in food processing. |
| CO-4 | They will understand the concepts and equipment for particle size reduction in food products. |
| CO-5 | Students will learn about agitation, mixing, and conveying of food materials, including liquids and solids. |

| Unit | Contents | Hrs. |
|--------------|---|-----------|
| I | <i>Size Reduction:</i> Crushers and Grinders: jaw crusher, crushing rolls, Gyratory Crusher Tumbling/revolving mills, hammer Mill and Fluid energy mill. Closed and open circuits Grinding Power requirements. Laws of crushing. | 06 |
| II | <i>Mechanical Separation:</i> Screening: Stationery screens, Grizzlies, Trommel and Vibrating screens. International Standard Screens & Indian Standard Screens. Screening Analysis- differential and cumulative. | 06 |
| III | Motion of particle through a fluid: Stoke's Newton's law. Free and hindered setting 1. Setting tank and double cone classifiers 2. Batch and continuous thickeners, Settling chamber, cyclone, filter bag and electrostatic precipitators <i>Filtration:</i> Plate and frame filter press, continuous rotary vacuum filter, filter aids, theory of filtration for non-compressible cakes | 06 |
| IV | <i>Centrifugation:</i> Tubular bowl centrifuge, disk centrifuge and batch basket centrifuge. <i>Fluidization:</i> Conditions for fluidization: Aggregate and particulate fluidization. Ergun's and Carman-Kozeny equations. | 06 |
| V | <i>Mixing and Agitation:</i> Basic ideas and characteristics of mixing equipment power consumptions scale-up. <i>Conveying:</i> Mechanical and pneumatic conveying systems, storage & handling of materials | 06 |
| Total | | 30 |

Textbooks:

| | |
|----|--|
| 1. | Mc Cabe, Warren L., Smith, Juluain C. and Harroit, Peter ; Unit Operations of Chemical Engineering, 5th Edition, Mc Graw Hill Int. ed (Chemical Engineering Series) Mc Graw Hill Book Company, New York, 1993. |
| 2. | Foust, Alan S., Wenseli, Leonard A., Clump, Curtis W., mans, Louis and Anersen, L.Bryce ; : Principles of Unit Operations, Wiley International Edition, John Wiley & Sons Inc., New York. |
| 3. | Coulson, J.M. and Richardson, J.F. ; Unit Operations (Volume 2 of Chemical Engineering) New York: Mc Graw – Hill Book Co;, Inc. |
| 4. | Gupta, Santosh K. ; Momentum Transfer Operations, Tata McGraw-Hill, New Delhi. |
| 5. | Badger, Walter L. and Banchemo, Julius T. : : Introduction to Chemical Engineering, Mc Graw-Hill, Kogakusha Ltd., New Delhi. |
| 6. | Brown, C.G.: Unit Operations, John Wiley & Sons, Inc., New York. |
| 7. | Chattopadhyay, P. : Unit Operations of Chemical Engineering, Vol. I, Khanna Publishers, New Delhi. |

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|-----------------------|------------------------------|----------|--------------|----------------|-------------------------------|------------|------------|------------|--------------|
| Course Code : | 25AF1COIVE307 | | | | | | | | |
| Title of the Course : | CONSTITUTION OF INDIA | | | | | | | | |
| Course Scheme | | | | | Evaluation Scheme | | | | |
| L | T | P | Total | Credits | Paper Duration in Hrs. | ISE | MSE | ESE | Total |
| 0 | 2 | 0 | 2 | AU | - | - | - | - | AU |

| COURSE OBJECTIVES: | |
|---------------------------|---|
| 1. | To enable students to understand the history, formation, and key features of the Indian Constitution. |
| 2. | To develop knowledge of Fundamental Rights, Duties, and Directive Principles to promote responsible citizenship. |
| 3. | To familiarize students with the structure and functions of the Union and State governments. |
| 4. | To help students understand the judicial system, constitutional bodies, and their roles in ensuring justice and democracy. |
| 5. | To cultivate constitutional values such as equality, liberty, secularism, and to encourage active participation in democratic governance. |

| COURSE OUTCOMES (CO): | |
|------------------------------|---|
| CO-1 | Students will be able to explain the historical background, structure, and key features of the Indian Constitution. |
| CO-2 | Students will be able to interpret Fundamental Rights, Duties, and Directive Principles and apply them in real-life contexts. |
| CO-3 | Students will be able to describe the roles and functions of Union and State governments, including legislative, executive, and judicial branches. |
| CO-4 | Students will be able to analyze the functioning of constitutional bodies and their importance in maintaining democratic governance. |
| CO-5 | Students will be able to demonstrate understanding of constitutional values such as equality, justice, liberty, and secularism, and relate them to responsible citizenship. |

| Unit | Contents | Hrs. |
|--------------|---|-----------|
| I | Introduction to the Indian Constitution <ul style="list-style-type: none"> • Meaning, nature, and importance of the Constitution • Historical background • Making of the Indian Constitution (Constituent Assembly) • Salient features of the Constitution | 06 |
| II | Fundamental Rights & Duties <ul style="list-style-type: none"> • Fundamental Rights: types and significance • Directive Principles of State Policy (DPSP) • Fundamental Duties | 06 |
| III | Union Government <ul style="list-style-type: none"> • President: powers and functions • Prime Minister & Council of Ministers • Parliament: Lok Sabha, Rajya Sabha – powers and functions • Judiciary: Supreme Court – structure and role | 06 |
| IV | State Government & Local Governance <ul style="list-style-type: none"> • Governor: powers and functions • Chief Minister & Council of Ministers • State Legislature: Vidhan Sabha, Vidhan Parishad • Panchayati Raj & Municipalities (Local Self-Government) | 06 |
| V | Constitutional Values & Governance <ul style="list-style-type: none"> • Preamble and its significance • Secularism, Equality, Liberty, Justice • Constitutional amendments (basic concept) • Role of citizens in democracy & good governance | 06 |
| Total | | 30 |

Suggested readings :

- 1) D.D. Basu – *Introduction to the Constitution of India*
- 2) M. Laxmikanth – *Indian Polity*
- 3) Granville Austin – *The Indian Constitution: Cornerstone of a Nation*
- 4) Subhash Kashyap – *Our Constitution*

- 5) B.K. Sharma – *Introduction to the Constitution of India*

Reference Books :

- 1) P.M. Bakshi – *The Constitution of India*
- 2) J.N. Pandey – *Constitutional Law of India*
- 3) V.N. Shukla – *Constitution of India*
- 4) M. Seervai – *Constitutional Law of India*
- 5) Subhash C. Kashyap – *India's Constitution: Origin & Evolution*

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III Semester B. Tech. (Food Technology)

| | |
|-----------------------|------------------------------|
| Course Code : | 25AF1503PCL308 |
| Title of the Course : | FOOD BIOCHEMISTRY LAB |

| Course Scheme | | | | | Evaluation Scheme | | | | |
|---------------|---|---|-------|---------|------------------------|-----|-----|-----|-------|
| L | T | P | Total | Credits | Paper Duration in Hrs. | ISE | MSE | ESE | Total |
| 0 | 0 | 2 | 2 | 1 | - | 60 | - | 40 | 100 |

List of Experiments: -

1. Estimation of proteins by Lowry's method.
2. Estimation of proteins by Biuret method.
3. Estimation of amino acid by ninhydrin method.
4. Qualitative tests of Carbohydrates.
5. Qualitative tests of proteins.
6. Estimation of total carbohydrate by anthrone method.
7. Estimation of reducing sugar by dinitro-salicylic acid (DNS) method.
8. Estimation of ash content and preparation of sample for AAS analysis.
9. Estimation of fat by Soxhlet method.
10. Estimation of cholesterol by Zak's method.
11. Calculation of protein quality indices using amino acid values of given sample.

Reference Book:

1. The Food Chemistry Laboratory: A Manual for Experimental Foods, Dietetics, and Food Scientists – Connie M. Weaver & James R. Daniel
2. Nielsen's Food Analysis Laboratory Manual – Edited by B. Pam Ismail & S. Suzanne Nielsen
3. Food Analysis Laboratory Manual – S. Suzanne Nielsen (3rd Ed.)

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| | |
|-----------------------|------------------------------|
| Course Code : | 25AF1503PCL309 |
| Title of the Course : | FOOD MICROBIOLOGY LAB |

| Course Scheme | | | | | Evaluation Scheme | | | | |
|---------------|---|---|-------|---------|------------------------|-----|-----|-----|-------|
| L | T | P | Total | Credits | Paper Duration in Hrs. | ISE | MSE | ESE | Total |
| 0 | 0 | 2 | 2 | 1 | - | 60 | - | 40 | 100 |

List of Experiments: -

1. Demonstration of common equipment in microbiology lab.
2. Preparation of culture media and its sterilization.
3. Demonstration of presence of microbes and their colony characters- Soil, Water, Air, Food and Skin.
4. Isolation of pure culture by pour plate, spread plate and streak plate methods.
5. Staining techniques- simple staining, Gram's staining, negative staining, Endospore staining, capsule staining.
6. Study of motility by Hanging Drop Method.
7. Enumeration of Microorganisms from food and milk by SPC method.
8. Microbiological analysis of water- MPN method.
9. Isolation and Enumeration of Coliform from food.
10. Isolation of salmonella from food.
11. Determination of quality of Milk by MBRT.
12. Checking of pasteurization of milk by Phosphatase Test.
13. Mycotoxin producing organism and detection of Aflatoxin.
14. Microbiological examination of Canned food.
15. Anaerobic cultivation of microorganisms.
16. Cultivation of Yeast and Molds (slide Culture).

Reference Book:-

1. Analytical Food Microbiology: A Laboratory Manual – Ahmed E. Yousef, Joy G. Waite-Cusic, Jennifer J. Perry
2. Food Microbiology Laboratory (1st Ed.) – Lynne McLandsborough
3. Food Microbiology Laboratory for the Food Science Student: A Practical Approach – Cangliang Shen, Yifan Zhang

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Detailed Syllabus

III Semester B. Tech. (Food Technology)

| | |
|-----------------------|--|
| Course Code : | 25AF1503HM310 |
| Title of the Course : | BASICS OF FINANCE AND ECONOMICS |

| Course Scheme | | | | | Evaluation Scheme | | | | |
|---------------|---|---|-------|---------|------------------------|-----|-----|-----|-------|
| L | T | P | Total | Credits | Paper Duration in Hrs. | ISE | MSE | ESE | Total |
| 0 | 2 | 0 | 2 | 2 | --- | 50 | -- | -- | 50 |

COURSE OBJECTIVES:

1.To provide students with foundational knowledge of economics, including the meaning, scope, and importance of economic concepts such as demand, supply, and market equilibrium.

2.To develop an understanding of consumer and producer behavior through the study of utility, production functions, cost and revenue concepts, economies of scale, and basic market structures.

3.To equip students with essential financial knowledge related to the meaning, scope, goals of finance, time value of money, and various sources of short-term and long-term finance.

4.To familiarize students with the structure and functioning of banking systems, central banks, NBFCs, stock exchanges, and the insurance sector.

5.To enable students to understand the Indian economic and financial environment, including GDP, national income, inflation, fiscal and monetary policies, and government budgeting.

COURSE OUTCOMES (CO)

| | |
|------|---|
| CO-1 | Explain the basic concepts, scope, and importance of economics, including demand, supply, and market equilibrium. |
| CO-2 | Analyze consumer and producer behavior using concepts of utility, cost, revenue, production function, and market structures. |
| CO-3 | Describe the meaning, scope, and goals of finance along with financial markets, sources of finance, and time value of money. |
| CO-4 | Explain the structure and functions of banking, central banking, NBFCs, stock exchanges, and insurance sector. |
| CO-5 | Discuss key aspects of the Indian economic environment including GDP, national income, inflation, fiscal and monetary policies, and government budgets. |

| Unit | Contents | Hrs. |
|--------------|--|-----------|
| I | Introduction to Economics <ul style="list-style-type: none"> • Meaning, scope, and importance of economics • Microeconomics vs. macroeconomics • Basic economic problems • Concepts of demand and supply • Market equilibrium (basic idea) | 06 |
| II | Consumer & Producer Behavior <ul style="list-style-type: none"> • Utility, consumer surplus • Production function (concept only) • Cost and revenue concepts • Economies and diseconomies of scale • Types of markets (perfect competition, monopoly – basic features) | 06 |
| III | Introduction to Finance <ul style="list-style-type: none"> • Meaning, scope, and goals of finance • Role of financial management • Time value of money (basic) • Sources of finance: short-term and long-term • Financial markets: money market & capital market | 06 |
| IV | Banking & Financial Institutions <ul style="list-style-type: none"> • Functions of commercial banks • Central bank: role and functions • Non-banking financial institutions (NBFCs – concept) • Introduction to stock exchanges • Insurance sector basics | 06 |
| V | Indian Economic & Financial Environment <ul style="list-style-type: none"> • Overview of Indian economy • Inflation: meaning and types • GDP, national income (basic concepts) • Fiscal policy and monetary policy • Government budgets and taxes (basics) | 06 |
| Total | | 30 |

Suggested readings :

1. N. Gregory Mankiw – Principles of Economics
2. H. L. Ahuja – Principles of Microeconomics
3. S. Chand Publications – Business Economics
4. P. L. Mehta – Managerial Economics
5. Prasanna Chandra – Fundamentals of Financial Management
6. K. P. M. Sundharam & E. N. Sundharam – Money, Banking and International Trade

Reference Books :

1. Paul Samuelson & William Nordhaus – Economics
2. Dornbusch, Fischer & Startz – Macroeconomics
3. C. Rangarajan – Indian Economy: Essays on Money and Finance
4. S. Gurusamy – Financial Markets and Institutions
5. B. N. Ghosh & Rama Ghosh – Fundamentals of Monetary Economics
6. R. K. Lekhi & Joginder Singh – Indian Economy

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Detailed Syllabus

III Semester B. Tech. (Food Technology)

| | |
|-----------------------|--|
| Course Code : | 25AF1503CP311 |
| Title of the Course : | Community Engineering Project/Field Project |

| Course Scheme | | | | | Evaluation Scheme | | | | |
|---------------|---|---|-------|---------|------------------------|-----|-----|-----|-------|
| L | T | P | Total | Credits | Paper Duration in Hrs. | ISE | MSE | ESE | Total |
| 0 | 0 | 2 | 2 | 1 | --- | 60 | -- | 40 | 100 |

COURSE OBJECTIVES:

- 1.Expose students to real-world community food and nutrition challenges.
- 2.Develop problem-solving and innovation skills in food processing, preservation, safety, and quality.
- 3.Encourage teamwork, leadership, community interaction, and social responsibility.
- 4.Apply food engineering principles to develop sustainable, low-cost solutions.
- 5.Strengthen communication, reporting, and project documentation skills.

COURSE OUTCOMES (CO)

| | |
|------|---|
| CO-1 | Identify community-level problems related to food, nutrition, hygiene, agriculture, and processing. |
| CO-2 | Analyze food-related issues using scientific and engineering approaches. |
| CO-3 | Design feasible, sustainable, and affordable solutions through community-based projects. |
| CO-4 | Implement prototypes or demonstrations addressing community needs |
| CO-5 | Communicate project findings effectively through reports, presentations, and community outreach. |

| | Contents | Hrs. |
|--|--|-------------|
| | Students may select one of the following ELP Modules <ol style="list-style-type: none">1. Drying and Dehydrations of fruits and vegetables2. Fruits and Vegetable Products3. Beverages and other Innovative Products4. Spice Products5. Postharvest management and marketing of Fresh Fruits and Vegetables6. Egg, Poultry and Meat Processing7. Bakery Products8. Grain based Products (Cereal, Legumes/pulses and oilseeds)9. Chocolate, Confectionary and Snack Products10. Traditional, Heritage Food Products11. Milk and Milk products12. Processing of Fish and Fish Products13. Functional Foods and Nutraceuticals | |
| | Total | 60 |

Suggested Readings:

1. FAO — Community Nutrition and Food Security
2. C. S. James — Analytical Chemistry of Foods
3. Potter & Hotchkiss — Food Science
4. Srilakshmi — Nutrition Science
5. Norman Potter — Food Microbiology
6. WHO — Guidelines on Food Safety and Hygiene
7. Sivasankar — Food Processing and Preservation
8. N. Shakuntala Manay — Foods: Facts and Principles
9. Ranganna — Handbook of Analysis and Quality Control for Fruit & Vegetable Products
10. R. Desrosier — The Technology of Food Preservation
11. Frazier & Westhoff — Food Microbiology
12. K. K. Sharma — Community Health & Nutrition

SEMESTER-IV

| Sr. No. | Course Code | Course Title | Teaching Scheme | | | Evaluation Scheme | | | | Credit |
|--------------|--|---|-----------------|----------|----------|-------------------|------------|------------|-------------|-----------|
| | | | L | T | P | ISE | MSE | ESE | Total | |
| 1 | 25AF1503PC401 | Food Process Engineering – II | 3 | 0 | 0 | 20 | 20 | 60 | 100 | 3 |
| 2 | 25AF1503PC402 | Food Additives | 3 | 0 | 0 | 20 | 20 | 60 | 100 | 3 |
| 3 | 25AF1503PC403 | Human Nutrition and Nutraceuticals | 3 | 0 | 0 | 20 | 20 | 60 | 100 | 3 |
| 4 | 25AF1503PCL404 | Food Additives and Nutrition Lab | 0 | 0 | 2 | 60 | - | 40 | 100 | 2 |
| 5 | 25AF10THOEM05 | OPEN ELECTIVE-II A. Heat and mass transfer B. ICT C. Chemical Reaction Engineering | 3 | 0 | 0 | 20 | 20 | 60 | 100 | 3 |
| 6 | 25AF1503MD406 | MDM Bucket* (Technology of Spices and Plantation crops) | 3 | 0 | 0 | 20 | 20 | 60 | 100 | 3 |
| 7 | 25AF1503PCL407 | Food Process Engineering Lab | 0 | 0 | 2 | 60 | - | 40 | 100 | 1 |
| 8 | 25AF1000VE408A | Life of Chatrapati Shivaji Maharaj | 1 | 0 | 0 | 50 | - | - | 50 | 1 |
| 9 | 25AF1UHVVE409 | Universal Human Values | 2 | 1 | 0 | 20 | 20 | 60 | 100 | 3 |
| 10 | 25AF1000AE410A 25AF1000AE410B 25AF1000AE410C | Modern Indian Language A) Marathi B) Hindi C) Sanskrit | 1 | 0 | 0 | 20 | 20 | 60 | 100 | 1 |
| 11 | 25AF1000HM411 | Intellectual Property Rights | 1 | 0 | 0 | 20 | 20 | 60 | 100 | 1 |
| TOTAL | | | 20 | 1 | 4 | 370 | 140 | 540 | 1050 | 24 |

List of Multidisciplinary minor courses offered by Department of Food Technology

| Sem | Course Title | Teaching Scheme | | | Evaluation Scheme | | | | |
|-----|---|-----------------|----------|----------|-------------------|------------|------------|------------|----------------|
| | | L | T | P | CA | MSE | ESE | Total | No. of Credits |
| III | Unit Operations in Food Processing | 2 | - | - | 20 | 20 | 60 | 100 | 2 |
| IV | Technology of Spices and Plantation Crops | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| V | Food Supply Chain Management | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| VI | Food by-products and waste utilization | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| VII | Applied Statistics | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| | Total | 14 | - | - | 100 | 100 | 300 | 500 | 14 |

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Detailed Syllabus

IV Semester B. Tech. (Food Technology)

| | |
|-----------------------|------------------------------|
| Course Code : | 25AF1503PC401 |
| Title of the Course : | FOOD PROCESS ENGINEERING- II |

| Course Scheme | | | | Evaluation Scheme | | | | |
|---------------|---|-------|---------|------------------------|----|-----|-----|-------|
| T | P | Total | Credits | Paper Duration in Hrs. | CA | MSE | ESE | Total |
| 3 | 0 | 3 | 3 | 3 | 20 | 20 | 60 | 100 |

COURSE OBJECTIVES

1. To understand the principles and applications of heat transfer in food processing operations such as pasteurization, sterilization, evaporation, and refrigeration.
2. To study mass transfer operations including drying, dehydration, and concentration of foods, and their impact on food quality and shelf life.
3. To learn the design, working, and performance evaluation of food processing equipment like heat exchangers, evaporators, dryers, and freezers.
4. To develop the ability to analyze and solve numerical problems related to heat and mass transfer in food processing systems.
5. To understand the energy efficiency and optimization of food processing operations while ensuring product safety and quality.

COURSE OUTCOMES (CO)

| | |
|------|---|
| CO-1 | Understand basic principles and design concepts of distillation. |
| CO-2 | Knowing the leaching process, equilibrium relationship, application and equipments used for extraction Process |
| CO-3 | Understand basic principles of thermal processing and its applications in food processing. |
| CO-4 | Understand basic principles of refrigeration and freezing and its application in food processing. |
| CO-5 | To provide students with a fundamental understanding of the principles and practices of crystallization involved in food processing |

| Unit | Contents | Hrs. |
|-------------|---|-------------|
| I | Distillation: Vapor liquid equilibrium, Distillation methods – flash distillation, differential distillation for binary systems, steam distillation, optimum reflux ratio, applications to food industries. Fractionation of binary mixtures using McCabe – Thiele method | 08 |
| II | Extraction: Types of extraction, Leaching process, preparation of solids, rate of leaching, equilibrium relations, calculations, equipment and application in food industries. | 08 |
| III | Thermal processing: Principles of Blanching, Pasteurization and Sterilization. Microbial survivor curves, thermal death time F, spoilage probability, methods for process calculations. | 08 |
| IV | Refrigeration and Freezing Refrigeration: Refrigeration system and its components. Selection of a refrigerant. Cold– storage plants Freezing: Food Freezing systems, Frozen food properties, Calculation of freezing time by Plank's equation and other modified methods | 08 |
| V | Crystallization Theory and principles of Crystallization, nucleation, crystal growth, crystallization equipment, applications of crystallization in food processing | 08 |
| | | 40 |

Suggested Books:

1. Zeki Berk. (2018). Food Process Engineering and Technology. 3rd Edition. Academic Press. 1985 McCabe and Smith “Unit Operations” McGraw-Hill, New York.
2. Dutta Binay K. Principles of mass transfer and Transportation systems. PHI Learning Private limited New Delhi 2009
3. Coulson and Richardsons. (1998). Chemical Engineering, Vol II, Asiali Books Pvt Ltd.
4. Earle, R.L., “Unit operations in food processing”, Pergamon Press, Oxford, U.K,
5. Singh, R.P., and Heldman, D.R. (2001). Introduction to Food Engineering, 3rd ed., Academic Press, San Diego, CA. Academic Press publications. 69–78, 144–157. 3.
6. Albert Ibarz and Gustavo V. Barbosa-Cánovas. 2003. Unit
7. Operations in Food Engineering. CRC Press, Boca Raton, FL, USA.
8. Geankoplis, C. J. (2002). Transport processes and unit operations. 3rd Edition. Prentice Hall of India.
9. Rao, D. G. (2012). Fundamental of Food Engineering. PHI Learning Private Limited, New Delhi.

Reference Books:

1. Treybal, R. E. (1981). Mass Transfer Operations. 3rd edition. McGraw Hill.
2. Dennis, R.H. (1981). "Food Process Engineering. Academic Publishing and Press, King SaudUniversity.
3. Rao, M.A. Syed S.H. Rizvi, and Ashim K. Datta. (2008). Engineering properties of foods. CRCPress.
4. Sahay, K.M. and Singh, K. K. (2003). UNIT Operations in Agricultural Processing. Vikas Publishing House Pvt. Ltd., New Delhi.
5. George D. Saravacos and Athanasios E. Kostaropoulos. 2002. Handbook of Food Processing Equipment. Springer Science +
6. Business Media, New York, USA.

Suggested Links:

1. https://onlinecourses.nptel.ac.in/noc24_ag03/preview
2. <http://rpaulsingh.com/course/index.html>
3. <https://encyclopedia.che.engin.umich.edu/dryers/>

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Detailed Syllabus

IV Semester B. Tech. (Food Technology)

| | |
|-----------------------|-----------------------|
| Course Code : | 25AF1503PC402 |
| Title of the Course : | FOOD ADDITIVES |

| Course Scheme | | | | | Evaluation Scheme | | | | |
|---------------|---|---|-------|---------|------------------------|-----|-----|-----|-------|
| L | T | P | Total | Credits | Paper Duration in Hrs. | ISE | MSE | ESE | Total |
| 3 | 0 | 0 | 3 | 3 | 3 | 20 | 20 | 60 | 100 |

| COURSE OBJECTIVES : | |
|----------------------------|---|
| 1. | Understand the need, role, and safety aspects of food additives in modern food processing. |
| 2. | Gain knowledge of classification, functions, regulatory limits, and applications of food additives. |
| 3. | Develop awareness about food contaminants, adulterants, and toxic substances affecting food safety. |
| 4. | Interpret national and international food additive regulations relevant to the food industry. |
| 5. | To familiarize students with the application of food additives in different food products and current trends in the use of natural and synthetic additives. |

| COURSE OUTCOME (CO) | |
|------------------------------|---|
| CO-1 | Understand the concept, classification, and regulatory framework governing food additives. |
| CO-2 | Explain the functions, applications, permitted limits, and safety concerns of major food additives. |
| CO-3 | Identify food contaminants and adulterants, their sources, and health impacts. |
| CO-4 | Understand toxicological aspects, risk assessment, and control measures for additives and contaminants. |
| CO-5 | Apply knowledge of food additives and contaminants in food product formulation and quality control. |

| Unit | Contents | Hrs. |
|------|--|------|
| I | <p>Introduction to Food Additives</p> <ul style="list-style-type: none"> • Definition and importance of food additives • Historical development and need for food additives • Classification of food additives: Intentional and unintentional additives • Functions of food additives in food processing • Regulatory bodies and standards: FSSAI, Codex Alimentarius, FDA, EFSA • Concept of ADI (Acceptable Daily Intake) • GRAS substances – definition and examples | 07 |
| II | <p>Major Classes of Food Additives</p> <p>Definition, examples (with E-numbers), mechanism of action, applications, permitted limits, and health effects of:</p> <ol style="list-style-type: none"> 1. Preservatives 2. Sweeteners (nutritive & non-nutritive) 3. Antioxidants 4. Emulsifiers 5. Stabilizers and Thickeners 6. Anti-caking agents and Humectants 7. Chelating agents 8. Firming agents | 11 |
| III | <p>Colouring, Flavouring and Texture-Modifying Additives</p> <ul style="list-style-type: none"> • Food colours: Natural vs synthetic colours, Stability, safety, and regulations • Flavouring agents: Natural, nature-identical, and artificial flavours • Flavour enhancers (e.g., MSG) • Texture-modifying additives: Gums, hydrocolloids, and their role in food structure • Health concerns related to excessive use | 08 |
| IV | <p>Food Contaminants and Adulterants</p> <ul style="list-style-type: none"> • Definition and classification of food contaminants • Sources of contamination in food chain • Types of contaminants: Chemical contaminants (pesticide residues, heavy metals), Biological contaminants (toxins, mycotoxins), Physical contaminants • Food adulteration: definition and common adulterants • Health effects and preventive measures • Regulatory limits for contaminants (FSSAI perspective) | 08 |

| | | |
|----------|--|-----------|
| V | Toxicology, Risk Assessment and Control <ul style="list-style-type: none"> • Basic principles of food toxicology • Acute and chronic toxicity • Risk assessment of food additives and contaminants • Safety evaluation procedures • Monitoring and control strategies in food industry • Consumer awareness and labeling regulations. | 06 |
| | Total | 40 |

Suggested readings :

1. Mahindru, S.N. – *Food Additives: Characteristics, Detection and Estimation*, Tata McGraw-Hill.
2. Wilson, B.G. – *Food Additives*, Woodhead Publishing.
3. Ashurst, P.R. – *Food Flavorings*, Springer.
4. Handbook of Food Chemistry (Springer)
5. Toxins and Contaminants in Indian Food Products
6. Food Adulterants and Contaminants (Gopal Kumar Sharma, Janifer Raj Xavier & Ajay Singh)
7. Essential Guide to Food Additives (Royal Society of Chemistry)

REFERENCE BOOKS :

1. Branen, A.L., Davidson, P.M., Salminen, S., Thorngate, J. – *Food Additives*, CRC Press.
2. Fennema, O.R. – *Food Chemistry*, CRC Press.
3. Vaclavik, V.A. & Christian, E.W. – *Essentials of Food Science*, Springer.
4. Codex Alimentarius Commission – Food Additives Standards.
5. FSSAI Manuals and Regulations on Food Additives and Contaminants
6. Food Additives Data Book — Jim Smith & Lily Hong-Shum (Wiley)

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Detailed Syllabus

IV Semester B.Tech. (Food Technology)

| | |
|-----------------------|---|
| Course Code : | 25AF1503PC403 |
| Title of the Course : | Human Nutrition and Nutraceuticals |

| Course Scheme | | | | | Evaluation Scheme | | | | |
|---------------|---|---|-------|---------|------------------------|-----|-----|-----|-------|
| L | T | P | Total | Credits | Paper Duration in Hrs. | ISE | MSE | ESE | Total |
| 3 | 0 | 0 | 3 | 3 | 3 | 20 | 20 | 60 | 100 |

COURSE OBJECTIVES:

1. To understand the basics and principles of human nutrition and its physiological role of in maintaining health and preventing diseases.
2. To study nutritional requirements and dietary guidelines for different age groups, genders, and physiological conditions based on ICMR and WHO recommendations.
3. To develop the ability to assess nutritional status using anthropometric, biochemical, clinical, and dietary assessment methods
4. To introduce the concept of nutraceuticals, functional foods, and dietary supplements and their role in health promotion.
5. To understand the role of nutraceuticals in the prevention and management of lifestyle-related disorders, along with regulatory aspects, safety, and quality considerations.

COURSE OUTCOMES (CO)

| | |
|-------------|--|
| CO-1 | Explain the principles of human nutrition, nutrient classification, digestion, absorption, metabolism, and their role in maintaining health and preventing diseases. |
| CO-2 | Analyze the nutritional requirements across different age groups and physiological conditions using ICMR Recommended Dietary Allowances (RDA). |
| CO-3 | Evaluate the role of nutraceuticals, functional foods, probiotics, and dietary supplements in the prevention and management of lifestyle-related disorders. |
| CO-4 | Apply analytical techniques to assess the nutritional composition, antioxidant activity, and quality of nutraceutical and functional food products. |
| CO-5 | Interpret food laws, FSSAI regulations, labeling requirements, and health claims related to nutraceuticals and dietary supplements, ensuring ethical and safe usage. |

| Unit | Contents | Hrs. |
|------------|---|-----------|
| I | <p>INTRODUCTION TO HUMAN NUTRITION</p> <ul style="list-style-type: none"> • Definition and scope of human nutrition • Relationship between food, nutrition, and health • Basic concepts: nutrients, diet, balanced diet • Classification of nutrients • Balanced diet and food groups • Nutritional status and its assessment (anthropometric, biochemical, clinical, dietary methods) • Recommended Dietary Allowances (RDA) – ICMR/NIN | 08 |
| II | <p>DIGESTION, ENERGY & HEALTH</p> <ul style="list-style-type: none"> • Human Digestive system • Digestion and absorption of nutrients • Concept of energy and calorie • Basal Metabolic Rate (BMR), Factors affecting BMR • Concept of malnutrition (undernutrition & overnutrition) • Common nutrition-related disorders (overview): <ol style="list-style-type: none"> a. Obesity b. Diabetes c. Cardiovascular diseases d. Anemia (conceptual) | 08 |
| III | <p>COMMUNITY AND PUBLIC HEALTH NUTRITION</p> <ul style="list-style-type: none"> • Concept and objectives of community nutrition • Nutrition problems in India • Food fortification and supplementation • National Nutrition Programs in India: <ol style="list-style-type: none"> a. ICDS b. Mid-Day Meal Scheme c. POSHAN Abhiyaan d. National Health Mission • Role of nutrition education in public health • Basic concepts of food safety and hygiene | 08 |

| | | |
|--------------|---|-----------|
| IV | INTRODUCTION TO NUTRACEUTICALS <ul style="list-style-type: none">• Concept Nutraceuticals, Classification of nutraceuticals• Difference between nutraceuticals, functional foods, dietary supplements & pharmaceuticals• Role of nutraceuticals in health promotion and disease prevention• Phytochemicals: polyphenols, flavonoids, carotenoids, alkaloids• Probiotics, Prebiotics & Synbiotics | 08 |
| V | NUTRACEUTICALS IN DISEASE MANAGEMENT <ul style="list-style-type: none">• Nutraceuticals in cardiovascular diseases• Nutraceuticals in diabetes management• Nutraceuticals for cancer prevention• Immunomodulatory nutraceuticals• Role of nutraceuticals in obesity and weight management• Nutraceuticals for bone health and osteoporosis• Nutraceuticals for brain health and aging | 08 |
| Total | | 40 |

Suggested Readings :

1. Gibson, R. S. (2005). *Principles of Nutritional Assessment*. Oxford University Press.
2. Wardlaw, G. M., Smith, A. M., & Collene, A. L. (2019). *Contemporary Nutrition*. McGraw-Hill Education.
3. Srilakshmi, B. (2017). *Nutrition Science*. New Age International Publishers, New Delhi.
4. Mahan, L. K., Raymond, J. L., & Krause, M. V. (2020).
5. *Krause's Food & the Nutrition Care Process*. Elsevier. Wildman, R. E. C. (Ed.). (2016).
6. *Handbook of Nutraceuticals and Functional Foods*. CRC Press, Taylor & Francis. Bagchi, D. (Ed.). (2019).
7. *Nutraceuticals and Functional Foods in Human Health and Disease Prevention*. CRC Press. ICMR–NIN (2020).
8. Food Safety and Standards (Health Supplements, Nutraceuticals, Food for Special Dietary Use) Regulations.

Reference Books

1. Human Nutrition and Dietetics — Garrow, J.S., James, W.P.T., & Ralph A.
2. Text Book of Human Nutrition — M. Bamji, N. Prahlad & R. Vinodhini
3. Advanced Textbook on Food and Nutrition (Vol. 1) — M. Swaminathan
4. Food Facts and Principles — S.N. Manay & M. Sadaksharaswami
5. *Functional Foods and Nutraceuticals: Bioactive Components, Formulations and Innovations* Springer (2020)
6. *Handbook of Nutraceuticals and Functional Foods* — Wildman & Bruno (3rd Ed.)
7. *Nutraceuticals and Functional Foods in Human Health and Disease Prevention* — Bagchi, Preuss & Swaroop

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Detailed Syllabus

IV Semester B. Tech. (Food Technology)

| | |
|-----------------------|---|
| Course Code : | 25AF1503PCL404 |
| Title of the Course : | FOOD ADDITIVES AND NUTRITION LAB |

| Course Scheme | | | | | Evaluation Scheme | | | | |
|---------------|---|---|-------|---------|-------------------|-----|-----|-------|--|
| L | T | P | Total | Credits | ISE | MSE | ESE | Total | |
| 0 | 0 | 2 | 2 | 2 | 60 | - | 40 | 100 | |

List of Experiments:

1. Detect benzoic acid in fruit juice or squash using Ferric Chloride Test.
2. Estimate total acidity (as citric acid) in a processed food sample using acid–base titration method.
3. Identify synthetic food colours in beverages or confectionery using paper chromatography method.
4. Detect saccharin in given food samples using Resorcinol Test.
5. Prepare a food emulsion using lecithin as emulsifier and study its stability by creaming index method.
6. Prepare a gel using gelatin / starch / pectin and evaluate its gel strength and syneresis.
7. Detect food adulterants using standard tests:
 - Starch in milk by Iodine Test
 - Metanil yellow in turmeric powder by Concentrated HCl Test
8. Diet Survey and Nutritional Assessment:
Assessment of dietary intake using 24-hour recall method and food frequency questionnaire (FFQ).
9. Calculation of Energy and Nutrient Requirements:
Determination of energy, protein, fat, and carbohydrate requirements using ICMR/NIN guidelines.
10. Anthropometric Measurements:
Measurement of height, weight, BMI, waist–hip ratio and interpretation of nutritional status.
11. Assessment of Basal Metabolic Rate (BMR) :
Calculation of BMR using predictive equations (Harris-Benedict/ICMR formula).
12. Planning of Balanced Diets:
Balanced diet planning for infants, adolescents, pregnant women, lactating mothers, and elderly.
13. Market Survey of Nutraceutical Products :

- Survey and comparative analysis of nutraceutical products available in the Indian market.
14. Case Study on Nutritional Disorders and Nutraceutical Intervention Diet ,planning for anemia, diabetes, obesity, or cardiovascular disorders using nutraceuticals.

SUGGESTED LAB MANUAL / REFERENCES :

1. Ranganna, S. – Handbook of Analysis and Quality Control for Fruit and Vegetable Products, Tata McGraw-Hill.
2. AOAC – Official Methods of Analysis.
3. FSSAI – Manuals of Methods of Analysis of Foods.
4. Branen et al. – Food Additives, CRC Press.
5. Food Additive User’s Handbook – Edited by Jim Smith.
6. Chemistry and Hygiene of Food Additives – *Springer Link* (Authors: various)
7. Food Analysis Laboratory Manual – *S. Suzanne Nielsen*
8. Nielsen’s Food Analysis Laboratory Manual – Edited by B. Pam Ismail & S. Suzanne Nielsen
9. Food Composition and Analysis – Springer (Various Authors)
10. Food Nutrition, Science and Technology – *Neelam Singh & I. S. Singh*

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Detailed Syllabus

IV Semester B.Tech. (Food Technology)

| | |
|-----------------------|----------------------------------|
| Course Code : | 25AF10THOEM05 |
| Title of the Course : | A) HEAT AND MASS TRANSFER |

| Course Scheme | | | | | Evaluation Scheme | | | | |
|---------------|---|---|-------|---------|------------------------|-----|-----|-----|-------|
| L | T | P | Total | Credits | Paper Duration in Hrs. | ISE | MSE | ESE | Total |
| 3 | 0 | 0 | 3 | 3 | 3 | 20 | 20 | 60 | 100 |

| COURSE OBJECTIVES : | |
|----------------------------|--|
| 1. | To understand Fundamental laws and mechanisms of heat (conduction, convection, radiation) and mass transfer (diffusion, convection). |
| 2. | To develop skills to analyze heat and mass transfer in simple and complex systems, including phase changes (boiling, condensation). |
| 3. | To solve Problems for various geometries and conditions (steady, unsteady, 1D, 2D). |
| 4. | To design equipment like heat exchangers, condensers, evaporators, and distillation columns |

| COURSE OUTCOMES (CO) | |
|-------------------------------|--|
| CO-1 | Students will be able to distinguish between steady/unsteady heat transfer and their applications. |
| CO-2 | Students will be able to analyze radiation heat transfer, including shields. |
| CO-3 | Students will understand vapor-liquid equilibrium and mass transfer theories (HTU, NTU). |
| CO-4 | Students will able to calculate heat/mass transfer coefficients and overall coefficients. |
| CO-5 | Students will be able to estimate heat loss/gain and determine insulation requirements. |

| Unit | Contents | Hrs. |
|--------------|---|-----------|
| I | Basic heat transfer processes, Heat transfer coefficients, properties related to heat transfer; One-dimensional steady state conduction, Theory of heat conduction, Fourier's law and its derivation | 07 |
| II | Heat transfer through composite walls one-dimensional steady state heat conduction with heat generation, Heat flow through slab, hollow sphere and cylinder with linear heat transfer, Convection: Forced and free convection | 07 |
| III | Use of dimensional analysis for correlating variables affecting convection heat transfer Concept of Nusselt number, Prandtl number, Reynolds number, Grashoff number, some important empirical relations used for determination of heat transfer coefficient | 07 |
| IV | Radiation: Heat radiation, emissivity, absorptivity, transmissivity, radiation through black and grey surfaces | 08 |
| V | Heat Exchangers: General discussion, fouling factors, jacketed kettles, LMTD, parallel and counter flow heat exchangers, shell and tube and plate heat exchanger, heat exchanger design Application of different types of heat exchangers in dairy and food industry | 08 |
| VI | Mass transfer: Mass transfer operations, Selection of mass transfer operation, Diffusion, Mass transfer coefficient, Theories of mass transfer, Fick's law of diffusion, steady state diffusion of gases and liquids through solids, application in food industry. Construction working and design of mass transfer equipments: Distillation column and Absorption column | 08 |
| Total | | 45 |

Suggested readings :

1. Heat and Mass Transfer , Nag P , McGraw Hill, 2011
2. Heat and Mass Transfer – Fundamentals and Applications, Yunus AC and Afshin JG, McGraw Hill, 2015
3. Heat Transfer, Gupta CP, Prentice Hall of Media, New Delhi 1994
4. Heat Transfer , J.P. Holman, 10th Ed. McGraw-Hill Book Co., Boston, USA. 2010

Reference books :

1. Heat Transfer in Process Engineering. Eduardo Cao, The McGraw-Hill Companies, Inc., New York, USA. 2010
2. A Heat Transfer Textbook, John HL and John HL, Phlogiston Press, Cambridge, MA, USA. 2008
3. Unit Operations of Chemical Engineering, Warren LM, Julian S. and Peter H., 7th Ed. McGraw-Hill, Inc., NY, USA. 2004
4. Transport Processes and Separation Process Principles (Includes Unit Operations), Christie John Geankoplis, 4th Ed. Prentice-Hall, NY, USA. 2003

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Detailed Syllabus

IV Semester B.Tech. (Food Technology)

| | |
|-----------------------|--|
| Course Code : | 25AF10THOEM05 |
| Title of the Course : | B) Information and Communication Technology |

| Course Scheme | | | | | Evaluation Scheme | | | | |
|---------------|---|---|-------|---------|------------------------|-----|-----|-----|-------|
| L | T | P | Total | Credits | Paper Duration in Hrs. | ISE | MSE | ESE | Total |
| 3 | 0 | 0 | 3 | 3 | 3 | 20 | 20 | 60 | 100 |

| COURSE OBJECTIVES : | |
|----------------------------|---|
| 1. | To understand core ICT concepts, terminology, hardware, software, and network components. |
| 2. | To gain hands-on experience with programming, databases (DBMS), networking (LANs, routing), cybersecurity, and common software (spreadsheets, documentation). |
| 3. | To learn how ICT impacts business, communication, and data management, and how to use tools for information retrieval and problem-solving. |
| 4. | To develop communication (listening, writing, presenting), critical thinking, collaboration, and entrepreneurial skills. |
| 5. | To understand ethical considerations, security protocols, and the social responsibility of using technology. |

| COURSE OUTCOMES (CO) | |
|-------------------------------|---|
| CO-1 | Students will be able to analyze problems, design algorithms, and plan ICT implementations. |
| CO-2 | Students will be able to understand codes, databases, etc |
| CO-3 | Students will communicate effectively in digital environments, present ideas, and work in teams. |
| CO-4 | Students will use various ICT tools for data analysis, digital documentation, multimedia creation, and efficient information retrieval. |
| CO-5 | Students will apply knowledge of data transmission, storage, network performance, and cybersecurity principles. |

| Unit | Contents | Hrs. |
|--------------|--|-----------|
| I | Introduction to Computers, Definition: Hardware, Software & firmware. Types of software. Data Representation, Number systems (Binary, Hexadecimal). Difference between ASCII & UNICODE (Different Encoding Schemes) | 07 |
| II | Primary , Secondary Memory , Units used for measurement of memory , Input Output devices, Operating Systems, definition and types | 07 |
| III | File Management. Applications used for document creation & Editing, Data presentation using slides | 07 |
| IV | Use of Spreadsheets for statistical analysis, evaluating mathematical & logical expressions. Use of Spreadsheets for Interpretation and graph creation. | 08 |
| V | Database, concepts and types, uses of DBMS/RDBMS in Agriculture Database design, creation, Preparation of presentation. Import export operations, using numerical tabular data/text/graph /slides within different applications using cut-paste. Smartphone Apps in Agriculture for farm advises, market price, postharvest management etc; | 08 |
| VI | Geospatial technology for generating valuable agri-information Decision support systems, concepts, components and applications in Agriculture, Agriculture Expert System, Soil Information Systems etc for supporting Farm decisions. Communication process, Berlo' s model, feedback and barriers to communication. | 08 |
| Total | | 45 |

Suggested readings :

1. Computer Fundamentals, Pradeep K. Sinha and Priti Sinha, III edition, BPB Publications, B-14, Connaught Place, New Delhi – 110 001
2. Computer Fundamentals, P.K. Sinha, BPB Publications, B-14, Connaught Place, New Delhi – 110 001.

Reference books :

1. Mastering Office Professional for window 95, BPB Publications, B-14, Connaught Place, New Delhi – 110 001.
2. Statistical Methods for Agricultural workers by V.G. Panse and P.V. Sukhatma, ICAR, New Delhi.
3. http://www.tutorialsforopenoffice.org/category_index/base.html <http://mkisan.gov.in/downloadmobileapps.aspx>
<http://www.nrsc.gov.in/Agriculture>
4. <http://iasri.res.in/>
5. <http://communicationtheory.org/berlos-smcr-model-of-communication/>

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Detailed Syllabus

IV Semester B.Tech. (Food Technology)

| | |
|-----------------------|---|
| Course Code : | 25AF10THOEM05 |
| Title of the Course : | C) Chemical Reaction Engineering |

| Course Scheme | | | | | Evaluation Scheme | | | | |
|---------------|---|---|-------|---------|------------------------|-----|-----|-----|-------|
| L | T | P | Total | Credits | Paper Duration in Hrs. | ISE | MSE | ESE | Total |
| 3 | 0 | 0 | 3 | 3 | 3 | 20 | 20 | 60 | 100 |

COURSE OBJECTIVES :

1. To grasp concepts like reaction order, molecularity, and experimental determination of rate expressions from batch data.
2. To apply mass/energy balances, calculus, and thermodynamics to derive design equations for ideal reactors
3. To choose suitable reactor types for specific processes and optimize operating conditions (temperature, pressure) for maximum yield/selectivity, especially in complex reactions.
4. To analyze non-ideal reactors (using RTD, dispersion models) and design reactors for multiple reactions (series, parallel) and heterogeneous systems (catalytic reactors, fixed beds).

COURSE OUTCOMES (CO)

| | |
|-------------|--|
| CO-1 | Develop rate expressions for reactions, analyze experimental data, and understand reaction mechanisms. |
| CO-2 | Design and size ideal (Batch, CSTR, PFR) and non-ideal reactors, considering single and multiple reactions, and heat effects (non-isothermal). |
| CO-3 | Use residence time distribution (RTD) to evaluate non-ideal reactors (dispersion, tanks-in-series models) and compare reactor performance. |
| CO-4 | Understand catalyst function, effectiveness factors, and design reactors for catalytic and multiphase reactions (e.g., fixed-bed reactors). |
| CO-5 | Apply fundamental balances to solve reactor design problems, incorporating heat exchange equipment. |
| CO-6 | Problem Solving: Use simulation tools and mathematical modeling to tackle complex industrial reactor problems. |

| Unit | Contents | Hrs. |
|--------------|---|-----------|
| I | Introduction and a brief review of the kinetics of homogeneous reactions, Interpretation of batch reactor rate and data, from constant volume and constant pressure systems. Single Ideal reactors including design aspects | 07 |
| II | Design for single reactions, Multiple reactions, Thermal characteristics of reactors: temperature and pressure effects. Non-ideality in reactors and its effects on chemical conversion. One parameter models to represent the behaviour of chemical reactors | 07 |
| III | Introduction to Non-ideal flow, RTD measurements, Models to predict conversions | 07 |
| IV | Homogeneous and Heterogeneous Catalysis, Kinetics of Solid Catalyzed Reactions. Design of gas – solid catalytic reactors | 08 |
| V | Introduction to multiphase reactors | 08 |
| VI | Mass Transfer with Chemical Reactions: Regimes of operation and Model contactors | 08 |
| Total | | 45 |

Suggested readings :

1. Chemical Reaction Engineering, Levenspiel, O. 3rd Edition, John Wiley and Sons, 2004.
2. Chemical Engineering, Kinetics, Smith, J.M. , Kinetics, 3rd Edition, and McGraw Hill, 1981.
3. Dinbigh, K. & Turner, K.G. Chemical Reactor Theory – An Introduction, Cambridge Univ. Press.Hall, 2007.
4. Scott Fogler, H. : Elements of Chemical Reaction Engineering, 4th Edition, Prentice

Reference books:

1. The Engineering of Chemical Reactions by L. D. Schmidt.
2. Introduction to Chemical Kinetics and Reactor Design by Charles Hill.
3. "The Engineering of Chemical Reactions" by L.D. Schmidt
4. "Perry's Chemical Engineers' Handbook" (Green & Perry)

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IV Semester B.Tech. (Food Technology)

| | |
|-----------------------|--|
| Course Code : | 25AF1503MD406 |
| Title of the Course : | Technology of Spices and Plantation Crops (MDM) |

| Course Scheme | | | | | Evaluation Scheme | | | | |
|---------------|---|---|-------|---------|------------------------|-----|-----|-----|-------|
| L | T | P | Total | Credits | Paper Duration in Hrs. | ISE | MSE | ESE | Total |
| 3 | 0 | 0 | 3 | 3 | 3 | 20 | 20 | 60 | 100 |

| COURSE OBJECTIVES : | |
|----------------------------|---|
| 1. | Impart knowledge about the importance, scope, and specific characteristics (composition, chemistry, etc.) of various plantation crops. |
| 2. | Develop an understanding of the principles and practices of post-harvest management, including harvesting techniques, pre-cooling, grading, and storage, to minimize losses. |
| 3. | Acquaint students with the specific processing technologies for converting raw plantation produce into finished products (e.g., manufacture of tea, coffee powder, cocoa, spice oils/oleoresins). |

| COURSE OUTCOMES (CO) | |
|-------------------------------|---|
| CO-1 | Understand the unique composition and properties of different plantation crops and how these influence processing methods. |
| CO-2 | Apply appropriate post-harvest handling and preservation techniques to maintain the quality and safety of plantation crops. |
| CO-3 | Operate and manage equipment and processes used in the industrial processing of tea, coffee, cocoa, and spices. |
| CO-4 | Evaluate the quality of raw materials and finished products using relevant analytical techniques and quality standards. |
| CO-5 | Develop new value-added products (e.g., chocolate, essential oils, various spice products) from plantation crops and their by-products. |

| Unit | Contents | Hrs. |
|--------------|--|-----------|
| I | Introduction: Introduction, definition, importance, historical significance, Production and processing scenario of spices and plantation crops. Commercial value of Spices, Condiments, plantation crops and their products in global market. | 6 |
| II | Processing Techniques for spices: Cultivation practices, Harvesting and transportation, cleaning, destoning, sorting-grading, winnowing, drying, storage, Curing, grinding and milling operations and Processing methods for spices like–ginger, chilli, turmeric, onion, garlic, pepper, cardamom, | 7 |
| III | Minor spices, herbs and leafy vegetables: processing and utilization of All spice, annie seed, sweet basil, caraway seed, cassia, cinnamon, clove, coriander, cumin, dill seed, Fern seed nutmeg, mint, marjoram, Rose merry, saffron, sage, savory, thyme, ajowan, curry leaves, asafetida , etc. | 8 |
| IV | Processing Technologies for Plantation Crops: Processing technologies and quality control for Tea, Coffee, Cocoa, kokum, chicory, cashew nut, jackfruit, coconut, Vanilla and annatto-processing. By products of plantation crops processing and its utilization. | 10 |
| V | Spice and flavorings: Flavoring compounds in Spice as spice-oils, spice powders, oleoresins, concentrates, etc. Separation and purification of natural and Synthetic flavoring agents. Quality Standards and Specifications | 8 |
| VI | Quality Assurance and Marketing of Spices and Plantation Crop Products: Quality evaluation and control of process, Food safety and hygiene practices, Marketing strategies and channels, Packaging technologies, labelling requirements, regulations and certifications. | 6 |
| Total | | 45 |

Suggested readings :

1. Spices and Plantation Crops by K.G. Shanmugavelu, Agrotech Publication, Delhi
2. Spice and Condiments by Pruthi J.S., National Book Trus, 1996
3. Handbook on Spices and Condiments (cultivation, processing and extraction), Panda H., Asia Pacific Business Press Inc. 2010
4. The Complete Book on Spices & Condiments (with cultivation, processing & uses) by NIIR BOARD, Asia Pacific Business Press Inc. 2010
5. Spices and Seasonings: A Food Technology Handbook by Tainter DR and Grenis AT, John Wiley and Sons, 2001

Reference books :

1. Handbook of Herbs and spices by Peter VK, Woodhead Publishing 2012
2. The Book of Spices by Rosengarten F., Pyramid Books, 1973
3. Spices and Herbs for the Food Industry by Lewis YS, Food Trade Press, 1984
4. Food Flavourings by P.R. Ashust, Springer, 2012

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IV Semester B. Tech. (Food Technology)

| | |
|-----------------------|-------------------------------------|
| Course Code : | 25AF1503PCL407 |
| Title of the Course : | FOOD PROCESS ENGINEERING LAB |

| Course Scheme | | | | | Evaluation Scheme | | | | |
|---------------|---|---|-------|---------|-------------------|-----|-----|-------|--|
| L | T | P | Total | Credits | ISE | MSE | ESE | Total | |
| 0 | 0 | 2 | 2 | 1 | 60 | - | 40 | 100 | |

List of Experiments: -

1. Performance evaluation of hammer mill
2. To determine the particle size by screen analysis
3. Power requirement in size reduction of grain using Rittinger's law, Kick's law and Bond's law
4. Experiment on working of mixer and determination of mixing index
5. Study of filtration
6. Study of centrifugation
7. Design problems of distillation
8. To study the principle and operation of simple distillation for separation of a binary liquid mixture
9. Study of Freezing of foods by different methods
10. To study the principle of crystallization and preparation of sugar crystals from super saturated solution.
11. To Study the effect of cooling rate on crystal size and crystal quality during crystallization.
12. Design problems on evaporators
13. Experiment on Solvent extraction
14. Determination of air properties using psychometric chart

Design problems on Dryers

SUGGESTED LAB MANUAL / REFERENCES :

1. Treybal, R. E. (1981). Mass Transfer Operations. 3rd edition. McGraw Hill.
2. Dennis, R.H. (1981). "Food Process Engineering. Academic Publishing and Press, King SaudUniversity.
3. ZekiBer. (2018). Food Process Engineering and Technology. 3rd Edition. Academic Press.
4. Coulson and Richardsons. (1998).Chemical Engineering, Vol I and II, Asiali Books Pvt ltd.
5. McCabe and Smith "Unit Operations" McGraw-Hill, New York

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IV Semester B.Tech. (Food Technology)

| | |
|-----------------------|---|
| Course Code : | 25AF1000VE408A |
| Title of the Course : | Life of Chatrapati Shivaji Maharaj |

| Course Scheme | | | | | Evaluation Scheme | | | | |
|---------------|---|---|-------|---------|------------------------|-----|-----|-----|-------|
| L | T | P | Total | Credits | Paper Duration in Hrs. | ISE | MSE | ESE | Total |
| 1 | 0 | 0 | 1 | 1 | -- | 50 | -- | -- | 50 |

COURSE OBJECTIVES :

1. Analyze Chhatrapati Shivaji Maharaj's leadership qualities, strategic thinking, and management skills
2. Develop critical thinking and problem-solving skills through case studies and discussions
3. Recognize the relevance of the Chhatrapati's principles and values in modern times

COURSE OUTCOMES (CO)

| | |
|-------------|--|
| CO-1 | Explain Chhatrapati Shivaji Maharaj's military strategies, conquests, and establishment of the Maratha Empire. |
| CO-2 | Evaluate the Chhatrapati's leadership qualities, such as courage, vision, human values and adaptability. |
| CO-3 | Apply the Chhatrapati's principles, such as decentralization and social welfare, to modern engineering challenges. |

| Unit | Contents | Hrs. |
|--------------|--|-------------|
| I | Shivaji Maharaj as a Great Conqueror: Master Strategist and innovator in Military Tactics, Guerrilla Warfare (Ganimi Kava), Fortress Strategy, Avoidance of Direct Confrontation, Diplomacy and Alliances, Naval Power. | 5 |
| II | Shivaji Maharaj's Management and leadership strategies: Architecture and metallurgy of Raigad Fort, Use of Light Cavalry , Intelligence Network, Asymmetric Warfare, Logistics and Supply Chains ,Fortifications and Military Architecture. | 5 |
| III | Shivaji Maharaj's views on Democracy and Nationalism: Shivaji Maharaj's views about Women's rights, their dignity and religious views, His views on Democracy & Nationalism | 5 |
| Total | | 15 |

REFERENCE BOOKS:

- 1 Desai, Ranjit. Shriman Yogi. Mehta Publishing House. 2018.
- 2 Kurundkar, Narhar. Chatrapati Shivaji Maharaj Jeevan Rahasya. Deshamukh and Company. 2024
- 3 Keluskar, Krushnaji Arjun. Chhatrapati Shivaji Maharaj. Sudhir Prakashan. 2020.
- 4 Bedekar, Ninad. Kalatil Vyavsthapan Tatve. 2015. Sarkar, Jadunath. Shivaji and His Times by Jadunath Sarkar, Classic Book on the Life and History.

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IV Semester B.Tech. (Food Technology)

| | |
|-----------------------|------------------------|
| Course Code : | 25AF1UHVVE409 |
| Title of the Course : | Universal Human Values |

| Course Scheme | | | | | Evaluation Scheme | | | | |
|---------------|---|---|-------|---------|------------------------|-----|-----|-----|-------|
| L | T | P | Total | Credits | Paper Duration in Hrs. | ISE | MSE | ESE | Total |
| 3 | 0 | 0 | 3 | 3 | 03 | 20 | 20 | 60 | 100 |

COURSE OBJECTIVES :

1. To understand the concept of value education and explore self-awareness as a foundation for continuous happiness and prosperity.
2. To promote harmony within oneself and between the self and the body, fostering self-regulation and holistic well-being.
3. To develop an understanding of harmonious relationships in the family and society, based on trust, respect, and universal values.
4. To gain insight into the interconnectedness and mutual fulfillment in nature, fostering a holistic perception of existence and ethical professional practices.

COURSE OUTCOMES (CO)

| | |
|-------------|--|
| CO-1 | Students will demonstrate an understanding of value education and its role in achieving happiness, prosperity, and self-exploration. |
| CO-2 | Students will be able to differentiate between the needs of the self and the body and develop strategies for achieving harmony and self-regulation. |
| CO-3 | Students will understand the importance of trust, respect, and values in human relationships, fostering harmony within the family and society. |
| CO-4 | Students will recognize the interconnectedness of nature, society, and existence, promoting a holistic approach to life and mutual fulfillment. |
| CO-5 | Students will apply ethical principles in professional settings, utilizing humanistic education and strategies for transitioning to a value-based life and profession. |

| Unit | Contents | Hrs. |
|--------------|--|-------------|
| I | Introduction to Value Education - Understanding Value Education - Self-exploration as the Process for Value Education - Continuous Happiness and Prosperity – the Basic Human Aspirations - Right Understanding, Relationship and Physical Facility - Happiness and Prosperity – Current Scenario -Method to Fulfil the Basic Human Aspirations | 7 |
| II | Harmony in the Human Being - Understanding Human being as the Co-existence of the Self and the Body - Distinguishing between the Needs of the Self and the Body - The Body as an Instrument of the Self - Understanding Harmony in the Self - Harmony of the Self with the Body -Programme to Ensure self-regulation and Health | 7 |
| III | Harmony in the Family and Society - Harmony in the Family – the Basic Unit of Human Interaction - Values in Human-to-Human Relationship - 'Trust' – the Foundational Value in Relationship - 'Respect' – as the Right Evaluation - Understanding Harmony in the Society -Vision for the Universal Human Order | 7 |
| IV | Harmony in the Nature (Existence) - Understanding Harmony in the Nature - Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature - Realizing Existence as Co-existence at All Levels -The Holistic Perception of Harmony in Existence | 7 |
| V | Implications of the Holistic Understanding – a Look at Professional Ethics - Natural Acceptance of Human Values - Definitiveness of (Ethical) Human Conduct - A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order - Competence in Professional Ethics - Holistic Technologies, Production Systems and Management Models- ----- Typical Case Studies -Strategies for Transition towards Value-based Life and Profession | 7 |
| Total | | 35 |

Suggested readings:

1. The Textbook

A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1

2. The Teacher's Manual

Teachers' Manual for *A Foundation Course in Human Values and Professional Ethics*, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978- 93-87034-53-2

Reference Books

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj - PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English) Gandhi - Romain Rolland (English)

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| | |
|-----------------------|--|
| Course Code : | 25AF1000AE410A |
| Title of the Course : | A) Modern Indian Language (Marathi) |

| Course Scheme | | | | | Evaluation Scheme | | | | |
|---------------|---|---|-------|---------|------------------------|-----|-----|-----|-------|
| L | T | P | Total | Credits | Paper Duration in Hrs. | ISE | MSE | ESE | Total |
| 1 | 0 | 0 | 1 | 1 | 03 | 20 | 20 | 60 | 100 |

| COURSE OBJECTIVES : |
|--|
| 1. मराठी भाषेचा ऐतिहासिक प्रवास, संस्कृत, प्राकृत आणि अपभ्रंश भाषांचा प्रभाव समजून घेणे. |
| 2. मराठी लेखनाचे नियम, व्याकरण व शुद्धलेखन यांची अचकूता आत्मसात करणे. |
| 3. समजनशील आणि औपचारिक लेखन कौशल्ये विकसीत करणे. |
| 4. भाषांतर तत्त्वे, प्रमेयता आणि सांस्कृत संदर्भाचा विचार करून मराठीतून इंग्रजी आणि इंग्रजीतून मराठी भाषांतर करण्याचे कौशल्य प्राप्त करणे. |

| COURSE OUTCOMES (CO) | |
|-------------------------------|--|
| CO-1 | विद्यार्थी मराठी भाषेच्या ऐतिहासिक प्रवासाची समज वाढवतील आणि तिच्या विकासातील टप्पे स्पष्टपणे सांगू शकतील. |
| CO-2 | शुद्ध व प्रमाणबद्ध लेखन करण्याची क्षमता प्राप्त होईल. |
| CO-3 | विविध प्रकारच्या लेखन शैली आत्मसात करून सजूनशील, विश्लेषणात्मक आणि औपचारिक लेखन करू शकतील. |
| CO-4 | अचकू, स्पष्ट आणि भाषिक -सांस्कृतिक दृष्टीकोनातून योग्य भाषांतर करू शकतील. |
| CO-5 | व्यावसायिक आणि साहित्यिक भाषांतरात प्रावीण्य मिळवू शकतील. |

| Unit | Contents | Hrs. |
|--------------|---|-----------|
| I | मराठीचा उगम आणि विकास: मराठीचा उगम आणि विकास, मराठी भाषेवर संत परंपरेचा प्रभाव - ज्ञानेश्वर, तुकाराम, नामदेव आणि एकनाथ यांच्या रचनांचा अभ्यास, मराठीत बखरी लेखन व इतिहास दर्शन, आधुनिक मराठी आणि सुधारणा चळवळी- टिळक, फुले, आणि आगरकर यांचे योगदान. | 3 |
| II | स्वातंत्र्यानंतरची मराठी भाषा: महाराष्ट्र राज्य निर्मिती व मराठीचा अधिकृत दर्जा, डिजिटल युगातील मराठी भाषा : ब्लॉग , सोशल मीडिया आणि ई-साहित्य , मराठी भाषा संरक्षणासाठी उपाययोजना, शिक्षण व्यवस्थेतील मराठीचा वापर, जागतिक स्तरावर मराठी भाषेचा प्रभाव | 3 |
| III | मराठी लेखनाचे नियम आणि व्याकरण : संधी, वाक्यप्रकार (विधानार्थी वाक्य , प्रश्नार्थी वाक्य , आज्ञार्थी वाक्य इ.), विरामचन्हे आणि त्यांचे उपयोग, शुद्धलेखन, समानार्थी शब्द (पर्यायवाची शब्द), विरुद्धार्थी शब्द . | 3 |
| IV | लेखन कौशल्य : लेखन कौशल्याचा परिचय, लेखन कौशल्याचे महत्त्व आणि आवश्यकता, पत्रलेखन, निबंध लेखन, वृत्तलेखन (वृत्तपत्रीय लेखन), इतिवृत्त लेखन, सारांश लेखन | 3 |
| V | भाषांतर (मराठीतून इंग्रजी आणि इंग्रजीतून मराठी): भाषांतराचा मूलभूत परिचय-भाषांतराची व्याख्या आणि स्वरूप , महत्त्व आणि उपयोग, भाषांतराचे प्रकार इ. पारिभाषक शब्दावली , मराठीतून इंग्रजी आणि इंग्रजीतून मराठी भाषांतर | 3 |
| Total | | 15 |

SUGGESTED READINGS :

1. प्रशासनिक लेखन, भाषा संचालनालय , महाराष्ट्र शासन, मुंबई १९६६
2. सुगम मराठी व्याकरण व लेखन - मो.रा. वाळंबे
3. "अनुवाद तसद्धांत आणि प्रयोग " – डॉ. भालचंद्र नेमाडे (लोकवाङ्मय गृहप्रकाशन)
4. मराठी भाषा आणि साहित्याचा इतिहास – वि. का. राजवाडे प्रकाशक : राजवाडे संशोधन मंडळ, धुळे
5. भाषांतर : सिद्धांत आणि प्रयोग – डॉ. अशोक केळकर प्रकाशक : लोकवाङ्मय गृह, मुंबई

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IV Semester B.Tech. (Food Technology)

| | |
|-----------------------|---|
| Course Code : | 25AF1000AE410B |
| Title of the Course : | B) Modern Indian Language(Hindi) |

| Course Scheme | | | | | Evaluation Scheme | | | | |
|---------------|---|---|-------|---------|------------------------|-----|-----|-----|-------|
| L | T | P | Total | Credits | Paper Duration in Hrs. | ISE | MSE | ESE | Total |
| 1 | 0 | 0 | 1 | 1 | 03 | 20 | 20 | 60 | 100 |

COURSE OBJECTIVES :

- हिंदी भाषा के उद्भव , विकास और ऐतिहासिक प्रवृत्तियों को समझाना।
- हिंदी व्याकरण और लेखन कौशल्य में दक्षता प्रदान करना।
- प्रशासन , शिक्षा और संचार में हिंदी के व्यावहारिक उपयोग को स्पष्ट करना।
- अनुवाद कौशल्य विकसित करना,जिससे तकनीक एवं व्यावसायिक संचार सुगम हो

COURSE OUTCOMES (CO)

| | |
|-------------|--|
| CO-1 | विद्यार्थी हिंदी भाषा के ऐतिहासिक और आधुनिक विकास को समझेंगे। |
| CO-2 | हिंदी व्याकरण और लेखन के नियमों में दक्षता प्राप्त करेंगे। |
| CO-3 | व्यावसायिक प्रशासनिक और तकनीकी लेखन में हिंदी का प्रयोग कर सकेंगे। |
| CO-4 | अनुवाद के सिद्धांतों को सीखकर अंग्रेजी और हिंदी के बीच प्रभावी अनुवाद कर सकेंगे। |

| Unit | Contents | Hrs. |
|--------------|--|-----------|
| I | हिंदी भाषा का उद्गी और स्रोत : ▪ हिंदी भाषा की उत्पत्ती और स्वरूप ▪ संस्कृत, प्राकृत और अपभ्रंश से हिंदी का विकास ▪ हिंदी की प्रमुख बोलियाँ (ब्रज , अवधी, खडी बोली, भोजपुरी, राजस्थानी आदी) ▪ हिंदी पर फारसी, अरबी और अंग्रेजी भाषा का प्रभाव. | 3 |
| II | स्वातंत्र्योत्तर काल में हिंदी भाषा ▪ प्रशासन , शिक्षा और संचार माध्यमों में हिंदी की भूमिका ▪ राजभाषा के रूप में हिंदी – संवैधानिक स्थिति और व्यावहारिक उपयोग ▪ हिंदी का वैश्विक विस्तार और डिजिटल माध्यमों में हिंदी की उपस्थिति ▪ प्रशासन और संचार माध्यमों में हिंदी | 3 |
| III | हिंदी भाषा लेखन के नियम और व्याकरण ▪ वर्णमाला ▪ शब्द -भेद ▪ संधी ▪ वाक्य रचना ▪ वर्तनी ▪ उपसर्ग, प्रत्यय और शब्द निर्माण की प्रक्रिया ▪ विराम चिन्हों का प्रयोग ▪ पर्यायवाची शब्द ▪ विलोम शब्द | 3 |
| IV | लेखन कौशल ▪ पत्र लेखन ▪ प्रतिवेदन (रपोट) लेखन ▪ विज्ञप्ती , नोटिस और परिपत्र लेखन निबंध लेखन ▪ सार लेखन. | 3 |
| V | अनुवाद (अंग्रेजी से हिंदी और हिंदी से अंग्रेजी) अनुवाद : सिद्धांत और परंपरा, अनुवाद : क्षेत्र , प्र कार , पारिभाषीक शब्दावली , अंग्रेजी से हिंदी और हिंदी से अंग्रेजी अनुवाद | 3 |
| Total | | 15 |

SUGGESTED READINGS :

1. हिंदी भाषा का उद्भव और विकास" – डॉ. हरीशचंद्र वर्मा (लोकभारती प्रकाशन)
2. "हिंदी भाषा का इतिहास" – डॉ. रामवलास शर्मा (राजकमल प्रकाशन)
3. "भारत में राजभाषा हिंदी" – डॉ. विश्वनाथ प्रसाद (भारतीय राजभाषा परिषद)
4. "हिंदी व्याकरण और रचना" – डॉ. हरीशचंद्र वर्मा (लोकभारती प्रकाशन)
5. "हिंदी लेखन कौशल" – डॉ. रमेश गुप्ता (सातहत्य भवन)
6. "अनुवाद विज्ञान और सिद्धांत " – डॉ. ओमप्रकाश (राजकमल प्रकाशन)

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IV Semester B.Tech. (Food Technology)

| | |
|-----------------------|-------------------------------------|
| Course Code : | 25AF1000AE410C |
| Title of the Course : | C) Modern Indian Language(Sanskrit) |

| Course Scheme | | | | | Evaluation Scheme | | | | |
|---------------|---|---|-------|---------|------------------------|-----|-----|-----|-------|
| L | T | P | Total | Credits | Paper Duration in Hrs. | ISE | MSE | ESE | Total |
| 1 | 0 | 0 | 1 | 1 | 03 | 20 | 20 | 60 | 100 |

| COURSE OBJECTIVES : | |
|---------------------|---|
| 1. | संस्कृत भाषेचा ऐतिहासिक प्रवास |
| 2. | संस्कृत लेखनाचे नियम, व्याकरण आत्मसात करणे . |
| 3. | दैनंदिन संवादासाठी लागणारे काही शब्द यांचा अभ्यास करणे. |

| COURSE OUTCOMES (CO) | |
|------------------------|---|
| CO-1 | विद्यार्थी संस्कृत भाषेच्या ऐतिहासिक प्रवासाची समज वाढवतील आणि तिच्या विकासातील टप्पे स्पष्टपणे सांगू शकतील |
| CO-2 | शुद्ध व प्रमाणबद्ध लेखन करण्याची क्षमता प्राप्त होईल. |
| CO-3 | विविध प्रकारच्या लेखन शैली आत्मसात करून लेखन करू शकतील |
| CO-4 | अचूक, स्पष्ट आणि भाषिक -सांस्कृतिक दृष्टिकोनातून योग्य भाषांतर करू शकतील |

| Unit | Contents | Hrs. |
|--------------|--|-------------|
| I | Introduction to Sanskrit: Importance and history of Sanskrit, Sanskrit alphabets (Varnamala), Swaras (Vowels), Vyanjanas (Consonants), Pronunciation and script (Devanagari). | 3 |
| II | Basic Grammar: Nouns, pronouns, Grammatical numbers, Grammatical genders, Grammatical person, Verbs, Tenses, Sandhi (Combination of letters), Karaka (Case system) – Nominative, Accusative, Instrumental, etc., Vibhakti (Declensions of nouns and pronouns), Linga (Gender: Masculine, Feminine, Neuter), Vakya Rachana (Sentence construction). | 3 |
| III | Simple Vocabulary and Sentence Formation: Basic words and their meanings (nature, family, animals, objects, etc.), Greetings and basic conversational phrases, Formation of simple sentences | 3 |
| IV | Selected Sanskrit Shlokas and Subhashitas: Recitation and meaning of simple verses from Bhagavad Gita, Hitopadesha, or Panchatantra, Common proverbs (Subhashitas) | 3 |
| V | Reading and Writing Practice: Reading simple Sanskrit texts, Writing small paragraphs in Sanskrit | 3 |
| Total | | 15 |

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IV Semester B.Tech. (Food Technology)

| | |
|-----------------------|-------------------------------------|
| Course Code : | 25AF1000HM411 |
| Title of the Course : | Intellectual Property Rights |

| Course Scheme | | | | | Evaluation Scheme | | | | |
|---------------|---|---|-------|---------|------------------------|-----|-----|-----|-------|
| L | T | P | Total | Credits | Paper Duration in Hrs. | ISE | MSE | ESE | Total |
| 1 | 0 | 0 | 1 | 1 | - | 20 | 20 | 60 | 100 |

COURSE OBJECTIVES :

1. Understand the fundamentals of patents, designs, and copyrights and the patent classification system in India.
2. Analyze the scope of patent rights, including licensing, technology transfer, and the use of patent databases.
3. Explore the evolution, significance, and administration of intellectual property rights (IPR) in India and internationally.
4. Examine recent developments in IPR across biological systems, software, and traditional knowledge through case studies.

COURSE OUTCOMES (CO)

| | |
|-------------|---|
| CO-1 | Demonstrate proficiency in patent categorization and practical patent procedures. |
| CO-2 | Utilize patent databases effectively. |
| CO-3 | Grasp the significance of IPR and its historical context. |
| CO-4 | Stay updated on the latest IPR developments, especially in biological systems and computer software |
| CO-5 | Apply acquired knowledge and problem-solving skills to real-world cases related to patents and IPR |

| Unit | Contents | Hrs. |
|--------------|--|-------------|
| I | Patents Designs, Trade and Copyright, Classification of patents in India, Categories of Patent, Special Patents, Patent document, Granting of patent, Rights of a patent, Patent Searching, Patent Drafting, filing of a patent, different layers of the international patent system, Utility models | 5 |
| II | Patent Rights Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. | 4 |
| III | Overview of Intellectual Property Introduction of IPR, Need for intellectual property right (IPR), IPR in India – Genesis and Development IPR in abroad. | 4 |
| IV | New Developments in IPR Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge, Case Studies | 4 |
| V | Case studies: Case studies related to patents and IPR | 4 |
| Total | | 21 |

REFERENCE BOOKS:

1. Feroz Ali, The Law of Patents, LexisNexis
 2. Ronald D. Slusky, Invention Analysis and Claiming – A Patent Lawyer’s Guide, Second Edition, American Bar Association, 2012.
- Feroz Ali, The Touchstone Effect – The Impact of Pre-grant Opposition on Patents, LexisNexis, 2009.