FACULTY OF ENGINEERING

DEGREE OF

BACHELOR OF TECHNOLOGY IN

FOOD TECHNOLOGY

DEPARTMENT OF FOOD TECHNOLOGY

CURRICULUM (2023 - 2024)



KARPAGAM ACADEMY OF HIGHER EDUCATION

(Deemed to be University) (Established Under Section 3 of UGC Act, 1956) (Accredited with A+ Grade by NAAC in the Second Cycle) Pollachi Main Road, Eachanari Post, Coimbatore – 641 021, Tamil Nadu, India. Phone : 0422 – 2980011 – 14, Email : info@kahedu.edu.



KARPAGAM ACADEMY OF HIGHER EDUCATION

(Deemed to be University Established under Section 3 of UGC Act 1956)

Eachanari, Coimbatore-641 021. INDIA

FACULTY OF ENGINEERING DEGREE OF BACHELOR OF ENGINEERING / TECHNOLOGY REGULAR PROGRAMME REGULATIONS 2023 CHOICE BASED CREDIT SYSTEM

These regulations are effective from the academic year 2023 – 2024 and applicable to the candidates admitted to B. E. / B. Tech. during 2023 - 2024 and onwards.

1. ADMISSION

1.1 Candidates seeking admission to the first semester of the eight semesters B. E./B.Tech Degree Programme:

Should have passed the Higher Secondary Examination (10+2) prescribed by the State Government / Central Government with Mathematics/ Physics/ Chemistry/ Computer Science/ Electronics/ Information Technology/ Biology/ Informatics Practices/ Biotechnology/ Technical Vocational subject/ Agriculture/ Engineering Graphics/ Business Studies/ Entrepreneurship. (Any of the above three subjects) or any similar Examination of any other institution/ University or authority accepted by the Karpagam Academy of Higher Education as equivalent thereto).

Should obtained at least 45% marks (40% marks in case of candidates belonging to reserved category) in the above subjects taken together.

(**OR**)

Passed min. 3 years Diploma examination with at least 45% marks (40% marks in case of candidates belonging to reserved category) subject to vacancies in the First Year, in case the vacancies at lateral entry are exhausted. (The Universities will offer suitable bridge courses such as Mathematics, Physics, Engineering drawing, etc., for the students coming from diverse backgrounds to achieve desired learning outcomes of the programme)

1.2 Lateral Entry Admission

Candidates who possess Diploma in Engineering / Technology (10+3 or 10+2+2) awarded by the Directorate of Technical Education with passed minimum THREE years / TWO years (Lateral Entry) Diploma examination with at least 45% marks (40% marks in case of candidates belonging to reserved category) in ANY branch of Engineering and Technology are eligible to apply for admission to the third semester of B. E./B. Tech.. Such candidates shall undergo two additional engineering subjects in the 3rd and 4th semester as prescribed by the University.

OR

Passed B.Sc. Degree from a recognized University as defined by UGC, with at least 45% marks (40% marks in case of candidates belonging to reserved category) and passed 10+2 examination with Mathematics as a subject.

OR

Passed D.Voc. Stream in the same or allied sector. (The Universities will offer suitable bridge courses such as Mathematics, Physics, Engineering drawing, etc., for the students coming from diverse backgrounds to achieve desired learning outcomes of the programme)

| S. No. | Programme | Eligibility criteria |
|--------|--|--|
| 1. | B.E Bio Medical Engineering | Passed Minimum THREE years / TWO years |
| | | (Lateral Entry) Diploma examination with at |
| 2 | B. E. Civil Engineering | candidates belonging to reserved category) in ANY branch of Engineering and Technology. |
| 3. | B. E. Computer Science and Engineering | OR Decend D.So. Decrea from a recognized |
| 4. | B. E. Computer Science and Engineering (Cyber security) | University as defined by UGC, with at least 45% marks (40% marks in case of candidates |
| 5. | B. E. Electrical and Electronics | belonging to reserved category) and passed 10+2 examination with Mathematics as a subject. |
| | Engineering | OR |
| 6. | B. E. Electronics and Communications Engineering | Passed D.Voc. Stream in the same or allied sector. (The Universities will offer suitable bridge courses such as Mathematics Physics |
| 7. | B. E. Mechanical Engineering | Engineering drawing, etc., for the students coming from diverse backgrounds to achieve |
| 8. | B. Tech. Artificial Intelligence and Data Science | desired learning outcomes of the programme) |
| 9. | B. Tech Bio - Technology | |
| 10. | B. Tech Food Technology | |

Eligibility criteria for admission in the third semester is given in the table below.

1.3 Migration from other University

Candidates who have completed their first to sixth semesters of B. E./B. Tech. study in any University are eligible to apply for admission to their next semester of B. E./B. Tech. in the branch corresponding to their branch of study. The student will be exempted from appearing for Examination of the equivalent courses passed in the earlier programme and will have to appear for courses which he/she has not done during the period of his/her earlier programme. Along with the request letter and mark sheets, he/she has to submit a copy of syllabus of the programme duly attested by the Registrar, Competent authority, he/she has undergone. Equivalence Certificate shall be provided by the "Students' Affairs Committee" of Karpagam Academy of Higher Education. Students' Affairs Committee comprises all the Heads of the Departments and Dean of the Faculty of Engineering and a nominee of the Registrar.

2. PROGRAMMES OFFERED

A candidate may undergo a programme in any one of the branches of study approved by the University as given below.

List of B. E. and B. Tech. Degree Programmes

- 1. B.E Bio Medical Engineering
- 2. B. E. Civil Engineering
- 3. B. E. Computer Science and Engineering
- 4. B. E. Computer Science and Engineering (Cyber Security)
- 5. B. E. Electrical and Electronics Engineering
- 6. B. E. Electronics and Communications Engineering
- 7. B. E. Mechanical Engineering
- 8. B.Tech. Artificial Intelligence and Data Science
- 9. B. Tech. Bio-Technology
- 10. B. Tech Food Technology

3. MODE OF STUDY

3.1 Full-Time:

In this mode of study, the candidates are required to attend classes regularly on the specified working days of the University.

- **3.2** Conversion from full time mode of study to part time is not permitted.
- **3.3** Change from one programme to another is not permitted.

4. STRUCTURE OF PROGRAMMES

- **4.1** Every programme will have a curriculum with syllabus consisting of theory and practical courses such as:
- (i) General core courses comprising Mathematics, Basic Sciences, Engineering Sciences and Humanities.
- (ii) Core courses of Engineering/Technology.
- (iii) Elective courses for specialization in related fields.
- (iv) Workshop practice, computer practice, engineering graphics, laboratory work, in-plant training, seminar presentation, project work, industrial visits, camps, etc.

Every student is encouraged to participate in at least any one of the following programmes

- NSS / Sports/Physical exercise/NCC/YRC/Red Ribbon club/Environment club and Energy club
- Other Co-Curricular and Extra Curricular activities

(V) Choice Based Credit System

CBCS is introduced for students admitted in the academic year 2017-18. As per AICTE guidelines, CBCS is an approach in which students opt for courses of their choice. CBCS provides greater flexibility with multiple courses and enable students to undergo additional courses. CBCS is applicable to Full Time Undergraduate & Post Graduate Programmes of study. It provides a choice for students to select from the prescribed courses (Professional soft core, Professional Hard core, Professional Electives, Open Electives, Value added courses, Humanity Sciences, Basic sciences & Engineering sciences). A course designated as hard core for a particular programme of study must invariably be completed by the student to receive the degree in the programme. The Hardcore courses cannot be substituted by another courses. Students can exercise their choice among a set of Soft core courses from the list of Soft core courses specified for each Programme of study. The student should meet the criteria for prerequisites to become eligible to register for that course. The student should request for the course for every semester within the first week of semester. Maximum no of students to be registered in each course shall depend on availability of physical facilities, classroom availability and lab capacity. Registration of already requested courses by students in previous semester is not allowed.

4.2 Each course is normally assigned certain number of credits.

| No. of credits per lecture period per week | 1 |
|--|---|
| No. of credits per tutorial period per week | 1 |
| No. of credits for 3 periods of laboratory course per week | 2 |
| No. of credits for 3 periods of project work per week | 2 |
| No. of credits for 2 weeks of field project/internship training during | |
| semester vacations | 1 |

4.3 In every semester, the curriculum shall normally have a blend of theory courses not exceeding 6 and practical courses not exceeding 4. However, the total number of coursesper semester shall not exceed 9.

4.4 The prescribed credits required for the award of the degree shall be within the limits specified below.

| PROGRAMME | PRESCRIBED CREDIT RANGE | |
|----------------|-------------------------|--|
| B. E./B. Tech. | 160–165 | |

4.5 The medium of instruction for all Courses, Examinations, Seminar presentations and Project/Thesis reports is English.

4.6 Value Added Course

Besides core courses and elective courses, value added course is introduced. The blend of different courses is so designed that the student would be trained not only in his / her relevant professional field but also as a socially conscious human being.

4.7 Evaluation in the courses comprises two parts, one is the Continuous Internal Assessment (CIA) and the other one is the End Semester Examination (ESE). Evaluation in few courses may be by Internal Assessment only.

5. DURATION OF THE PROGRAMME

5.1The prescribed duration of the programme shall be

| Programme | Min. No. of semesters | Max. No. of semesters |
|---|--------------------------|-----------------------|
| B. E./B. Tech. (HSC Candidates) | 8 | 14 |
| B. E./B. Tech. (Lateral Entry Candidates) | 6 | 12 |

5.2 Each semester shall normally consist of 90 working days or 540 hours.

5.3 Additional classes for improvement, conduct of model test, etc., over and above the specified periods shall be arranged, if required. But for the purpose of calculation of attendance requirement for eligibility to appear for the end semester Examinations (as per Clause 11) by the students, 540 hours conducted within the specified academic schedule alone shall be taken into account and the overall percentage of attendance shall be calculated accordingly.

6. REQUIREMENTS FOR COMPLETION OF THE SEMESTER

6.1 Ideally every student is expected to attend all classes and secure 100% attendance. However, in order to allow for certain unavoidable circumstances, the student is expected to attend at least 75% of the classes and the conduct of the candidate has been satisfactory during the course.

6.2 A candidate who has secured attendance between 65% and 74% (both included), due to medical reasons (Hospitalization / Accident / Specific Illness) or due to participation in University / District / State / National / International level sports or due to participation in Seminar / Conference / Workshop / Training Programme / Voluntary Service / Extension activities or similar programmes with prior permission from the Registrar shall be given exemption from prescribed attendance requirements and shall be permitted to appear for the Examination on the recommendation of the Head of the Department concerned and Dean to condone the lack of attendance. The Head of the Department has to verify and certify the genuineness of the case before recommending to the Dean. However, the candidate has to pay prescribed condonation fees.

6.3 Candidates who are not recommended for condonation and those who have less than 65% attendance will not be permitted to proceed to the next semester and have to redo the course. However, they are permitted to write the arrear Examinations, if any.

7. CLASS ADVISOR

To help the students in planning their courses of study and for general advice on the academic programme, the Head of the Department will attach a certain number of students to a teacher of the Department who shall function as Class Advisor for those students throughout their period of study. Such Class Advisors shall advise the students and monitor the courses undergone by the students, check the attendance and progress of the students and counsel them periodically. If necessary, the Class Advisor may display the cumulative attendance particulars in the Department notice board and also discuss with or inform the Parents/Guardian about the progress of the students. Each student shall be provided with course plan for each course at the beginning of each semester.

8. CLASS COMMITTEE

8.1. Every class shall have a class committee consisting of teachers of the class concerned, Maximum of six student representatives [boys and girls] and the concerned Head of the Department. It is like the 'Quality Circle' with the overall goal of improving the teaching-learning process. The functions of the class committee include

- Clarifying the regulations of the degree programme and the details of rules therein particularly Clause 4 and 5 which should be displayed on Department Notice-Board.
- Informing the student representatives, the details of Regulations regarding weight age used for each assessment. In the case of practical courses (laboratory / drawing / project work / seminar, etc.) the breakup of marks for each experiment / exercise /module of work, should be clearly discussed in the class committee meeting and informed to the students.
- Solving problems experienced by students in the class room and in the laboratories.
- Informing the student representatives, the academic schedule, including the dates of assessments and the syllabus coverage for each assessment.
- Analyzing the performance of the students of the class after each test and finding the ways and means of solving problems, if any.
- Identifying the weak students, if any and requesting the teachers concerned to provide some additional academic support.

8.2 The class committee for a class under a particular branch is normally constituted by the Head of the Department. However, if the students of different branches are mixed in a class (like the first semester which is generally common to all branches), the class committee is to be constituted by the Dean.

8.3 The class committee shall be constituted within the first week of each semester.

8.4 The Chairperson of the Class Committee may convene the meeting of the class committee.

- **8.5** The Dean may participate in any Class Committee of the Faculty.
- **8.6** The Chairperson is required to prepare the minutes of every meeting, submit the same to Dean through the HOD within two days of the meeting and arrange to circulate it among the students and teachers concerned. If there are some points in the minutes requiring action by the

Management, the same shall be brought to the notice of the Registrar by the HOD through Dean.

8.7 The first meeting of the Class Committee shall be held within one week from the date of commencement of the semester, in order to inform the students about the nature and weightage of assessments within the framework of the regulations. Two subsequent meetings may be held in a semester at suitable intervals. During these meetings the student members representing the entire class, shall meaningfully interact and express their opinions and suggestions of the other students of the class in order to improve the effectiveness of the teaching-learning process.

9. COURSE COMMITTEE FOR COMMON COURSES

Each common theory course offered to more than one discipline or group, shall have a "Course Committee" comprising all the teachers handling the common course with one of the nominated as Course Coordinator. The nomination of the Course Coordinator shall be made by the Dean depending upon whether all the teachers teaching the common course belong to a single department or to several departments. The 'Course Committee' shall meet to arrive at a common scheme of evaluation for the test and shall ensure a uniform evaluation of the tests. Where ever feasible, the Course Committee may also prepare a common question paper for the Internal Assessment test(s).

10. PROCEDURE FOR AWARDING MARKS FOR INTERNAL ASSESSMENT

10.1 Every teacher is required to maintain an 'ATTENDANCE AND ASSESSMENT RECORD'(Log book) which consists of attendance marked in each theory or practical or project work class, the test marks and the record of class work (topic covered), separately for each course.

10.2 Continuous Internal Assessment (CIA): The performance of students in each subject will be continuously assessed by the respective teachers as per the guidelines given below:

| S. No. | CATEGORY | MAXIMUM MARKS |
|---------------------------------------|------------|------------------|
| 1. | Assignment | 5 |
| 2. | Seminar * | 5 |
| 3. | Attendance | 5 |
| 4. | Test – I | 8 |
| 5. | Test – II | 8 |
| 6. | Test – III | 9 |
| Continuous Internal Assessment: TOTAL | | 40 |

THEORY COURSES:

*Evaluation shall be made by a committee.

| INSTRUCTION REMARKS | | | |
|---------------------|---|--|--|
| Maximum Marks | 60 | | |
| Duration | 2 Hours | | |
| Port_ A | 1 to 9 Two Mark Questions, uniformly covering the two | | |
| | units of the syllabus. All the 9 Questions are to be | | |
| | answered. | | |
| | (9 x 2 =18Marks). | | |
| | Question 10 to 12 will be of either or type, covering two | | |
| Part- B | units of the syllabus. Each Question may have | | |
| | subdivision. | | |
| | (3 x 14 =42 Marks). | | |

PATTERN OF TEST QUESTION PAPER (Test I & II)

PATTERN OF TEST QUESTION PAPER (Test III)

| INSTRUCTION | REMARKS | | |
|---------------|--|--|--|
| Maximum Marks | Marks 100 | | |
| Duration | 3 Hours | | |
| Port _ A | Part A will be online Examination. 20 Objective type | | |
| I alt - A | Questions, Covering all the 5 units. (20 x 1= 20 Marks) | | |
| | (Online Examination). | | |
| Dort R | 21 to 25 Two Mark Questions, uniformly covering the | | |
| I al t- D | Five units of the syllabus. All the 5 Questions are to be | | |
| | answered. | | |
| | (5 x 2= 10Marks). | | |
| | Question 26 to 30 will be of either or type, covering Five | | |
| Part- C | units of the syllabus. Each Question may have | | |
| | subdivision. | | |
| | (5 x 14=70 Marks). | | |

PRACTICAL COURSES:

| S. No | CATEGORY | MAXIMUM MARKS |
|------------|------------------------------|------------------|
| 1. | Attendance | 5 |
| 2. | Observation work | 5 |
| 3. | Record work | 5 |
| 4. | Model Examination | 15 |
| 5. | Viva – Voce [Comprehensive] | 10 |
| Continuous | s Internal Assessment: TOTAL | 40 |

Every practical exercise / experiment shall be evaluated based on the conduct of exercise/ experiment and records maintained.

INTEGRATED THEORY AND PRACTICAL COURSES:

The Continuous Internal Assessment for Integrated Theory and Practical Course is awarded for 40 Marks with mark split up similar to regular theory course. But Assignment and Seminar components are replaced by Observation and Record marks.

| S.No. | CATEGORY | MAXIMUM MARKS |
|---------------------------------------|-------------|------------------|
| 1. | Observation | 5 |
| 2. | Record | 5 |
| 3. | Attendance | 5 |
| 4. | Test –I | 8 |
| 5. | Test –II | 8 |
| 6. | Test–III | 9 |
| Continuous Internal Assessment :TOTAL | | 40 |

The external evaluation of integrated practical component from End semester Examination by internal mode is awarded for 50 Marks and later scaled down to 15 Marks and similarly the external evaluation for integrated theory from End semester Examination is awarded for 100 Marks and later scaled down to 45 Marks. Hence the external assessment for integrated theory and practical components contribute to 60 Marks.

10.3 ATTENDANCE

Attendance carries a maximum of 5 marks and the distribution is as under:

| S. No. | Attendance % | Marks |
|--------|--------------|-------|
| 1 | 91 and above | 5.0 |
| 2 | 81-90 | 4.0 |
| 3 | 76-80 | 3.0 |

10.4 PROJECT WORK/ INTERNSHIPS:

Final year project work will be always in-house. However, as a special case, if a student is able to get a project from a government organization or private or public sector company, the student may be permitted to do his/her project work in reputed institution/research organization/industry. Hence final year students may have commencement of eighth semester classes for 30 days in fast track mode and complete their final semester and are made eligible for undergoing Internships in Industry and also interested students are permitted for doing projects in Industries.

10.5 CERTIFICATION COURSES:

Students have to undergo a minimum of one value added course beyond curriculum as a certified course per semester for duration not less than 30 hours.

11. REQUIREMENTS FOR APPEARING FOR END SEMESTER EXAMINATION (ESE)

A candidate shall normally be permitted to appear for the ESE of any semester commencing from I semester if he/she has satisfied the semester completion requirements (Subject to Clause 5) and has registered for Examination in all courses of the semester. Registration is mandatory for Semester Examinations as well as arrear Examinations failing which the candidate will not be permitted to attend the next semester. A candidate already appeared for a subject in a semester and passed the Examination is not entitled to reappear in the same subject of the semester for improvement of grade.

12. END SEMESTER EXAMINATION

ESE will be held at the end of each semester for each subject, for 100 marks, later scaled down to 60 marks.

| INSTRUCTION REMARKS | | | |
|---------------------|---|--|--|
| Maximum Marks | 100 | | |
| Duration | 3 Hours | | |
| Port - A | Part A will be online Examination. 20 Objective | | |
| I alt - A | type Questions. Covering all the 5 units. 20*1 = | | |
| | 20 Marks (Online Examination) | | |
| Port- B | 21 to 25 Two Mark Questions, uniformly | | |
| | covering the Five units of the syllabus. All the | | |
| | 5 Questions are to be answered. | | |
| | (5 *2= 10Marks). | | |
| | Question 26 to 30 will be of either or type, | | |
| Part- C | covering Five units of the syllabus. Each | | |
| | Question may have subdivision. | | |
| | (5*14=70 Marks) | | |

PATTERN OF ESE QUESTION PAPER:

13. PASSING REQUIREMENTS

13.1 Passing minimum: The passing minimum for CIA is 20 (i.e. out of 40 marks). The passing minimum for ESE is 30 (i.e. out of 60 marks). The overall passing minimum for theory/laboratory course is 50 (Sum of his/her score in CIA and ESE) out of 100 marks.

13.1.1 The passing minimum for value added course is 50 marks out of 100marks. There will betwo tests, the first covering 50% of syllabus for 50 marks and the other for 50 marks.

13.2 If the candidate fails to secure a pass in a particular course ESE, it is mandatory that candidate shall register and reappear for the Examination in that course during the subsequent semester when Examination is conducted in that course. Further the candidate should continue to register and reappear for the Examination till a pass is secured in such supplementary Examination within the stipulated maximum duration of the programme (Clause 5.1).

The CIA marks obtained by the candidate in his/her first or subsequent appearance where

he/she secures a pass shall be retained by the office of the Controller of Examinations and considered valid for all remaining attempts till the candidate secures a pass in his/her ESE.

13.3 If the candidate fails to secure a pass in a particular course in CIA, it is mandatory that candidate shall register and reappear for the CIA in that course during the subsequent semester when CIA is conducted in that course by the faculty member assigned for that particular course during that semester by the concerned HOD. Further, the candidate should continue to register and reappear for the CIA till a pass is secured in such subsequent Examination within the stipulated maximum duration of the programme (Clause 5.1).

13.3.1 If a candidate fails to secure a pass in value added course, he/she has to appear for the tests when course is conducted subsequently.

13.4 ONLINE COURSE(MOOC) COORDINATOR

To help students in planning their online courses and for general advice on online courses, the HOD shall nominate a MOOC coordinator for the online courses. The Online course MOOC coordinator

shall identify the courses which students can select for their programme from the available online courses offered by the different agencies periodically and inform the same to the students. Further, the coordinator shall advice the students regarding the online courses and monitor their course.

13.4.1 Student Shall study atleast one online course from Sawayam/NPTEL in anyone of the first seven semesters for which examination shall be conducted at the end of the course by the respective organization body. The student can register to the course which are approved by the department. The student shall produce a pass certificate from the respective body before the end of the seventh semester.

14. AWARD OF LETTER GRADES

14.1 All assessments of a course will be done on absolute mark basis. However, for the purpose of reporting the performance of a candidate letter grades, each carrying certain number of points will be awarded as per the range of total marks (out of 100) obtained by the candidate in each subject as detailed below:

| Letter grade | Marks Range | Grade Point | Description |
|--------------|-------------|-------------|---------------|
| 0 | 91 - 100 | 10 | OUTSTANDING |
| A+ | 81-90 | 9 | EXCELLENT |
| Α | 71-80 | 8 | VERY GOOD |
| B+ | 66- 70 | 7 | GOOD |
| В | 61 – 65 | 6 | ABOVE AVERAGE |
| С | 55 - 60 | 5 | AVERAGE |
| D | 50 - 54 | 4 | PASS |
| RA | <50 | - | REAPPEARANCE |

| AB | 0 | ABSENT |
|----|---|--------|
| | | |

14.2 GRADE SHEET

After results are declared, Grade sheet will be issued to each student which will contain the following details:

- i. The list of courses enrolled during the semester and the grade scored,
- ii. The Grade Point Average (GPA) for the semester and
- iii. The Cumulative Grade Point Average (CGPA) of all courses enrolled from first semester onwards.

GPA is the ratio of the sum of the products of the number of Credits (**C**) of courses enrolled and the Grade Points (**GP**) corresponding to the grades scored in those courses, taken for all the courses to the sum of the number of credits of all the courses in the semester.

$$GPA = \frac{Sum of [C*GP]}{sum of c}$$

CGPA will be calculated in a similar manner, considering all the courses enrolled from First semester. **RA** grade and value added course will be excluded for calculating **GPA** and **CGPA**.

14.3 REVALUATION

Revaluation and Re-totaling are allowed on representation. A candidate can apply for revaluation of his/her semester Examination answer paper in a theory course, within 2 weeks from the declaration of results, on payment of a prescribed fee through proper application to the Controller of Examinations through the Head of the Department and Dean. A candidate can apply for revaluation of answer scripts for not exceeding 5 subjects at a time. The Controller of Examinations will arrange for the revaluation and the results will be intimated to the candidate through the Head of the Department and Dean. Revaluation is not permitted for Supplementary Examinations, Practical Examinations, Technical Seminars, In-plant Training and Project Work.

14.4 TRANSPARENCY AND GRIEVANCE COMMITTEE

A student may get the Photostat copy of the answer script on payment of prescribed fee, if he/she wishes. The students can represent the grievance, if any, to the Grievance Committee, which consists of Dean of the Faculty, (if Dean is HOD, the Dean of another Faculty nominated by the University), HOD of the Department concerned, the faculty of the course and Dean from other discipline nominated by the University and the COE. If the Committee feels that the grievance is genuine, the script may be sent for external valuation; the marks awarded by the External Examiner will be final. The student has to pay prescribed fee for the same.

15. ELIGIBILITY FOR AWARD OF DEGREE

A student shall be declared to be eligible for award of Degree if he/she has

 Successfully gained the required number of total credits as specified in the curriculum Karpagam Academy of Higher Education (Deemed to be University), Coimbatore-641021 XII corresponding to his/her programme within the stipulated time.

• No disciplinary action is pending against him/her.

The award of the degree must be approved by the Board of Management of Karpagam

Academy of Higher Education.

16. CLASSIFICATION OF THE DEGREE AWARDED

- **16.1** A candidate who qualifies for the award of the Degree (vide Clause 15) having passed the Examination in all the courses in his/her first appearance within the specified minimum number of semesters (vide Clause 5.1) securing a CGPA of not less than **8** shall be declared to have passed the Examination in First Class with Distinction.
- 16.2 A regular is eligible candidate or a lateral entrant to register for BE(Honors), B.Tech.(Honors). If, he / she has passed all the courses in the first appearance and holds / maintains a CGPA of 7.5 at VI Semester. He / she has to take an additional 20 credits by studying online courses through Swayam/NPTEL. Such a candidate is eligible for the award of BE (Honor), B.Tech.(Honor). However, is he / she fails in securing 20 additional credits but maintains CGPA of 7.5 and above is not eligible for Honors degree but eligible for First class with Distinction.
- 16.3 A candidate who qualifies for the award of the Degree (vide Clause 15) having passed the Examination in all the courses within the specified minimum number of semesters (vide Clause 5.1) plus one year (two semesters), securing CGPA of not less than 6.5 shall be declared to have passed the Examination in First Class.
- **16.3** All other candidates (not covered in Clauses 17.1 and 17.2) who qualify for the award of the degree (vide Clause 15) shall be declared to have passed the Examination in Second Class.

17. PROVISION FOR WITHDRAWAL FROM END-SEMESTER EXAMINATION

- **17.1** A candidate may for valid reasons and on prior application, be granted permission to Withdraw from appearing for the examination of any one course or consecutive examinations of more than one course in a semester examination.
- **17.2** Such withdrawal shall be permitted only once during the entire duration of the degree programme. Withdrawal application shall be valid only if the candidate is otherwise eligible to write the Examination
- .17.3 Withdrawal application is valid only if it is made within 10 days prior to the commencement of the Examination in that course or courses and recommended by the Head of the Department, Dean and approved by the Registrar.
- **17.3.1** Notwithstanding the requirement of mandatory TEN days notice, applications for withdrawal for special cases under extraordinary conditions may be considered on the merit of the case.
- **17.4** Withdrawal shall not be construed as an appearance for the eligibility of a candidate for First Class with Distinction. This provision is not applicable to those who seek withdrawal during III semester.

- **17.5** Withdrawal from the ESE is NOT applicable to arrear Examinations.
- **17.6** The candidate shall reappear for the withdrawn courses during the Examination conducted in the subsequent semester.

18. PROVISION FOR AUTHORISED BREAK OF STUDY

18.1 Break of Study shall be granted only once for valid reasons for a maximum of one year during the entire period of study of the degree programme. However, in extraordinary situation the candidate may apply for additional break of study not exceeding another one year by paying prescribed fee for break of study. If a candidate intends to temporarily discontinue the programme in the middle of the semester for valid reasons and to rejoin the programme in a subsequent year, permission may be granted based on the merits of the case provided he/she applies to the Registrar, through the Head of the Department and Dean stating reasons thereof and the probable date of rejoining the programme.

18.2 The total number of semesters for completion of the programme from the commencement of the first semester to which the candidate was admitted shall not exceed the maximum no. of semesters specified in Clause 5.1 irrespective of the period of break of study (vide Clause 18) in order that he/she may be eligible for the award of the degree (vide Clause 15). The candidate thus permitted to rejoin the programme at the commencement of the semester after the break shall be governed by the curriculum and regulations in force at the time of rejoining. Such candidates may have to do additional courses as per the curriculum and regulations in force at that period of time.

18.3 The authorized break of study (for a maximum of one year) will not be counted for the duration specified for passing all the courses for the purpose of classification (vide Clause17). However, additional break of study granted will be counted for the purpose of classification.

18.4 The total period for completion of the programme reckoned from, the commencement of the first semester to which the candidate was admitted shall not exceed the maximum period specified in Clause 5.1 irrespective of the period of break of study (vide Clause 18.3) in order that he/she may be eligible for the award of the degree.

18.5 If any student is detained for want of requisite attendance, progress and good conduct, the period spent in that semester shall not be considered as permitted 'Withdrawal' or 'Break of Study' (Clause18 and 18 respectively).

19. SUPPLEMENTARY ESE: After the publication of VIII semester results, if a student has **ONE** arrear in any theory course of the entire programme, he/she will be permitted to apply within 15 days of the publication of results, and appear for supplementary Examination.

20. INDUSTRIAL VISIT

Every student is required to undergo one industrial visit for every semester, starting from the third semester of the programme.

21. DISCIPLINE

Every student is required to observe discipline and decorous behavior both inside and outside the University and not to indulge in any activity which will tend to bring down the prestige of the University. The erring student will be referred to the Disciplinary Committee constituted by the University, to enquire into acts of indiscipline and recommend to the University about the disciplinary action to be taken.

If a student indulges in malpractice in any of the ESE/CIA he/she shall be liable for punitive action as prescribed by the University from time to time.

22. REVISION OF REGULATION AND CURRICULUM

The University may from time to time revise, amend or change the Regulations, Scheme of Examinations and syllabi, if found necessary on the recommendations of Board of Studies, Academic Council and Board of Management of Karpagam Academy of Higher Education.

23.KARPAGAM INNOVATION AND INCUBATION COUNCIL (KIIC) (A Section 8 Company)

Based on the 2019 National Innovation and Startup Policy and the 2019–2023 Tamil Nadu Startup Policy, KIIC has recommended to the KAHE students who are affiliated with the KIIC that it be incorporated in the university Program Regulations 2023-24 and implement from this academic year.

23.1 Norms to Student Start-Ups

- a) Any (UG/PG /(Ph.D.) Research scholars, student, right from the first year of their programme is allowed to set a startup (or) work part time/ full time in a startup or work as intern in a startup
- b) Any (UG/PG / (Ph.D.) Research scholars) student right from the first year of their programme is allowed to earn credit for working on Innovative prototypes/business Models/ Pre incubation (case to case basis). Start Up activities will be evaluated based on the guidelines being given by the expert committee of the KIIC
- c) Student Entrepreneurs may use the address of incubation center (KIIC) to register their venture while studying in KAHE.
- d) Students engaged in startups affiliated with the KIIC or those who work for them may be exempted from KAHE's attendance requirements for academic courses under current regulations, up to a maximum of 30% attendance per semester, including claims for ODs and medical emergencies Potential Students who have been incubated at KIIC may be permitted to take their University semester exams even if their attendance is below the minimum acceptable percentage, with the proper authorization from the head of the institution.

(On case-to-case basis depends upon the applicability strength, societal benefits and quality of the Innovation and Subsequent engagement of the students with the/ her business)

- e) Any Students Innovators/entrepreneurs are allowed to opt their startup in place mini project /major project, /seminar and summer training etc. (In plant training, Internship, value added Course.). The area in which the student wishes to launch a Startup may be interdisciplinary or multidisciplinary.
- f) Student's startups are to be evaluated by Expert committee, formed by KIIC and KAHE.

23.2 Guide lines to award Credits/ Marks to a Student startup

Student's startup stages are divided into five phases and these startup phases can be considered equally in place of the course title as mentioned below with the same credits allotted to the course title in a university curriculum.

| Sl. No. | Description/Startup phases | In place of the Subject / Course title | Grades/Credits /Marks |
|------------|---|--|--|
| 1 | Idea stage/Problem Identification | Seminar | |
| 2 | Proof of Concept (POC) /Solution development | In-plant training /Internship | Same Marks/Credits can |
| 3 | Product Development (Lab scale) /Prototype Model/ Company Registered | Mini Project/ Value added Course | be awarded that are listed in the course title's curriculum for the |
| 4 | Validation/Testing | Main Project phase I | respective startup phases. |
| 5 | Business Model/Ready for Commercialization/Implementation | Main Project phase II | |

DEPARTMENT OF FOOD TECHNOLOGY

B. TECH. FOOD TECHNOLOGY

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

- 1. To prepare the graduates with strong knowledge and practical skills in their professional career.
- 2. To prepare the graduates to find out the workable solutions to troubleshoot the challenges involved in the food processing and its related sectors.
- 3. To prepare the graduates with ethical attitude, leadership, interdisciplinary skills, adapt to current trends through lifelong learning and to serve the society.

PROGRAM OUTCOME (PO)

The graduates of Food Technology (B. Tech.) will be able to:

- a. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- b. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- c. Design/development of solutions: Design solutions for complex engineeringproblems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
- d. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation ofdata, and synthesis of the information to provide valid conclusions
- e. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- f. The engineer and society: Apply reasoning informed by the contextual knowledgeto assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
- g. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate theknowledge of, and need for sustainable development.
- h. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

- i. Individual and team work: Function effectively as an individual, and as a memberor leader in diverse teams, and in multidisciplinary settings
- j. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend andwrite effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- k. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- 1. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSO)

At the end of the B.Tech. Biotechnology program, the graduates will be able to

- 1. Demonstrate the knowledge in fundamental sciences and engineering that are essential to understand food processing and preservation technology.
- 2. Demonstrate a working knowledge to apply for advanced food sciences and technologies.

PEO-PO mapping

| | PO | PO | PO | PO | PO | PO | PO | PO | PO | PO | PO | PO |
|-----|----|--------------|--------------|----|----|--------------|--------------|----|----|----|----|--------------|
| | а | b | С | d | e | f | g | h | i | j | k | 1 |
| PEO | 1 | 1 | 1 | 1 | 1 | | | | | 1 | | |
| 1 | • | • | • | • | • | | | | | • | | |
| PEO | | \checkmark | \checkmark | ~ | | \checkmark | \checkmark | ~ | | | | |
| 2 | | • | • | - | | • | • | • | | | | |
| PEO | | | | | | | | | 1 | | 1 | \checkmark |
| 3 | | | | • | | | | | • | | • | • |

PEO-PSO mapping

| | PSO1 | PSO2 |
|------|--------------|--------------|
| PEO1 | \checkmark | \checkmark |
| PEO2 | \checkmark | \checkmark |
| PEO3 | | \checkmark |



KARPAGAM ACADEMY OF HIGHER EDUCATION

Deemed to be University (Established Under Section 3 of the UGC Act, 1956) (Accredited with A+ Grade by NAAC in the Second Cycle) Pollachi Main Road, Eachanari Post, Coimbatore - 641 021, Tamil Nadu, India.

B. TECH. – FOOD TECHNOLOGY

COLLEGE OF STUDY AND SCHEME OF EXAMINATION

(2023 BATCH ONWARDS)

| Semester - I | | | | | | | | | | | | |
|--------------|-----------------------|------|----------------|-----|------------|-----|---|-------|-------|-------|-------|----|
| Course Code | Course Title | | Objective | Ins | truct | ion | | Ma | ximum | Marks | Page | |
| | | ory | | | hours/week | | | its | | | | No |
| | | ateg | РО | PSO | L | Т | Р | Credi | CIA | ESE | Total | |
| | | C | | | | | |) | 40 | 60 | 100 | |
| 23BTCC101 | Professional | HS | 9,10,11,12 | - | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 1 |
| | Communicative | | | | | | | | | | | |
| | English | | | | | | | | | | | |
| 23BTCC102 | Matrices and Calculus | BS | 1,2,3,4,12 | 1 | 3 | 1 | 0 | 4 | 40 | 60 | 100 | 3 |
| 23BTCC103 | Environmental Studies | BS | 1,2,7,12 | - | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 5 |
| 23BTCC141 | Engineering | BS | 1,2,3,4 | | 4 | 0 | 2 | 5 | 40 | 60 | 100 | 8 |
| | Chemistry | | | | | | | | | | | |
| 23BTCC142 | Programming in C | ES | 1,2,3,4,5,6,12 | 1,2 | 4 | 0 | 2 | 5 | 40 | 60 | 100 | 11 |
| 23BTCC111 | Engineering Graphics | ES | - | - | 2 | 0 | 2 | 3 | 40 | 60 | 100 | 14 |
| 23BTMC151 | Design Thinking | ES | 1,5,9,10,12 | | 1 | 0 | 2 | 2 | 100 | - | 100 | 16 |
| 23BTMC152 | Sports and Yoga | MC | - | - | 1 | 0 | 0 | 0 | 100 | - | 100 | 18 |
| 23BTMC153 | தமிழர் மரபும் | MC | - | - | 1 | 0 | 0 | 0 | 100 | - | 100 | 20 |
| | பண்பாடும் | | | | | | | | | | | |
| SEMESTER 1 | TOTAL | | | | 22 | 1 | 8 | 25 | 540 | 360 | 900 | |

| Semester - II | | | | | | | | | | | | | |
|---------------|-----------------------------|------|----------------------|-----|------|-------|---|-----|-----|-------|-------|-------|--|
| Course Code | Course Title | ry | Objectives Instructi | | | uctio | n | its | Ma | ximum | Marks | Page | |
| | | tego | | | hour | s/wee | k | red | | | | No | |
| | | Ca | РО | PSO | L | Т | Р | | CIA | ESE | Total | | |
| | | | | | | | | | 40 | 60 | 100 | | |
| 23BTCC201C | Transforms and its | BS | 1,2,3, | 1 | 3 | 1 | 0 | 4 | 40 | 60 | 100 | 22 | |
| | Applications | | 4,12 | | | | | | | | | | |
| 23BTFT202 | Physics for Food Technology | BS | 1,2,3, | 1 | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 25 | |
| | | | 10,12 | | | | | | | | | | |
| 23BTFT203 | Fundamentals of Food | ES | 1,2,6, | 1,2 | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 28 | |
| | Science and Technology | | 8,10, | | | | | | | | | | |
| | | | 12 | | | | | | | | | | |
| 23BTCC241 | Basic Electrical and | ES | 1,2,3 | 1,2 | 3 | 0 | 2 | 4 | 40 | 60 | 100 | 30 | |
| | Electronics Engineering | | | | | | | | | | | | |
| 23BTCC242A/ | Data Structure and | ES | 1,2,3, | 1,2 | 4 | 0 | 2 | 5 | 40 | 60 | 100 | 32,35 | |
| 23BTCC242B | Algorithms/Object Oriented | | 4,5,6, | | | | | | | | | | |
| | Programming with Python | | 9,11, | | | | | | | | | | |
| | | | 12 | | | | | | | | | | |
| 23BTCC211 | Workshop Practices | HS | - | - | 0 | 0 | 4 | 2 | 40 | 60 | 100 | 38 | |
| 23BTMC251 | Soft Skills | MC | _ | — | 1 | 0 | 0 | 0 | 40 | 60 | 100 | 40 | |
| 23BTMC252 | Women Safety and Security | MC | - | - | 1 | 0 | 0 | 0 | 100 | - | 100 | 41 | |
| SEMESTER TO | OTAL | | | | 18 | 1 | 8 | 21 | 380 | 420 | 800 | | |

| Semester – III | | | | | | | | | | | | | |
|----------------|---------------------------|-------|------------|--------|-------|-------|---|------|-----|-------|-------|-------|--|
| Course Code | Course Title | | Obje | ctives | Instr | uctio | n | | Max | timum | Marks | Page | |
| | | ory | hours/week | | its | | | | No | | | | |
| | | Categ | РО | PSO | L | Т | Р | Cred | CIA | ESE | Total | | |
| | | | | | | | | | 40 | 60 | 100 | | |
| 23BTFT301B | Numerical Methods | HS | 1,2,3, | 1 | 3 | 1 | 0 | 4 | 40 | 60 | 100 | 42 | |
| | | | 4,12 | | | | | | | | | | |
| 23BTFT302 | Post-HarvestTechnology | ES | 1,2,1 | 1,2 | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 44 | |
| | | | 1,12 | | | | | | | | | | |
| 23BTFT303 | Food ProcessCalculations | ES | 1,2,9 | 1,2 | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 46 | |
| 23BTFT304 | Thermodynamics | ES | 1,2,9 | 1,2 | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 48 | |
| 23BTFT341 | Food Microbiology | ES | 1,2,9, | 1,2 | 3 | 0 | 2 | 4 | 40 | 60 | 100 | 50 | |
| | | | 11 | | | | | | | | | | |
| 23BTFT342 | Food Chemistry | ES | 1,2,9, | 1,2 | 3 | 0 | 2 | 4 | 40 | 60 | 100 | 53 | |
| | | | 11 | | | | | | | | | | |
| 23BTFT343 | Field Project/ Internship | Р | - | - | 0 | 0 | 0 | 1 | 100 | 0 | 100 | 56 | |
| 23BTMC351 | Aptitude and Reasoning | MC | - | - | 1 | 0 | 0 | 0 | 100 | 0 | 100 | 57 | |
| 23BTMC352A | Foreign Language German/ | MC | - | - | 1 | 0 | 0 | 0 | 100 | 0 | 100 | 59,61 | |
| /23BTMC352 | Foreign Language French | | | | | | | | | | | | |
| В | | | | | | | | | | | | | |
| SEMESTER TO | SEMESTER TOTAL | | | | | 1 | 4 | 22 | 540 | 360 | 900 | | |

| Semester – IV | | | | | | | | | | | | | |
|---------------|-------------------------------|------|--------|--------|-------|--------|----|-----|-----|--------|-------|------|--|
| Course Code | Course Title | ry | Obje | ctives | Insti | ructio | n | its | May | kimumI | Marks | Page | |
| | | tego | | | hour | s/wee | ek | red | | | | No | |
| | | Ca | РО | PSO | L | Т | Р | | CIA | ESE | Total | | |
| | | | | | | | | | 40 | 60 | 100 | | |
| 23BTFT401A | Probability and | HS | 1,2,3, | 1 | 3 | 1 | 0 | 4 | 40 | 60 | 100 | 63 | |
| | Statistics | | 4,12 | | | | | | | | | | |
| 23BTFT402 | Fluid Mechanics | ES | 1,2,9 | 1,2 | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 66 | |
| 23BTFT403 | Plantation Productsand Spice | ES | 1,2,1 | 1,2 | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 68 | |
| | Processing Technology | | 1 | | | | | | | | | | |
| 23BTFT404 | Heat and MassTransfer | ES | 1,2,9 | 1,2 | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 71 | |
| | | | | | | | | | | | | | |
| 23BTFT441 | Unit Operations inFood | ES | 1,2,9 | 1,2 | 3 | 0 | 2 | 4 | 40 | 60 | 100 | 74 | |
| | Processing | | | | | | | | | | | | |
| 23BTFT442 | Food Biochemistryand | ES | 1,2,9, | 1,2 | 3 | 0 | 2 | 4 | 40 | 60 | 100 | 77 | |
| | Nutrition | | 11 | | | | | | | | | | |
| 23BTMC451 | Foundation of | MC | - | - | 1 | 0 | 0 | 0 | 100 | 0 | 100 | 80 | |
| | Entrepreneurship | | | | | | | | | | | | |
| 23BTMC452 | Essence of Traditional Indian | MC | - | | 1 | 0 | 0 | 0 | 100 | 0 | 100 | 82 | |
| | Knowledge and Heritage | | | | | | | | | | | | |
| SEMESTER T | OTAL | | | | 20 | 0 | 4 | 21 | 440 | 360 | 800 | | |

| Semester – V | | | | | | | | | | | | | |
|--------------|---|--------|------------|--------|---------------|----------------|----------|--------|-----|-------|------------|----|--|
| Course Code | Course Title | tegory | Obje | ctives | Instr hour | uctio s/wee | on ek | redits | Max | Marks | Page No | | |
| | | Ca | РО | PSO | L | Т | Р | | CIA | ESE | Total | | |
| | | | | | | | | | 40 | 60 | 100 | | |
| 23BTFT501 | Refrigeration, Air conditioning and Cold Storage for Perishable Foods | ES | 1,2,3 | 1,2 | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 83 | |
| 23BTFT502 | Dairy Technology | ES | 1,2 | 1,2 | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 85 | |
| 23BTFT541 | Food Analysis | ES | 1,2 | 1,2 | 3 | 0 | 2 | 4 | 40 | 60 | 100 | 87 | |
| 23BTFT542 | Fruits and Vegetables Processing Technology Laboratory | ES | 1,2,1 1 | 1,2 | 3 | 0 | 2 | 4 | 40 | 60 | 100 | 90 | |
| 23BTFT5E- | ProfessionalElective - I | ES | - | - | 3 | 0 | 0 | 3 | 40 | 60 | 100 | - | |
| 23BTFT5E- | Professional Elective - II | ES | - | - | 3 | 0 | 0 | 3 | 40 | 60 | 100 | - | |
| 23BTFT591 | Field Project/ Internship | HS | - | - | 0 | 0 | 0 | 1 | 100 | 0 | 100 | 93 | |
| 23BTMC551 | Cyber Security | MC | - | - | 1 | 0 | 0 | 0 | 100 | 0 | 100 | 94 | |
| SEMESTER T | EMESTER TOTAL | | | | | 0 | 4 | 21 | 440 | 360 | 800 | | |

| Semester – VI | | | | | | | | | | | | | |
|---------------|--|--------------|-------|---------------|---------------------------|---|---|-----|------------|-----|-------|-----|--|
| Course Code | Course Title | A Objectives | | Instr hour | Instruction hours/week | | | Max | Page No | | | | |
| | | Ca | РО | PSO | L | Т | Р | | CIA | ESE | Total | | |
| | | | | | | | | | 40 | 60 | 100 | | |
| 22BTFT601 | Food SafetyRegulations | ES | 1,2 | 1,2 | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 96 | |
| 22BTFT641 | Food Additives | ES | 1,2 | 1,2 | 3 | 0 | 2 | 4 | 40 | 60 | 100 | 99 | |
| 22BTFT642 | Bakery and Confectionary Technology | ES | 1,2,3 | 1,2 | 3 | 0 | 2 | 4 | 40 | 60 | 100 | 102 | |
| 22BTFT6E | ProfessionalElective – III | ES | - | - | 3 | 0 | 0 | 3 | 40 | 60 | 100 | - | |
| 23BTFT6E | ProfessionalElective – IV | ES | - | - | 3 | 0 | 0 | 3 | 40 | 60 | 100 | - | |
| 22BTFT6OE | Open Elective –I | ES | - | - | 3 | 0 | 0 | 3 | 40 | 60 | 100 | - | |
| 23BTFT691 | 23BTFT691 Mini Project P | | | | | | | 2 | 100 | 0 | 100 | 105 | |
| SEMESTER TO | OTAL | • | - | • | 18 | 0 | 6 | 22 | 340 | 360 | 700 | | |

| Semester – VII | | | | | | | | | | | | | |
|----------------|-----------------------------|------|------------------------|-----|-----|-------|-----|--------|-------|------|-------|-----|--|
| Course Code | Course Title | | Objectives Instruction | | | | Max | kimumI | Marks | Page | | | |
| | | ory | | | hou | ırs/w | eek | its | | | | No | |
| | | ateg | РО | PSO | L | Т | Р | Cred | CIA | ESE | Total | | |
| | | C | | | | | | Ŭ | 40 | 60 | 100 | | |
| 23BTFT701 | Professional Ethicsand IPR | HS | 1,7,8, | - | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 106 | |
| | | | 12 | | | | | | | | | | |
| 23BTFT702 | Process Economics and Plant | ES | 1,2,3, | 1,2 | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 108 | |
| | Layout Design | | 6,7,8, | | | | | | | | | | |
| | | | 9,10, | | | | | | | | | | |
| | | | 11,12 | | | | | | | | | | |
| 23BTFT741 | Food PackagingTechnology | ES | 1,2,6, | 1,2 | 3 | 0 | 2 | 4 | 40 | 60 | 100 | 110 | |
| | | | 7,10, | | | | | | | | | | |
| | | | 11,12 | | | | | | | | | | |
| 23BTFT7E | ProfessionalElective -V | ES | - | - | 3 | 0 | 0 | 3 | 40 | 60 | 100 | - | |
| 23BTFT7E | ProfessionalElective -VI | ES | - | - | 3 | 0 | 0 | 3 | 40 | 60 | 100 | - | |
| 23BTFT7OE | Open Elective – II | ES | - | - | 3 | 0 | 0 | 3 | 40 | 60 | 100 | - | |
| 23BTFT791 | Project Work Phase | Р | - | - | 0 | 0 | 8 | 4 | 100 | 0 | 100 | 113 | |
| | - I | | | | | | | | | | | | |
| SEMESTER TO | OTAL | 1 | | I | 18 | 0 | 10 | 23 | 340 | 360 | 700 | | |

| | | | Semeste | er – VII | I | | | | | | | |
|-------------|-------------------------|------|--------------|----------|-------------|---|----|------|-----|--------|-------|------|
| Course Code | Course Title | | Obje | ctives | Instruction | | | | May | kimumN | Marks | Page |
| | | ory | hours/week s | | hours/week | | | | No | | | |
| | | ateg | РО | PSO | L | Т | Р | Cred | CIA | ESE | Total | |
| | | | | | | | | _ | 160 | 240 | 400 | |
| 23BTFT891 | Project Work Phase – II | Р | - | - | 0 | 0 | 16 | 8 | 160 | 240 | 400 | 114 |
| SEMESTER T | OTAL | • | | • | 0 | 0 | 16 | 8 | 160 | 240 | 400 | |
| TOTAL CRED | ITS | | | | 163 | • | • | • | • | • | | |

Professional Elective - I

| Course Code | Course Title | | Objectives | | Instruction | | | | MaximumMarks | | | Page |
|-------------|----------------------------|-------|------------|-----|-------------|------------|---|------|--------------|-----|-------|------|
| | | ory | | | | hours/week | | | | | | No |
| | | Categ | РО | PSO | L | Т | Р | Cred | CIA | ESE | Total | |
| | | | | | | | | | 40 | 60 | 100 | |
| 23BTFT5E01 | Lipid ProcessingTechnology | ES | 1,2,1 | 1,2 | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 115 |
| | | | 1 | | | | | | | | | |
| 23BTFT5E02 | Non-thermal Techniques in | ES | 1,2,9 | 1,2 | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 118 |
| | Food Processing | | | | | | | | | | | |
| 23BTFT5E03 | Cereals andPulses | ES | 1,2,9 | 1,2 | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 120 |
| | Technology | | | | | | | | | | | |

Professional Elective – II

| Course Code | Course Title | | Objectives Instruction | | ion | | May | Marks | Page | | | |
|-------------|--------------------------|-------|------------------------|-----|------------|---|-----|-------|------|-----|-------|-----|
| | | ory | • | | hours/week | | | lits | | | | No |
| | | Categ | РО | PSO | L | Т | Р | Cred | CIA | ESE | Total | |
| | | | | | | | | | 40 | 60 | 100 | |
| 23BTFT5E04 | Milling Technology | ES | 1,2,1 | 1,2 | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 122 |
| | | | 1 | | | | | | | | | |
| 23BTFT5E05 | Technology of Oilseeds | ES | 1,2,9 | 1,2 | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 125 |
| | Processing | | | | | | | | | | | |
| 23BTFT5E06 | Design and Formulationof | ES | 1,2,9 | 1,2 | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 127 |
| | Foods | | | | | | | | | | | |
| 23BTFT5E07 | Functional Foods and | ES | 1,2,9 | 1,2 | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 129 |
| | Nutraceuticals | | | | | | | | | | | |
| 23BTFT5E08 | Snack Food Technology | ES | 1,2,9 | 1,2 | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 132 |

| I I Olebbioliai Elective III |
|------------------------------|
|------------------------------|

| Course Code | Course Title | | Objectives | | Ins | truct | ion | | Max | Marks | Page | |
|--------------------|-----------------------------|-------|------------|-----|------------|-------|------|------|-----|-------|-------|-----|
| | | ory | | | hours/week | | lits | | | | No | |
| | | Categ | РО | PSO | L | Т | Р | Cred | CIA | ESE | Total | |
| | | • | | | | | | | 40 | 60 | 100 | |
| 23BTFT6E01 | Analytical Methods for Food | ES | 1,2,9 | 1,2 | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 134 |
| | Products | | | | | | | | | | | |
| 23BTFT6E02 | Beverage Processing | ES | 1,2,3, | 1,2 | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 137 |
| | Technology | | 7,12 | | | | | | | | | |
| 23BTFT6E03 | New Product Development | ES | 1,2,3, | 1,2 | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 140 |
| | and Sensory | | 12 | | | | | | | | | |
| | Science | | | | | | | | | | | |
| 23BTFT6E04 | Marketing Management | ES | 1,2,8 | 1,2 | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 142 |
| | and InternationalTrade | | | | | | | | | | | |

Professional Elective – IV

| Course Code | Course Title | | Objectives | | Instruction | | | | Max | Marks | Page | |
|-------------|-----------------------------|-------|------------|-----|-------------|--------|-----|------|-----|-------|-------|-----|
| | | ory | | | hou | ırs/we | eek | lits | | | | No |
| | | Categ | РО | PSO | L | Т | Р | Cred | CIA | ESE | Total | |
| | | | | | | | | | 40 | 60 | 100 | |
| 23BTFT6E05 | Food Process Automation | ES | 1,2,3 | 1,2 | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 144 |
| 23BTFT6E06 | Energy Conservation in Food | ES | 1,2,3, | 1,2 | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 146 |
| | Design | | 7 | | | | | | | | | |
| 23BTFT6E07 | Process Control for Food | ES | 1,2,3 | 1,2 | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 148 |
| | Engineers | | | | | | | | | | | |
| 23BTFT6E08 | Waste Management in Food | ES | 1,2,3 | 1,2 | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 151 |
| | Industries | | | | | | | | | | | |
| 23BTFT6E09 | Food Colorants and | ES | 1,2,3 | 1,2 | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 154 |
| | Flavorants | | | | | | | | | | | |
| 23BTFT6E10 | Biologically Active | ES | 1,2,3 | 1,2 | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 156 |
| | Phytochemicals in Foods | | | | | | | | | | | |
| 23BTFT6E11 | Livestock and Marine | ES | 1,2 | 1,2 | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 158 |
| | Technology | | | | | | | | | | | |

| Professional | Elective – V |
|--------------|--------------|
| | |

| Course Code | Course Title | | Obje | ctives | Instruction | | | MaximumMarks | | Marks | Page | |
|-------------|-----------------------------|-------|--------|--------|-------------|-------|-----|--------------|-----|-------|-------|-----|
| | | ory | | | hou | ırs/w | eek | its | | | | No |
| | | Categ | РО | PSO | L | Т | Р | Cred | CIA | ESE | Total | |
| | | Ŭ | | | | | | | 40 | 60 | 100 | |
| 23BTFT7E01 | Novel Food Processing | ES | 1,2,3, | 1,2 | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 161 |
| | Technologies | | 4,5,1 | | | | | | | | | |
| | | | 0,11, | | | | | | | | | |
| | | | 12 | | | | | | | | | |
| 23BTFT7E02 | Extrusion Technology | ES | 1,3,5, | 1,2 | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 163 |
| | | | 8,9,1 | | | | | | | | | |
| | | | 0,12 | | | | | | | | | |
| 23BTFT7E03 | Food Allergy and | ES | 2,9 | 1,2 | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 165 |
| | Toxicology | | | | | | | | | | | |
| 23BTFT7E04 | Total QualityManagement | ES | 1,2,4, | 1,2 | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 167 |
| | | | 6,8,9, | | | | | | | | | |
| | | | 10,11 | | | | | | | | | |
| | | | ,12 | | | | | | | | | |
| 23BTFT7E05 | Cryogenic Engineering | ES | 1,2,3, | 1,2 | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 169 |
| | | | 4,9,1 | | | | | | | | | |
| | | | 1 | | | | | | | | | |
| 23BTFT7E06 | Process Instrumentation and | ES | 1,2,3, | 1,2 | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 171 |
| | Control in Food Processing | | 9,10, | | | | | | | | | |
| | | | 11 | | | | | | | | | |



| Professional | Elective – VI |
|--------------|---------------|
|--------------|---------------|

| Course Code | Course Title | | Obje | ctives | Instruction | | MaximumMarl | | Marks | Page | | |
|-------------|------------------------|-------|--------|--------|-------------|--------|-------------|------|-------|------|-------|-----|
| | | ory | | | hou | ırs/wo | eek | its | | | | No |
| | | Categ | РО | PSO | L | Т | Р | Cred | CIA | ESE | Total | |
| | | Ŭ | | | | | | | 40 | 60 | 100 | |
| 23BTFT7E07 | Food Biotechnology | ES | 1,4,6, | 1,2 | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 173 |
| | | | 11 | | | | | | | | | |
| 23BTFT7E08 | Supply ChainManagement | ES | 1,2,3, | 1,2 | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 175 |
| | | | 4,8,9, | | | | | | | | | |
| | | | 10,11 | | | | | | | | | |
| 23BTFT7E09 | Drying | ES | 1,2,3, | 1,2 | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 177 |
| | Technology forFoods | | 4,8,9, | | | | | | | | | |
| | | | 10,11 | | | | | | | | | |
| 23BTFT7E10 | Food Fermentation | ES | 1,2,3, | 1,2 | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 179 |
| | Technology | | 4,8,9, | | | | | | | | | |
| | | | 10,11 | | | | | | | | | |
| 23BTFT7E11 | Rheology & Texture | ES | 1,2,3, | 1,2 | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 181 |
| | Analysis of Foods | | 4,8,9, | | | | | | | | | |
| | | | 10,11 | | | | | | | | | |
| 23BTFT7E12 | Sea Food Processing | ES | 1,2,3, | 1,2 | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 183 |
| | Technology | | 4,5,6, | | | | | | | | | |
| | | | 7,8,9, | | | | | | | | | |
| | | | 10,11 | | | | | | | | | |

Open Electives I & II

(Offered by Food Technology)

| Course Code | Course Title | | In | structio | n | | Max | larks | PageNo | |
|-------------|--|-------|------------|----------|-----|------|-----|-------|--------|-----|
| | | ory | hours/week | | | lits | | | | |
| | | Jateg | L | Т | T P | | CIA | ESE | Total | |
| | | 0 | | | | | 40 | 60 | 100 | |
| 23BTFTOE01 | Processing of FoodMaterials | OE | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 185 |
| 23BTFTOE02 | Nutrition andDietetics | OE | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 187 |
| 23BTFTOE03 | Ready-to-Eat Foods | OE | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 189 |
| 23BTFTOE04 | AgriculturalWaste and ByproductsUtilization | OE | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 191 |
| 23BTFTOE05 | Design of Food Process Equipment | OE | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 193 |

OPEN ELECTIVE LIST (Offered by other departments) SEMESTER VI &VII

| Course Code | Course Title | | Instruction | | | | Max | larks | PageNo | |
|--------------------|------------------------------|-------|-------------|----------|---|------|-----|-------|--------|-----|
| | | gory | ho | ours/wee | k | lits | | | | |
| | | Categ | L | Т | Р | Cred | CIA | ESE | Total | |
| | | 0 | | | | | 40 | 60 | 100 | |
| 23BEBMEOE0 | Human anatomy and | OE | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 195 |
| 1 | Physiology | | | | | | | | | |
| 23BEBMEOE0 | Artificial Organs and | OE | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 197 |
| 2 | implants | | | | | | | | | |
| | | CIVIL | ENGIN | EERING | ſ | | | | | |
| 23BECEOE01 | Housing, Plan and | OE | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 199 |
| | Management | | | | | | | | | |
| 23BECEOE02 | Building Services | OE | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 201 |
| 23BECEOE03 | Repair and rehabilitation of | OE | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 203 |
| | structures | | | | | | | | | |
| 23BECEOE04 | Computer-Aided Civil | OE | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 205 |
| | Engineering Drawing | | | | | | | | | |

Karpagam Academy of Higher Education (Deemed to Be University), Coimbatore

| 23BECEOE05 | Contracts Management | OE | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 207 |
|------------|-----------------------------|---------|--------|---------|------|-------|-------|----|----------|-----|
| 23BECEOE06 | Air and Noise Pollution and | OE | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 209 |
| | Control | | | | | | | | | |
| | COMPUT | ER SCIE | NCE A | ND ENG | INEE | RING | | | | |
| 23BECSOE01 | Internet of things | OE | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 211 |
| 23BECSOE02 | Machine Learning | OE | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 213 |
| 23BECSOE03 | Block chain Technologies | OE | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 215 |
| 23BECSOE04 | Cloud Computing | OE | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 217 |
| | · | | | | | | | | | |
| 23BECYOE01 | Basics of Cybercrime and | OE | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 219 |
| | Cyber Security | | | | | | | | | |
| 23BECYOE02 | Basics of Cyber Forensics | OE | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 221 |
| 23BECYOE03 | Cyber laws and intellectual | OE | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 223 |
| | property rights | | | | | | | | | |
| 23BECYOE04 | Blockchain and cyber | OE | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 225 |
| | security | | | | | | | | | |
| | ELECTRICAI | AND E | LECTR | ONICS | ENGI | NEERI | NG | | | |
| 23BEEEOE01 | Renewable Energy Systems | OE | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 228 |
| 23BEEEOE02 | Hybrid Electric Vehicles | OE | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 230 |
| | ELECTRONICS | AND CO | MMUN | ICATIC | N EN | GINEI | ERING | | | |
| 23BEECOE01 | Real Time Embedded | OE | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 232 |
| | Systems | | | | | | | | | |
| 23BEECOE02 | Consumer Electronics | OE | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 234 |
| | ME | CHANIC | CAL EN | GINEE | RING | | | | | |
| 23BEMEOE01 | Battery Management System | OE | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 236 |
| 23BEMEOE02 | Industrial Safety and | OE | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 238 |
| | Environment | | | | | | | | | |
| 23BEMEOE03 | Non-destructive Testing | OE | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 240 |
| 23BEMEOE04 | Operation Research | OE | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 242 |
| | ARTIFICIAL 1 | INTELLI | IGENC | E AND I | DATA | SCIEN | NCE | | | |
| 23BTADOE01 | Fundamentals of Data | OE | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 244 |
| | Science | | | | | | | | | |
| 23BTADOE02 | Fundamentals of Artificial | OE | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 246 |
| | Intelligence | | | | | | | | | |
| 23BTADOE03 | Internet Programming | OE | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 248 |
| 23BTADOE04 | Robotics and Automation | OE | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 251 |
| | | BIO T | ECHNO | DLOGY | | | | | . | |

Karpagam Academy of Higher Education (Deemed to Be University), Coimbatore

| 23BTBTOE01 | Basic Bioinformatics | OE | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 253 | |
|------------------------|----------------------|----|---|---|---|---|----|----|-----|-----|--|
| 23BTBTOE02 | Fundamentals of Nano | OE | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 255 | |
| | Biotechnology | | | | | | | | | | |
| SCIENCE AND HUMANITIES | | | | | | | | | | | |
| 23BESHOE01 | Mass communication | OE | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 258 | |
| 23BESHOE02 | Fuzzy mathematics | OE | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 260 | |
| 23BESHOE03 | Material sciences | OE | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 262 | |
| 23BESHOE04 | Green Chemistry | OE | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 265 | |

OPEN ELECTIVE LIST (Offered by Faculty of Arts, Science, Commerce And Management) SEMESTER VI &VII

| Course Code | | Ir | structio | n | | Ma | Page | | | |
|-------------|---|-------|----------|---|------|------|------|-----|-------|-----|
| | ory | ho | ours/wee | k | lits | | No | | | |
| | | Categ | L | Т | Р | Cred | CIA | ESE | Total | |
| | | Ŭ | | | | | 40 | 60 | 100 | |
| 23PHPOE301 | Material Characterization | OE | 3 | 0 | 0 | 2 | 40 | 60 | 100 | 267 |
| 23CHPOE301 | Chemistry In Everyday Life | OE | 3 | 0 | 0 | 2 | 40 | 60 | 100 | 270 |
| 23MBPOE301 | English For Competitive Examinations | OE | 3 | 0 | 0 | 2 | 40 | 60 | 100 | 273 |
| 23BTPOE301 | Sericulture | OE | 3 | 0 | 0 | 2 | 40 | 60 | 100 | 275 |

B.TECH. FOOD TECHNOLOGY

23BTCC101

PROFESSIONAL COMMUNICATIVE ENGLISH

Instruction Hours/week: L:3 T:0 P:0

COURSE OBJECTIVES:

The goal of this course is for students to

- Extend the communicative competence of learners.
- Develop usage of language effectively in academic /work contexts
- Make use of Language skills in Reading and Writing
- Use language efficiently in expressing their opinions via various media.
- Enhance inter-personal communication skills.

COURSE OUTCOMES:

Students undergoing this course will be able to

- Identify new words by employing vocabulary building techniques.
- Build correct sentence structures and grammatical patterns in oral and written communication
- Construct business letters, proposals and E-Mail communication.
- Adopt the skills of planning, structuring, and delivery techniques in group discussions and presentations.
- Follow leadership, work ethics and management principles.

UNIT-1 VOCABULARY BUILDING

Word formation process - One word Substitutes – Homophones – Homonyms – British and American vocabulary – Punctuation marks and capitalization

UNIT-2 FUNDAMENTALS OF ENGLISH GRAMMAR

Subject –verb agreement (Concord) – If-conditionals – Modal verbs - Question types (Wh, Yes or No & Question tag), Prepositions- Articles

UNIT- 3 LANGUAGE SKILLS (READING AND WRITING)

Reading (Skimming& Scanning) - Reading Methods (SQR3) – Writing -Business Letters (Job Application Letter & Resume Preparation, sales letter, Quotation letter) – E- Mail communication & etiquettes – Business Proposals (Structure & Types)

UNIT-4 PROFESSIONAL SKILLS

Interview skills – Dos and Don'ts of an Interview, Group Discussion – Dos and Don'ts of GD, Presentation skills – Planning, structuring and Delivering Techniques

SEMESTER-I

Marks: Internal:40 External:60 Total:100

3H-3C

End Semester Exam: 3 Hours

9

9

9

UNIT -5 INTERPERSONAL SKILLS

Personality development –Conflict management, Team work, Leadership Principles, Negotiation skills

Note: Students shall have hands on training in improving Speaking skill in the language laboratory @ 2 periods per each unit.

TOTAL:45

TEXT BOOKS

- 1. Raman. Meenakshi, Sharma. Sangeeta (2015). Professional English. Oxford university press. New Delhi.
- 2. Sanjay Kumar, Pushpalata, (2011), Communication skills, 1st Edition Oxford Press.
- 3. Ashraf Rizvi M, Effective Technical Communication, McGraw Hill Education, First Edition, 2013.

CO - PO MAPPING:

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|------|-------------|------|------|
| CO1 | - | - | - | - | - | - | - | 1 | 2 | 3 | 1 | 3 | - | 1 |
| CO2 | - | - | - | - | - | - | - | 1 | 2 | 3 | 1 | 2 | - | 1 |
| CO3 | - | - | - | - | - | - | - | 2 | 2 | 3 | 1 | 2 | - | 1 |
| CO4 | - | - | - | - | - | - | - | 3 | 2 | 3 | 1 | 2 | - | 1 |
| CO5 | - | - | - | - | - | - | - | 3 | 2 | 3 | 1 | 3 | - | 1 |
| Average | - | - | - | - | - | - | - | 2 | 2 | 3 | 1 | 2.4 | - | 1 |

B.TECH. FOOD TECHNOLOGY

23BTCC102

MATRICES AND CALCULUS

Instruction Hours/week: L:3 T:1 P:0

COURSE OBJECTIVES:

The goal of this course is for students:

- To develop the use of matrix algebra techniques that is needed by engineers for practical applications.
- To familiarize the student with the differential calculus of multivariable functions. This is needed in many branches of engineering.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals. •
- To make the students acquire sound knowledge in techniques of solving linear ordinary differential equations.
- To provide knowledge about the concepts of partial differential equation with constant coefficients.

COURSE OUTCOMES:

Upon completion of this course, the student will be able to:

- Make use of orthogonal transformation to reduce the quadratic form to ٠ canonical form.
- Utilize differential calculus of multivariable to optimization problems. •
- Apply multiple integrals for finding the area and volume. •
- Solve the linear differential equations using Euler's Cauchy and method of variation of parameter.
- Solve the nth order partial differential equations.

UNIT – I MATRICES

Eigenvalues and Eigenvectors of a real matrix- Characteristic equation - Properties of Eigenvalues and Eigenvectors - Cayley-Hamilton theorem - Diagonalization of matrices by orthogonal transformation - Reduction of a quadratic form to canonical form by orthogonal transformation - Nature of quadratic forms.

UNIT – II DIFFERENTIAL CALCULUS OF MULTIVARIABLE FUNCTIONS 12 Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Change of variables - Jacobians - Partial differentiation of implicit functions - Applications: Maxima and

minima of functions of two variables – Lagrange's method of undetermined multipliers. 12

UNIT – III MULTIPLE INTEGRALS

Proper and Improper integrals - Bernoulli's extension formula - Double integrals - Change of order of integration – Double integrals in polar coordinates – Area using double integrals – Evaluation of **Triple Integrals**

UNIT – IV ORDINARY DIFFERENTIAL EQUATIONS

Linear differential equation of second and higher order with constant coefficients - Euler-Cauchy linear differential equation – Method of Variation of parameters.

12

2023-2024

4H-4C

Marks: Internal:40 External:60 Total:100

End Semester Exam: 3 Hours

12
UNIT – V PARTIAL DIFFERENTIAL EQUATIONS

Homogeneous linear partial differential equations of second and higher order with constant coefficients – Classification of partial differential equations.

TOTAL: 45+15

TEXT BOOKS:

- 1. Grewal, B. S., & Grewal, J. S. (1996). Higher engineering mathematics. 2018, Khanna Publishers, New Delhi.
- Kreyszig, E. (2007). Advanced Engineering Mathematics 10th Edition with Wiley Plus Set (p. 334). John Wiley & Sons.

REFERENCE BOOKS:

- 1. Thomas, B. T., and Ross L Finney (2002). Calculus and Analytic Geometry, Pearson Publishers, Ninth edition
- 2. Ross, S. L. (1984). Differential Equation-Jhon Wiley & Sons. Inc. New York.
- 3. Henner, V., Belozerova, T., & Khenner, M. (2013). Ordinary and partial differential equations. CRC Press.

WEBSITES:

- 1. www.archive.nptel.ac.in/courses/111/108/111108157/
- 2. www.nptel.ac.in/courses/111107108
- 3. www.archive.nptel.ac.in/courses/111/104/111104125/
- 4. www.nptel.ac.in/courses/111108081
- 5. www.nptel.ac.in/courses/111108144

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|------|------|
| CO1 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | - | - |
| CO2 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | - | - |
| CO3 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | - | - |
| CO4 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | - | - |
| CO5 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | - | - |
| Average | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | - | - |

CO PO MAPPING:

B.TECH. FOOD TECHNOLOGY

23BTCC103

ENVIRONMENTAL STUDIES

2023-2024 **SEMESTER-I**

Instruction Hours/week: L:3 T:0 P:0

Marks: Internal:40 External:60 Total:100 End Semester Exam: 3 Hours

COURSE OBJECTIVES:

The goal of this course is for students to:

- Create the awareness about environmental problems among people.
- Develop an attitude of concern for the environment.
- Motivate public to participate in environment protection and improvement.
- To gain a variety of experiences and acquire a basic understanding of environment and its associated problems.
- Relate critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world.

COURSE OUTCOMES:

Upon completion of this course, the student will be able to:

- Outline the ecological processes supporting the life system.
- Infer the importance of environment and impact of human acivities on natural resources.
- Explain the levels and values of biodiversity and its conservation.
- Summarize the problems of environmental pollution and its control measures.
- Interpret the remediation methods for social issues and degraded environment.

UNIT I INTRODUCTION - ENVIRONMENTAL STUDIES& ECOSYSTEMS

Environment Definition, Scope and importance; Ecosystem, Structure and functions of ecosystem. Energy flow, Food chains and food webs, Ecological succession. Classification of ecosystem. Forest ecosystem, Grass and Ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

UNIT II - NATURAL RESOURCES - RENEWABLE AND NON RENEWABLE RESOURCES

Natural resources - Renewable and Non - Renewable resources. Land resources and land use change, Land degradation, soil erosion and desertification. Forest resources- Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations. Water resources- Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water. Use of alternate energy sources, growing energy needs, case studies. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

UNIT III - BIODIVERSITY AND ITS CONSERVATION

Karpagam Academy of Higher Education (Deemed to be University), Coimbatore

Levels of biological diversity - genetic, species and ecosystem diversity. Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value. Bio-geographical classification of India. Biodiversity patterns (global, National and local levels). Hot-spots of biodiversity. India as a mega-diversity nation. Endangered and endemic species of India. Threats to

9

9

9

3H-3C

biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Conservation of biodiversity: in-situ and ex-situ conservation of biodiversity.

UNIT IV -ENVIRONMENTAL POLLUTION

Definition, causes, effects and control measures of Air pollution, Water pollution – Water reuse and recycling, Soil pollution, Noise pollution. Nuclear hazards and human health risks. Solid waste management and control measures of urban, industrial and e-wastes. Role of an individual in prevention of pollution. Case studies.

UNIT V - SOCIAL ISSUES AND THE ENVIRONMENT

Concept of sustainability and sustainable development, Circular economy. Water conservation -Rain water harvesting, watershed management. Climate change, global warming, ozone layer depletion, acid rain and its impacts on human communities and agriculture. Environment Laws (Environment Protection Act, Air Act, Water Act, Wildlife Protection Act, Forest Conservation Act). International agreements (Montreal and Kyoto protocols).Resettlement and rehabilitation of project affected persons. Disaster management (floods, earthquake, cyclones and landslides). Environmental Movements (Chipko, Silent valley, Bishnois of Rajasthan). Environmental ethics: Role of Indian and other religions and cultures in environmental conservation. Environmental communication and public awareness, case studies (e.g.,CNG vehicles in Delhi).Human population growth: Impacts on environment ,human health and welfare.

TEXT BOOKS:

- 1. Anubha Kaushik, and Kaushik, C.P. 2004. Perspectives in Environmental Studies. New Age International Pvt. Ltd. Publications, New Delhi.
- 2. Erach Bharucha. 2004. A text book for Environmental Studies, University Grants Commission and Bharat Vidypeeth Institute of Environmental Education Research, New Delhi.
- 3. Rajagopalan, R. 2016. Environmental Studies: From Crisis to Cure, Oxford University Press.
- Sing, J.S., Sing. S.P. and Gupta, S.R. 2014. Ecology, Environmental Science and Conservation. S. Chand & Publishing Company, New Delhi.
- 5. Mishra, D.D. 2010. Fundamental Concepts in Environmental Studies. S. Chand& Company Pvt. Ltd., New Delhi.
- 6. Arvind Kumar. 2004. A Textbook of Environmental Science. APH Publishing Corporation, New Delhi.
- 7. Singh, M.P., Singh, B.S., and Soma, S. Dey. 2004. Conservation of Biodiversity and Natural Resources. Daya Publishing House, New Delhi.
- 8. Tripathy. S.N., and Sunakar Panda. (2004). Fundamentals of Environmental Studies (2nd ed.). Vrianda Publications Private Ltd, New Delhi.
- 9. Verma, P.S., and Agarwal V.K. 2001. Environmental Biology (Principles of Ecology). S. Chand and Company Ltd, New Delhi.
- 10. Uberoi, N.K. 2005. Environmental Studies. Excel Books Publications, New Delhi.

9

9

TOTAL: 45

CO PO MAPPING

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|------------|-----|-----|------------|------------|------------|------------|------------|------------|-------------|-------------|------|------|------|
| CO1 | 2 | 1 | - | - | - | 2 | 3 | 3 | - | 1 | - | 2 | - | - |
| CO2 | 2 | 1 | - | - | - | 2 | 3 | 3 | - | 1 | - | 2 | - | - |
| CO3 | 2 | 1 | - | - | - | 2 | 3 | 3 | - | 1 | - | 2 | - | - |
| CO4 | 2 | 1 | - | - | - | 2 | 3 | 3 | - | 1 | - | 2 | - | - |
| CO5 | 2 | 1 | - | - | - | 2 | 3 | 3 | - | 1 | - | 2 | - | - |
| Average | 2 | 1 | - | - | - | 2 | 3 | 3 | - | 1 | - | 2 | - | - |

Karpagam Academy of Higher Education (Deemed to be University), Coimbatore

B.TECH. FOOD TECHNOLOGY

23BTCC141

ENGINEERING CHEMISTRY (THEORY &LABORATORY)

Instruction Hours/week: L:4 T:0 P:2

Marks: Internal:40 External:60 Total:100 End Semester Exam: 3 Hours

(i) THEORY

COURSE OBJECTIVES:

The goal of this course is for students:

- To learn the basics of Periodic properties, Intermolecular forces
- To infer the terminologies of electrochemistry and to analyze about energy storage devices
- To build the concept of corrosion and its prevention
- To summarize the basic water technology and its purification.
- To develop an understanding of the range and uses of analytical methods in chemistry

COURSE OUTCOMES:

Upon completion of this course, the student will be able to:

- Analyze periodic properties of elements.
- Apply the concepts of electrochemistry in storage devices.
- Illustrate the types of corrosion and its prevention.
- Identify the quality of water and its treatment methodologies.
- Explain the principle and working of spectroscopic techniques.

UNIT I - PERIODIC PROPERTIES, INTERMOLECULAR FORCES

Introduction to Periodic Properties- atomic and ionic sizes, ionization energies, electron affinity and electronegativity, effective nuclear charge. Penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations. Polarizability, oxidation states, coordination numbers. Ionic, dipolar and van Der Waals interactions.

UNIT II ELECTROCHEMISTRY AND STORAGE DEVICE

Thermodynamic functions. Free energy and emf. Cell potentials, the Nernst equation and applications. Types of electrodes Standard Hydrogen Electrode (SHE) & Calomel. Energy storage devices Primary and secondary cells- Leclanche cell, Lead Acid Battery, Nickel Cadmium Battery, Lithium Battery Charging and discharging reactions.

UNIT III CORROSION AND ITS CONTROL

Chemical and Electrochemical corrosion - Galvanic corrosion - Differential aeration corrosion-Corrosion control - Sacrificial anode and Impressed current cathodic methods - Corrosion inhibitors -Protective coatings - Organic coatings-Paints - Constituents and functions Inorganic coatings-Metallic coatings - Electroplating (Au) and Electro less plating (Ni) - Surface conversion coating -Hot dipping

2023-2024

SEMESTER-I

6H-5C

9 ns

9

UNIT IV WATER TECHNOLOGY

Sources-Characteristics - Specification for drinking water, BIS &WHO-Alkalinity-Types of alkalinity and determination - Hardness - Types and estimation by EDTA method - Domestic water treatment -Disinfection methods (Chlorination, Ozonation. UV treatment) - Boiler feed water - Requirements -Disadvantages of using hard water in boilers - Internal conditioning (Phosphate, Calgon and Carbonate conditioning methods) - External conditioning - Demineralization process - Desalination - Reverse osmosis.

UNIT V - SPECTROSCOPIC TECHNIQUES AND APPLICATIONS

Spectroscopy (Principles and Instrumentation only). Electronic spectroscopy. Vibrational and rotational spectroscopy. Applications. Surface characterization techniques Scanning electron microscope (SEM) and Transmission electron microscopy (TEM). Fluorescence and its applications in medicine

TEXT BOOKS:

- 1. P C Jain & Monica Jain, (2015). Engineering Chemistry, 18th edition, Dhanpat Rai Publishing Company
- 2. B. H. Mahan, (2010). University chemistry, Pearson Education.
- 3. M. J. Sienko and R. A. Plane, (1976) Chemistry: Principles and Applications. 5th edition, McGraw-Hill Higher Education.
- 4. C. N. Banwell, (2001) Fundamentals of Molecular Spectroscopy, McGraw-Hill.
- 5. B. L. Tembe, Kamaluddin and M. S. Krishnan, Engineering Chemistry (NPTEL Webbook)
- 6. P. W. Atkins, (2009). Physical Chemistry, Oxford University Press.
- 7. K. P. C. Volhardt and N. E. Schore, (2014).5th Edition, Organic Chemistry: Structure and Function, W.H. Freeman Publications.

REFERENCE BOOKS

- 1. Adsorption of acetic acid by charcoal
- 2. Use of the capillary viscosimeters to the demonstrate of the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg.

9

TOTAL: 45

(ii) LABORATORY

Choice of 10 experiments from the following:

- 3. Determination of surface tension and viscosity
- 4. Determination of Sodium Carbonate and Sodium Hydrogen Carbonate in a mixture using volumetric titration
- 5. Determination of Ca / Mg using complexometric titration
- 6. Thin layer chromatography
- 7. Determination of chloride content of water
- 8. Determination of the rate constant of a reaction
- 9. Conductometry Determination of cell constant and conductance of solutions
- 10. pH Metry Determination of Acid /Base
- 11. Potentiometry Determination of redox potentials and emfs
- 12. Saponification/acid value of an oil
- 13. Determination of the partition coefficient of a substance between two immiscible liquids

TOTAL: 30

CO PO MAPPING

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|------------|-----|------|-----|-----|------------|------------|------------|-----|-------------|------|------|------|------|
| | | | | | | | | | | | | | | |
| CO1 | 3 | 3 | 2 | 1 | - | 1 | 1 | 1 | 1 | 1 | - | 1 | - | - |
| CO2 | 3 | 2 | 1 | 1 | - | 1 | 1 | 1 | 1 | 1 | - | 1 | - | - |
| CO3 | 2 | 1 | - | - | - | 1 | 1 | 1 | - | 1 | - | 1 | - | - |
| CO4 | 3 | 2 | 1 | 1 | - | 1 | 1 | 1 | 1 | 1 | - | 1 | - | - |
| CO5 | 2 | 1 | - | - | - | 1 | 1 | 1 | - | 1 | - | 1 | - | - |
| Average | 2.6 | 1.8 | 1.33 | 1 | - | 1 | 1 | 1 | 1 | 1 | - | 1 | - | - |

B.TECH. FOOD TECHNOLOGY

23BTCC142

PROGRAMMING IN C (THEORY AND LABORATORY)

Instruction Hours/week: L:4 T:0 P:2

Marks: Internal:40 External:60 Total:100 End Semester Exam:3 Hours

(i) THEORY

COURSEOBJECTIVES:

The goal of this course is for the students:

- To interpret problem solving using C.
- To apply the concept of arrays and strings.
- To identify the functions of C Language.
- To apply the concept of pointers.
- To develop C Programs using user defined function and file handling.

COURSE OUTCOMES:

Upon completion of this course the students will be able to:

- Apply algorithmic solutions to computational problems using C.
- Solve problems using arrays and strings.
- Build modular applications in C using functions.
- Categorize dynamic memory management operators along with pointers.
- Develop an applications using sequential and random access file processing.

UNIT I INTRODUCTION

An overview of computers and programming - Understanding computer systems - Programming logic -Steps in program development – Algorithm - Using pseudocode and flowchart – types of programming languages – Compiler – Interpreter – Linker - Introduction to C – Structure of C program - Identifiers and Keywords - Data types - Constants and variables - Type conversion – Operators - Expressions. Formatted and Unformatted Input/Output functions - Control structures

UNIT II ARRAYS AND STRINGS

Arrays in C - Declaring and initializing arrays in C - Defining and processing 1D and 2D arrays - Inserting and deleting elements of an array - Strings - Defining and initializing strings - Processing of string - Character arithmetic - String manipulation functions and libraryfunctions of string.

UNIT III FUNCTIONS

Functions - Types of Functions - Function prototypes - Function definition - Function call including passing arguments by value and passing arguments by reference - Passing arrays to functions - Math library functions - Recursive functions - Scope rules (local and global scope) - Storage classes in C.

11

2023-2024

9

9

UNIT IV POINTERS

Pointers - Pointer declaration and initialization - Types of pointers - Pointer expressions and arithmetic - Operations on pointers - Passing pointer to a function - Pointer and one-dimensional array - Pointers and strings – Command line arguments - Dynamic memory management functions.

UNIT V USER DEFINED TYPES AND FILE HANDLING

User defined types - Enumerator – Typedef - Structures - Declaration of a structure - Accessing structures - Array of Structures - Structures and pointers - Nested structures – Bit fields – Unions - Declaration of a union – Accessing unions – Union vs Structure - File Input/Output – Preprocessor directives.

TOTAL :45

TEXTBOOKS:

- 1. Programming In C By Ashok N. Kamthane,3rd edition, Pearson, 2015.
- 2. Programming In C, Reema Thareja, Oxford University Press, Second Edition, 2016.

REFERENCESBOOKS:

- 1. "C How to Program" By Paul Deitel And Harvey Deitel, 8th edition, Prentice Hall, 2015.
- 2. "Programming In Ansi C" By E. Balagurusamy, 8th edition, Mcgraw Hill Education, 2019.
- 3. "Let Us C", by Yashwant Kanetkar, 17th Edition, Bpb Publications, 2020.
- 4. "C: The complete reference", Herbert Schildt, 4th edition, Mcgraw Hill Education, 2017.

WEBLINKS:

- 1. www.hackerrank.com
- 2. www.codechef.com
- 3. www.learn-c.org
- 4. www.udemy.com
- 5. www.hackearth.com

CO-PO MAPPING

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|------------|------------|-----|-----|-----|-----|------------|------------|------------|-----|------|------|------|------|------|
| CO1 | 3 | 2 | 1 | - | - | - | - | - | 2 | 2 | - | 2 | 2 | - |
| CO2 | 3 | 2 | 1 | - | - | _ | - | - | 2 | 2 | - | 2 | 2 | - |
| CO3 | 3 | 2 | 1 | I | - | - | I | I | 2 | 2 | - | 2 | 2 | - |
| CO4 | 3 | 3 | 2 | 1 | - | - | I | I | 2 | 2 | - | 2 | 2 | - |
| CO5 | 3 | 3 | 2 | 1 | - | - | - | - | 2 | 2 | - | 2 | 2 | - |
| Average | 3 | 2.4 | 1.4 | 1 | - | - | - | - | 2 | 2 | - | 2 | 2 | - |

(ii) LABORATORY

LISTOFEXPERIMENTS:

- 1. Develop a C Program to find the roots of quadratic equation for non-zero coefficient using if-else ladder construct.
- 2. Develop Programs using simple control statements such as if else, while, do while. Example Extracting the digits of an integer, reversing digits, finding sum of digits
- 3. Develop a C Program to implement a simple calculator to perform addition, subtraction, multiplication and division operations using switch construct. Display appropriate messages for invalid operator and divide by zero error.
- 4. Deveop C Program to generate Fibonacci sequence, calculation of factorials, printing various patterns and generate the Prime numbers between the ranges m & n using for loop.
- 5. Develop a C program to read n elements into an integer array, Insert and Delete element from the array.Print the input array and the resultant array with suitable messages.
- 6. Develop a C program to read two matrices A (m x n) and B (p x q) and compute the product of the two matrices. Print both the input matrices and resultant matrix with suitable headings and output should be in matrix format only. Program must check the compatibility of orders of the matrices for multiplication. Report appropriate message in case of incompatibility.
- 7. Develop a C function Program to sort the given names in Asecnding Order.
- 8. Develop a C program to count the vowels & consonants in a given string.
- 9. Develop a C Program to find the GCD of two integers using Euclid's algorithm
- 10. Develop a recursive C function to find the factorial of a number, n!, defined by fact(n)=1, if n=0. Otherwise fact(n)=n*fact(n-1). Using this function, develop a C program to compute the Binomial coefficient nCr. Perform input validation as well.
- 11. Develop a C program to find the smallest and largest elements in an array using pointers and then swap these elements and display the resultant array.
- 12. Develop a C program to find the sum of all the elements of an integer array using pointers.
- 13. Insert, update, delete and append telephone details of an individual or a company into a telephone directory using structures and pointers

TOTAL:30

B.TECH. FOOD TECHNOLOGY

23BTCC111

ENGINEERING GRAPHICS

Instruction Hours/ week: L:2T:0 P:2

COURSE OBJECTIVES

The goal of this course is for the students to:

- Expose them to existing national standards related to technical drawings and develop their ability to produce engineering drawings using drawing instruments.
- Emphasize freehand sketching to aid in the visualization process and to efficiently communicate ideas graphically.
- Introduce CAD software for the creation of 2D engineering drawings. •
- Develop a clear understanding of projection and the projection of points.
- Produce computer generated drawings using CAD software and develop a clear • understanding of plane geometry.

COURSE OUTCOMES

On completion of this course, students will be able to

- Apply BIS and ISO standards in engineering drafting.
- Construct mathematical curves in engineering applications
- Illustrate geometrical solids in 3D space using orthographic projections.
- Develop the projection of simple solids.
- Interpret the information of the 2D and 3D drawing.

UNIT I INTRODUCTION

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Bureau of Indian Standards (BIS), Layout of drawing sheets, sizes of drawing sheets, different types of lines used in drawing practice geometric constructions, principles of dimensioning-linear, angular, aligned system, unidirectional system, parallel dimensioning, chain dimensioning, location dimension and size dimension. Reducing Scale, Enlarging Scale, Plain Scale, Diagonal Scale and Vernier Scale.

UNIT II FREE HAND SKETCHING

Representation of Three-Dimensional objects – General principles of orthographic projection – Need for importance of multiple views and their placement – First angle projection – layout views - Developing visualization skills through free hand sketching of multiple views from pictorial views of objects.

UNIT III INTRODUCTIONTO COMPUTERGRAPHICS-2D

Overview of Computer Graphics and drafting tools, listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software, Sketching of 2D simple geometries, editing and dimensioning of 2D geometries. Projection of points and straight lines located in the first quadrant inclined to both planes- Determination of true lengths and true inclinations (By using CAD software).

Marks: Internal:40 External:60 Total:100

End Semester Exam: 3Hours

9

9

9

2023-2024 SEMESTER-I

4H-3C

UNIT IV PROJECTION OF PLANE SURFACES AND SOLIDS

Projection of polygonal surface and circular lamina inclined to both reference planes (By using CAD software). Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method.

UNIT V ISOMETRIC PROJECTIONS

Demonstrating knowledge of the theory of CAD software, Introduction to 3D modeling packages. Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple solids, truncated prisms, pyramids, cylinders and cones; Conversion of Isometric Views to Orthographic Views and Vice-versa.

TOTAL: 45

TEXT BOOKS:

- 1. Venugopal K and Prabhu Raja V, (2021), Engineering Graphics, New Age International Publishers.
- 2. James D. Bethune, (2020), Engineering Graphics with AutoCAD, Macromedia Press.
- 3. C M Agrawal and Basant Agrawal, (2019), Engineering Graphics, Tata McGraw Hill, New Delhi.

REFERENCE BOOKS:

- 1. Annaiah M.H., Prem Kumar, Chandrappa C N, (2022), Computer Aided Engineering Drawing, New Age International Private Limited.
- 2. Narayana, K.L. and P Kannaiah, (2021), Text book on Engineering Drawing, Scitech Publications (India) Pvt. Ltd.
- 3. Shah, M.B. and Rana B.C., (2010), Engineering Drawing and Computer Graphics, Pearson Education.
- 4. Bhatt N.D., Panchal V.M. and Ingle P.R, (2019), Engineering Drawing, Charotar Publishing House.

WEBSITES:

- 1. https://onlinecourses.nptel.ac.in/noc21_me128
- 2. https://www.mygreatlearning.com/academy/learn-for-free/courses/engineering-graphics-drawing
- 3. https://www.autodesk.in/solutions/technical-drawing

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|-----|-----|-----|------------|------------|-----|------------|------------|-----|-------------|------|------|------|------|
| CO1 | 3 | 2 | - | - | - | - | - | 1 | - | 2 | - | 2 | 2 | - |
| CO2 | 3 | 2 | - | - | - | - | - | 1 | - | 2 | - | 2 | 2 | - |
| CO3 | 3 | 2 | - | - | - | - | - | 1 | - | 2 | - | 2 | 2 | - |
| CO4 | 3 | 2 | - | - | - | - | - | 1 | - | 2 | - | 2 | 2 | - |
| CO5 | 3 | 3 | 2 | 1 | - | - | - | 1 | - | 2 | - | 2 | 2 | - |
| Average | 3 | 2 | 2 | 1 | - | - | - | 1 | - | 2 | - | 2 | 2 | - |

CO PO MAPPING

Karpagam Academy of Higher Education (Deemed to be University), Coimbatore

DESIGN THINKING

Instruction Hours/week: L:1 T:0 P:2

B.TECH. FOOD TECHNOLOGY

Course objectives:

23BTMC151

The goal of this course is for the students to

- Illustrate design thinking concepts and principles
- Utilize design thinking methods in every stage of the problem
- Identify the different phases of design thinking
- Plan for various product and service communication in design thinking
- Interpret the use of tools for the design process

Course outcomes:

Upon completion of the course, students will be able to

- Explain the design thinking process, tools and theories.
- Identify the types of users and the requirements of customers.
- Explore the concepts of Prototyping and its testing.
- Analyze design thinking strategies in product and service design.
- Customize existing products by utilizing design thinking strategies.

INTRODUCTION

Understanding Design thinking and tools - Human-Centric Design Process - Design Thinking Process- DT Activity with case studies.

EMPATHISE WITH USERS

Five Whys - Needs of user - Types of user research -Customer Journey Mapping - Observational Research

PROTOTYPING

Ideas to presentable concepts - Scenario-based Prototyping – Testing prototypes - Usability and ergonomic testing - Rapid prototyping.

PRODUCT AND SERVICE DESIGN

Product Design - Interaction Design - Service Design - Communication Design - Transportation Design.

DESIGN AND INNOVATION

DT For Strategic innovations - Extreme Competition - Experience design - Standardization -

Humanization - Creative Culture.

TOTAL: 30

2023-2024

SEMESTER-I 3H - 2C

End Semester Exam:3 Hours

6

6

6

6

TEXT BOOKS:

- 1. Bala Ramadurai, "Karmic Design Thinking", 2020.
- Christian Mueller-Roterberg, "Handbook of Design thinking", Amazon Digital Services LLC - KDP Print US, 2018.
- 3. Tim Brown, "Change by Design", Harper Business Publisher, 2019
- 4. Hasso Plattner, Christoph Meinel and Larry Leifer, "Design Thinking: Understand –Improve Apply", Springer, 2011
- 5. Idris Mootee, "Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School", John Wiley & Sons 2013.

| 010 | IVII AI | | U | | | | | | | | | | | |
|---------|---------|-----|-----|------------|-----|------------|------------|------------|-----|------|------|------|------|------|
| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| C01 | 2 | 1 | 1 | - | - | - | - | 1 | 1 | 1 | - | 3 | - | - |
| CO2 | 3 | 2 | 1 | - | - | - | - | 2 | 1 | 1 | - | 3 | - | - |
| CO3 | 3 | 2 | 2 | 1 | - | 2 | 1 | 2 | 2 | 2 | - | 3 | - | - |
| CO4 | 3 | 3 | 2 | 1 | - | 2 | 1 | 2 | 2 | 2 | - | 3 | - | - |
| CO5 | 3 | 3 | 2 | 1 | - | 2 | 1 | 2 | 2 | 2 | - | 3 | - | - |
| Average | 2.8 | 2.2 | 1.6 | 1 | - | 2 | 1 | 1.8 | 1.6 | 1.6 | - | 3 | - | - |

CO PO MAPPING

2023-2024

23BTMC152

SPORTS and YOGA

Semester-I

1H-0C

Instruction Hours/week: L:1 T:0 P:0

Marks: Internal:100 External:0 Total:100

COURSE OBJECTIVES:

The goal of this course, is for the students:

- To have knowledge of Physical fitness and exercise management to lead better quality life
- To enable to officiate, supervise various sports events and
- organize sports events
- To acquire the knowledge of Physical Education, Sports and Yoga and
- understand the purpose and its development
- To gain knowledge to plan, organize and execute sports events

COURSE OUTCOMES:

Upon completion of this course, the student will be able to:

- Practice physical activities and yoga for strength, flexibility and relaxation.
- Use techniques for increasing concentration and decreasing anxiety for stronger academic performance.
 - Perform yoga exercises in various combination and forms.
 - Improve personal fitness through participation in sports and yoga activities.
 - Follow sound nutritional practices for maintaining good health and physical performance.

Unit – I Introduction to Physical fitness

Explain importance of physical education - Describe importance of Physical Fitness & Wellness - Explain the components of physical fitness - Demonstrate healthy life style - Prevent health threats by changing life style

Unit – II Fundamentals of Anatomy & Physiology in sports & yoga

Explain importance of anatomy and physiology - Describe effects of exercise in various body systems - Describe concept of correct posture - Explain corrective measures for posture deformities.

Unit– III Yoga & Pranayama

Explain importance of yoga - Perform various pranayama for increasing concentration - Use meditation and other relaxation techniques for improving concentration.

TEXT BOOKS:

- 1. Ajmer Singh, Modern Trends and Physical Education class 11&class12, Kalyani Publication, NewDelhi ISBN:9789327264319.
- 2. B.K.S. Iyengar, Light on Yoga, Thomson's Publication, New Delhi ISBN 8172235011
- 3. V.K. Sharma, Health and Physical Education, NCERT Books; Class11,12Saraswati House Publication, New Delhi

Karpagam Academy of Higher Education (Deemed to be University), Coimbatore

- 4. Acharya Yatendra, Yoga and Stress Management, Fingerprint Publishing ISBN: 938905303X
- 5. Swami Vivekanand, Patanjali Yoga Sutras, Fingerprint Publishing
- 6. Ramdev, Pranayam Rahasya, Patanjali-Divya Prakashan, Haridwar
- 7. Ramdev, Yoga its Philosophy & Practice, Divya Prakashan, Haridwar.

23BTMC153

தமிழர் மரபும் பண்பாடும்

பருவம் -l 1H–0C

கற்பித்தல் நேரம்/வாரம்: L:1 T:0 P: 0 மதிப்பெண்: இடைத்தேர்வு: 100 மொத்தம்:100

பாடத்திட்ட பயன் விளைவு:

- வரலாற்றிற்கு முற்பட்ட தமிழகத்தை மாணவர்களுக்கு அறிமுகப்படுத்துதல்
- பழந்தமிழர் பண்பாடு சார்ந்த வாழ்க்கை முறையை மாணவர்கள் அறிய ஊக்குவித்தல்
- தமிழ் மொழியின் பழைமையும், திராவிட மொழிகளில் தமிழ்மொழியின் தனிச்சிறப்பையும் மாணவர்களுக்கு அறிமுகப்படுத்துதல்.
- தமிழர்களின் வாழ்வியல், தமிழர்கலைகள்,
 ஆற்றங்கரைப்பண்பாடுகள் குறித்து மாணவர்கள் அறியச்செய்தல்.
- இந்தியக்குடியுரிமைப்பணி முதலான போட்டித்தேர்வுகளில் விருப்பப்பாடமாக இடம்பெறுகின்ற தமிழ்நாகரிகமும் பண்பாடும் குறித்த முழுமையான அறிமுகம் பெற்றிருத்தல்

பாடத்திட்டப் பொது நோக்கம்:

- இந்தியக்குடியுரிமைப்பணி முதலான போட்டித்தேர்வுகளில், விருப்பப்பாடமாக இடம்பெறுகின்ற, 'தமிழ்இலக்கியவரலாறு' குறித்த முழுமையான அறிமுகம் பெற்றிருத்தல்.
- கல்வெட்டியல், ஓலைச்சுவடியியல் மற்றும் தொல்லியல் சார்ந்த ஆவணத்தேடலுக்குரிய ஆய்வு மனப்பான்மையுடன், இலக்கியங்களை அணுகுதல்.
- தமிழின்வளர்ச்சித்துறையாகிய, 'அறிவியல்தமிழ்'; 'இணையதமிழ்' குறித்த பன்நோக்கு அணுகுமுறையிலான ஆய்வுச்சிந்தனை மேம்பாடு.
- வலைவாய்ப்புக்குரிய சுயதிறன் மேம்பாட்டுடன், படைப்பாக்கத்திறன் மேம்பாடும் பெற்றிருத்தல்.
- சமுதாய மற்றும் வாழ்வியல் மதிப்புகளைப்பேணுவதற்குக்கருவியாக இலக்கியங்களை நாடுகின்ற மனப்பான்மைவளர்ச்சி. மொழிபெயர்ப்புத்துறை சார்ந்த வேலைவாய்புத்திறன் பெற்றிருத்தல்.

அலகு:1 தமிழர் மரபு

மரபு- விளக்கம் - சங்ககால தமிழர் மரபு – திணைப்பகுப்பும் தமிழர் மரபும்-உலகப்பொதுமை – அகத்திணை மரபு – புறத்திணை மரபு- இடைக்காலத்தமிழர் மரபு – பிற்கால மரபும் மாற்றமும் – தற்கால தமிழர்மரபு - வளர்ச்சி.

அலகு: 2 தமிழர் பண்பாடு

பண்பாடு – விளக்கம் – பழந்தமிழர் பண்பாடு – இயற்கை சார்ந்த வாழ்வியல் – தமிழர் சமயம் – அரசியல் நிலை–சமூகப் பழக்கவழக்கங்கள் – நம்பிக்கைகள் – வாழ்வியல் அறங்கள் – வணிகம் போன்றவை.

அலகு:3 தமிழர் கலைகள்

தமிழகத்தில் கலைகளின் வளர்ச்சி – சிற்பக்கலை வளர்ச்சி –கோயில் கலை – கற்கோவில்கள் - ஓவியக்கலை – அழகுக்கலைகள் - கூத்துக்கலை – மருத்துவக்கலை – நாடகக்கலை– இசைக்கலை போன்றவை.

அலகு: 4 தமிழர் சமயம்

பழந்தமிழரின் சமயம் – சங்ககால சமயம் – தொல்காப்பியத்தில் சமயம் – சைவ சமயம் – வைணவம் – தமிழ்ப் பண்பாட்டில் பௌத்தம் – தமிழ்ப் பண்பாட்டில் சமணத்தின் தாக்கம்–தமிழ்ப் பண்பாட்டில் இசுலாம் மற்றும் கிறித்துவ சமயத்தின் தாக்கம்- தமிழர் பண்பாட்டில் விழாக்கள்-கோயில்களும் விழாக்களும்- சமூக ஒருங்கிணைப்பில் விழாக்களின் பங்கு-சங்க இலக்கியத்தில் விழாக்கள் பற்றிய குறிப்புகள்-இடைக்கால இலக்கியங்களில் விழாக்கள் பற்றிய செய்திகள் – விழாக்களின் சமூகப்பங்களிப்பு – தற்காலத்தில் தமிழர் விழாக்கள் - விளையாட்டும் விழாக்களும்.

அலகு: 5 இலக்கியங்களில் தமிழர் பண்பாட்டுப் பதிவுகள்

சங்க இலக்கியமும் வாழ்வியலும்-திருக்குறளில் வாழ்வியல் நெறிகள் – இரட்டைக் காப்பியங்களும் வாழ்வியலும் – சிற்றிலக்கியங்களில் வாழ்வியல் பதிவுகள்-இக்கால இலக்கியமும் வாழ்வியலும்.

பார்வைநூல்கள்:

- தமிழ் இலக்கிய வரலாறு தமிழண்ணல், மீனாட்சி புத்தக நிலையம்-மதுரை-இரண்டாம் பதிப்பு-ஜூலை – 2000.
- தமிழர் நாகரிகமும் பண்பாடும், அ. தட்சிணாமூர்த்தி, ஐந்திணைப் பதிப்பகம், சென்னை, திருத்திய பதிப்பு – 2022.
- தமிழர் வரலாறும் பண்பாடும், நா. வானமாமலை, நியூசெஞ்சுரி புக் ஹவுஸ், சென்னை, ஆறாம்பதிப்பு - 2007.
- தமிழக வரலாறு மக்களும் பண்பாடும், கே.கே. பிள்ளை, உலகத் தமிழராய்ச்சி நிறுவனம், சென்னை.

| B.Tech. Food Technology | | | 2023-2024 |
|---------------------------|----------------|-----------------------------|---------------|
| | | | Semester-II |
| 23BTCC201C | TRANSFORMS AND | ITS APPLICATIONS | 4H-4 C |
| Instruction Hours/week: L | :3 T:1 P:0 | Marks: Internal:40 External | :60 Total:100 |
| | | End Semester E | xam: 3 Hours |

COURSE OBJECTIVES:

The goal of this course is for students:

- To make the students to understand the concept of periodic function and represent them in Fourier series.
- To make the students to understand the applications of partial differential equations.
- To acquaint the students with the concepts of Fourier transform techniques.
- To impart knowledge in Laplace transform techniques and its applications.
- To provide knowledge about solving ordinary differential equations using the Inverse Laplace transform.

COURSE OUTCOMES:

Upon completion of this course, the student will be able to:

- Illustrate Fourier series representation of periodic functions.
- Apply Fourier series in one dimensional heat flow and wave equation.
- Make use of Fourier transform for converting elementary functions into frequency domain.
- Utilize Laplace Transform to convert time-domain systems into frequency-domain systems.
- Apply Inverse Laplace Transform in linear differential equations.

UNIT I FOURIER SERIES

Dirichlet's conditions – General Fourier series in the interval (0,2l) & (-l,l) – Half range sine series –Half range cosine series –Harmonic analysis.

UNIT II: APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS

Fourier series solution for one dimensional wave equation – Fourier series solution for one dimensional heat equation with zero end conditions.

UNIT III FOURIER TRANSFORMS

Fourier transform pair – Complex form of Fourier transform- Fourier sine and cosine transforms – Convolution theorem – Parseval's identity of Fourier transform.

12

12

UNIT IV LAPLACE TRANSFORM

Transforms of standard functions – Properties of Laplace transform – Transforms of derivatives and integrals –Initial and final value theorem – Transforms of periodic functions.

UNIT V INVERSE LAPLACE TRANSFORM

Inverse Laplace transforms of standard functions – Inverse Laplace transform using second shifting theorem – Method of partial fractions– Solution of ordinary differential equations with constant coefficients using Laplace transforms

Total: 45+15

TEXT BOOKS:

- 1. John W. Miles Integral Transforms in Applied Mathematics Cambridge University Press 2008
- Erwin Kreyszig Advanced Engineering Mathematics John Wiley and Sons, Tenth Edition 2017

REFERENCE BOOKS:

- 1. Eric W Hansen Fourier Transforms: Principles and Applications John Wiley 2014
- 2. N.W. McLachlan Laplace Transforms and Their Applications to Differential Equations Dover Publications Inc. 2014
- 3. Richard Haberman Applied Partial Differential Equations with Fourier Series and Boundary Value Problems Pearson, Fifth edition 2021

Web URL:

- 1. www.nptel.ac.in/courses/111106111
- 2. www.nptel.ac.in/courses/111107111
- 3. www.nptel.ac.in/courses/111102129
- 4. www.nptel.ac.in/courses/111106139
- 5. www.archive.nptel.ac.in/courses/111/105/111105123/

CO PO MAPPING

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|------------|-----|-----|------------|-----|-----|------------|------------|-----|------|------|------|------|------|
| CO1 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | - | - |
| CO2 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | - | - |
| CO3 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | - | - |
| CO4 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | - | - |
| CO5 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | - | - |
| Average | 2.8 | 1.8 | 1 | - | - | - | - | - | - | _ | - | 1 | - | - |

2023-2024

Semester-II 3H-3C

23BTFT202

PHYSICS FOR FOOD TECHNOLOGY

Instruction Hours/week: L:3 T:0 P:0

Marks: Internal:40 External:60 Total:100 End Semester Exam: 3 Hours

COURSE OBJECTIVES

The goal of this course is for students to

- Familiarize with fundamentals of physics to understand the engineering concepts effectively.
- Inculcate the basics of properties of matter, sound and its applications.
- Understand the basics of laser and optical fiber with appropriate applications.
- Disseminate the fundamentals of thermal physics and their applications.
- Introduce the concepts of crystals and quantum mechanics for diverse applications.

COURSE OUTCOMES

Upon completion of this course, the students will be able to

- Identify the elastic properties of the materials using young's modulus and rigidity modulus.
- Infer the characteristics of laser and optical fiber.
- Illustrate the thermal properties for calculating thermal conductivity of the materials.
- Relate the quantum concepts in working of electron microscope.
- Outline the basics of crystals, structures and its defects

UNIT I – PROPERTIES OF MATTER

Elasticity –stress – strain – Hookes law- classification of elastic modulus -Poisson's ratio - Stress-Strain diagram and its uses - factors affecting elastic modulus and tensile strength Moment, Couple and Torque – Twisting couple on a wire - Torsion pendulum- bending of beams – bending moment – cantilever- young's modulus – uniform bending and non-uniform bending(Experimental) – Ishaped girders and its applications.

UNIT II – LASER AND FIBER OPTICS

LASER: Introduction - characteristics - Einstein's co-efficients derivation Principle of laser actionpopulation inversion- pumping methods -Types of laser - Nd: YAG, CO₂- Applications of LASER in industry and medicine.

Fiber optics - principle- modes of propagation of light in optical fibers - numerical aperture and acceptance angle -types of optical fibers (Material, refractive index and mode) - fiber optical communication system (block diagram).

UNIT III – THERMAL PHYSICS

Mode of Heat Transfer -conduction, convection, radiation (qualitative) - thermal expansions of solid and liquid - bimetallic strips – thermal conductivity: Forbe's and Lee's disc method: theory and experiment – heat conduction through compound media (series and parallel) – Thermal insulators – Laws of thermodynamics – referigerators-microwave oven and solar water heater.

9

9

UNIT IV – QUANTUM PHYSICS

Black body radiation -Energy Distribution laws: Stefan Boltzmann's law, Wein's Displacement law Rayleigh Jeans Law- Photo electric effect – Compton effect (Qualitative) – De Broglie hypothesis - uncertainty principle – physical significance of wave function - Schrödinger's Time dependent wave equation - Schrödinger's Time independent wave equation – Electron Microscope:Scanning Electron Microscope and Transmission Electron Microscope.

UNIT V – CRYSTAL PHYSICS

Classification of solids: Crystalline and amorphous solids – crystal structure - unit cell, primitive cell –seven crystal systems, Bravais lattices, Miller indices – inter-planar distances (Qualitative) - Coordination number and Atomic packing factor for Simple Cubic, Body Centered Cubic, Face Centered Cubic, Hexagonal Closed Packing structures – Defects in crystal: Point & Line defect.

TOTAL: 45

TEXT BOOKS

- 1. Bhattacharya D.K. & Poonam T., Engineering Physics, Oxford University Press, 2015.
- 2. Gaur R.K. and Gupta S.L, Engineering Physics, Dhanpat Rai Publications, 2012.
- 3. Pandey. B.K. & Chaturvedi .S, Engineering Physics, Cengage Learning India, 2012.
- 4. Halliday.D. Resnick R. & Walker. J, Principles of Physics, Wiley, 2015.
- 5. Charles Kittel, Kittel's Introduction to Solid State Physics, Wiley India Edition, 2019.
- 6. P.M. Mathews, K.Venkatesan, A text book of Quantum Mechanics, 2/e, Mc Graw Hill Education, 2017.
- 7. Laser Fundamentals, William T Silfvast, Cambridge Univ Press. 2012.
- 8. Fiber Optics and Optoelectronics, R P Khare, Oxford, 2012.
- 9. Daniel V.Schroeder, An Introduction to Thermal Physics, Pearson, 2014.
- 10. D.S. Mathur, Elements of properties of matter, S.Chand, 2010.

JOURNALS

- Nature Physics
- Journal of Applied Mechanics (ASME)
- Ultrasonics and sonochemistry (Elsevier)
- Journal of Light wave Technology (IEEE)
- Optics and Laser Technology (Elsevier)
- Applied Thermal Engineering (Elsevier)
- Physical Review B (American Physical Society)

WEBLINKS

- 1. www.nptel.ac.in/courses/122/103/122103011/
- 2. www.nptel.ac.in/courses/113/104/113104081/
- 3. www.hyperphysics.phy-astr.gsu.edu/hbase/optmod/lascon.html

CO PO MAPPING

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 2 | 1 | - | - | - | - | - | - | 1 | - | 1 | - | - |
| CO2 | 2 | 1 | - | - | - | - | - | - | - | 1 | - | 1 | - | - |
| CO3 | 2 | 1 | - | - | - | 1 | - | - | - | 1 | - | 1 | - | - |
| CO4 | 2 | 1 | - | - | - | - | - | - | - | 1 | - | 1 | - | - |
| CO5 | 2 | 1 | - | - | - | - | - | - | - | 1 | - | 1 | - | - |
| Average | 2.2 | 1.2 | 1 | - | - | 1 | - | - | - | 1 | - | 1 | - | - |

Karpagam Academy of Higher Education (Deemed to be University), Coimbatore

23BTFT203 FUNDAMENTALS OF FOOD SCIENCE AND TECHNOLOGY 3H-3C

Instruction Hours/week: L:3 T:0 P:0

Marks: Internal:40 External:60 Total:100 End Semester Exam:3 Hours

COURSEOBJECTIVES

The goal of this course is for students to,

- Outline the history and evolution of food processing.
- Illustrate knowledge on the structure and composition of foods.
- Infer the nutritional quality and post-harvest changes of various plant foods.
- Interpret the structure and composition of various animal foods.
- Experiment the functions of food.

COURSEOUTCOMES

Upon successful completion of the course, students will be able to,

- Explain the history, development and present status of Food Science and Technology.
- Explain the significance and basic concepts of the Food technology. Beaware of the skills required to be a professional food technologist.
- Infer the scope for self-employment as small, medium or large-scale entrepreneurs.
- Outline knowledge on the principles of food preservation.
- Identify novel processed foods.

UNIT I INTRODUCTION

Historical evolution of food processing technology. Basic concepts of food science, food processing, Food technology and food manufacturing, Development of Food Processing and Technology, Importance of Food Processing and Preservation,

UNIT II FOODGROUPS

Compositional, Nutritional and Technological aspects of Plant foods; Cereals and Millets, Pulses, Fats and Oils, Fruits and Vegetables - Classification of fruits and vegetables, general composition, enzymatic browning, names and sources of pigments, Dietary fibre. Compositional, Nutritional and Technological aspects of Animal foods; Flesh Foods-Meat, Fish, Poultry and egg.

UNIT III METHODSOFFOODHANDLING ANDSTORAGE

Nature of harvested crop, plant and animal; storage of raw materials and products using low temperature, refrigerated gas storage of foods, gas packed refrigerated foods, sub atmospheric storage, Gas atmospheric storage of meat, grains, seeds and flour, roots and tubers; freezing of raw and processed foods.

9 in

9

UNITIV-FOODPRESERVATION

Preservation of food by salt, sugar, high temperature, Preservation by use of low temperature– Chilling, freezing and cold storage-Principle, methods and equipment-Preservation by drying, dehydration and concentration-Principle, methods and equipment. Irradiation and fermentation.

UNITV-PROCESSEDFOODS

Classification of processed food on the basis of extent and type of processing; Minimally processed foods, Preserved foods, Manufactured foods, Formulated foods, Food derivatives, Pharmaceuticals and Functional foods.

TEXT BOOKS:

- Sri lakshmi, B.2005. Food Science, 3rdedition. New Age International (P)Ltd. Publishers, New Delhi.
- 2. Manay N.S and Shadaksharaswamy, M.(2001).Foods facts and principles. Wiley Eastern Ltd. New Delhi, Bangalore, Bombay, Calcutta, Hyderabad.

REFERENCE BOOKS:

- 1. R.P. Srivastava and SanjeevKumar.2002.Fruit and Vegetable Preservation: Principles and Practices,3rd Ed. International Book Distribution Co., Delhi.
- 2. Potter, N.N., & Hotchkiss, J.H. (2012). Food science. Springer Science & Business Media.

WEB LINKS:

- 1. https://www.britannica.com/science/fatprocessing#:~:text=It%20consists%20of%20cutt ing%20or,it%20is%20collected%20by%20skimming.
- 2. https://onlinelibrary.wiley.com/journal/14389312

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|-----|-----|-----|-----|-----|-----|------------|-----|-----|------|------|------|------|------|
| CO1 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 1 | 2 | 1 |
| CO2 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 1 | 2 | 1 |
| CO3 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 1 | 2 | 1 |
| CO4 | 3 | 2 | 1 | - | - | - | - | - | - | - | 1 | 1 | 2 | 1 |
| CO5 | 3 | 2 | 1 | - | - | - | - | - | - | - | 1 | 1 | 2 | 1 |
| Average | 2.4 | 1.4 | 1 | - | - | - | - | - | - | - | 1 | 1 | 2 | 1 |

CO PO MAPPING

9

TOTAL: 45

2023 - 2024 Semester-VII

5H-4C

BASIC ELECTRICAL & ELECTRONICS ENGINEERING

(THEORY & LABORATORY)

Instruction Hours/week: L:3 T:0 P:2

Marks: Internal:40 External:60 Total:100 End Semester Exam:3 Hours

(i) Theory

23BTCC241

Course Objectives

The goal of this course is for students to,

- To impart the basic knowledge about the Electric circuits.
- To understand the concept of Electrical Machines and Transformers.
- To understand the working of Semiconductor devices and Digital Circuits.
- To impart the basic knowledge of Measuring Instruments and Electrical Installation.
- Know the fundamentals of Electrical Engineering and Practical.

Course Outcomes

Upon completion of this course, students will be able to,

- Build the electric circuits with DC and AC excitation by applying various circuit laws.
- Illustrate the basic principles, construction and working of AC DC Motor and transformer
- Identify the various characteristics of semiconductor devices and real time application of digital circuits
- Explain the principle, construction and operation of moving coil and moving iron instruments
- Compare the different types of Batteries & its application in Electric Vehicle.

UNIT I - DC Circuits

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff's current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin's and Norton Theorems.

UNIT II - AC Circuits

Representation of sinusoidal waveforms, peak and rms values, Phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT III - Electrical Machines and Transformer

Construction and working of a three-phase and Single-phase induction motor. Construction, working and speed control of DC motor. Magnetic materials, BH characteristics, Construction and working principle of ideal and practical transformer.

UNIT IV- Semiconductor Devices and Digital Electronics

Bipolar Junction Transistor - Characteristics. Introduction to operational Amplifier -Model-

9

9

9

Applications. Number systems – binary codes - logic gates - Boolean algebra, laws & theorems

UNIT V- Measuring Instruments and Electrical Installation

Principle, construction, and operation of moving coil and moving iron meters-Measurement of Power. Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, RCCB, MCCB. Earthing. Types of Batteries and its application in Electric Vehicle, Important Characteristics for Batteries. Elementary calculations for energy consumption and battery backup.

Total: 45

- **TEXT BOOKS** 1.
- S.K.Bhattacharya, "Basic Electrical Engineering", Pearson, 2019. 2.
- E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
- 3. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010
- 4. VN Mittle and Arvind Mittal, (2006), Basic Electrical Engineering, McGraw Hill.
- 5. A.Sudhaka and Shyammohan S Palli, (2013), Circuits and Networks, McGraw Hill.
- 6. R.Muthusubramanian and S.Salivahanan, (2014), Basic Electrical and Electronics Engineering, McGraw Hill.

WEB LINKS:

- www.nptel.ac.in. 1.
- 2. encyclopedia-magnetica.com/doku.php/co energy.
- 3. https://en.wikibooks.org/wiki/electronics/measuring instruments.

ii) Laboratory

List of Experiments

- 1. Experimental verification of electrical circuit problems using Ohms law
- 2. Experimental verification of electrical circuit problems using Kirchhoff's Voltage law.
- 3. Experimental verification of electrical circuit problems using Kirchhoff's Current law.
- 4. Measurement of electrical quantities voltage, current, power & power factor in R load.
- 5. Measurement of energy using single phase energy meter.
- 6. Speed control of DC Shunt Motor.
- 7. Verification of truth table of Logic Gates

CO PO Manning

| | | rappin | -B | | | | | | | | | | | |
|------------|------------|--------|-----|-----|-----|------------|------------|------------|------------|------|------|------|------|------|
| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 2 | 2 | 1 | - | - | - | - | 1 | - | - | - | 2 | - | - |
| CO2 | 2 | 2 | 1 | - | - | - | - | 1 | - | - | - | 2 | - | - |
| CO3 | 2 | 2 | 1 | - | - | - | - | 1 | - | - | - | 2 | - | - |
| CO4 | 2 | 2 | 1 | - | - | - | - | 1 | - | - | - | 2 | - | - |
| CO5 | 2 | 2 | 1 | - | - | - | - | 1 | - | - | - | 2 | - | - |
| Average | 2 | 2 | 1 | - | - | - | - | 1 | - | - | - | 2 | - | - |

TOTAL: 30

23BTCC242A DATA STRUCTURES AND ALGORITHMS

Instruction Hours/week: L:4 T:0 P:2

PRE-REQUISITES: Programming in C

(i) THEORY

COURSE OBJECTIVES:

The goal of this course is for the students:

- To understand the concepts of ADTs.
- To learn linear data structures lists, stacks, and queues.
- To interpret non-linear data structures trees and graphs.
- To implementd sorting, searching and hashing algorithms.
- To apply Tree and Graph structures to real world scenario.

COURSE OUTCOMES:

Upon completion of this course the students will be able to:

- Build abstract data types for linked list data structure.
- Apply the concepts of stack, queue and its applications.
- Experiment with operations on binary trees.
- Identify the traversal techniques of graphs and its applications.
- Inspect sorting, searching and hashing techniques.

UNIT I LISTS

Abstract Data Types (ADTs) – Elementary Data types–List ADT – Array-based implementation – Linked list implementation – Singly linked lists – Doubly-linked lists – Circularly linked lists – Applications of lists – Polynomial ADT –Multilists–Sparse Matrices.

UNIT II STACKS AND QUEUES

Stack ADT – Operations – Applications – Balancing Symbols – Evaluating arithmetic expressions-Infix to Postfix conversion – Function Calls – Queue ADT – Operations – Circular Queue – Deque – Applications of Queues.

UNIT III TREES

Tree ADT – Tree Traversals - Binary Tree ADT – Expression trees – Binary Search Tree ADT – AVL Trees – Red-Black Trees – Priority Queue (Heaps) – Binary Heap.

UNIT IV MULTIWAY SEARCH TREES AND GRAPHS

 $B-Tree-B+\ Tree-Tries-Graph\ Definition-Representation\ of\ Graphs-Types\ of\ Graphs-$

Breadth-first traversal – Depth-first traversal – Bi-connectivity – Euler circuits – Topological

Sort – Dijkstra's algorithm – Minimum Spanning Tree – Prim's algorithm – Kruskal's algorithm

2023-2024

GORITHMS 6H-5C Marks: Internal:40 External:60 Total:100 End Semester Exam:3 Hours

9

9

9

9

UNIT V SEARCHING, SORTING AND HASHING TECHNIQUES

Searching – Linear Search – Binary Search. Sorting – Bubble sort – Selection sort – Insertion sort – Shell sort — Quick Sort – Merge Sort – Heap Sort – Radix Sort – Hashing – Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing.

TEXT BOOKS:

TOTAL: 45

- 1. Mark Allen Weiss," Data Structures and Algorithm Analysis in C", Pearson Education, Second Edition, 2005
- 2. Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein," Introduction to Algorithms", Mcgraw Hill/ MIT Press, Fourth Edition,2022

REFERENCE BOOKS:

- 1. Narasimha Karumanchi," Data Structures and Algorithms Made Easy", CareerMonk Publications, First Edition,2016
- 2. Langsam, Augenstein and Tanenbaum, "Data Structures Using C", Pearson Education, Second Edition,2015
- 3. Kamthane," Introduction to Data Structures in C", Pearson Education, First Edition, 2007
- 4. Kruse," Data Structures and Program Design in C", Pearson Education, Second Edition, 2003

WEBSITES:

- 1. www.nptel.ac.in/courses/106106145
- 2. www.nptel.ac.in/courses/106102064
- 3. www.coursera.org/learn/data-structures
- 4. www.edx.org/learn/data-structures
- $5. \ www.cs.usfca.edu/~galles/visualization/Algorithms.html$

(ii) LABORATORY

LIST OF EXPERIMENTS:

- 1. Array implementation of Stack, Queue and Circular Queue ADTs
- 2. Implementation of Singly Linked List
- 3. Linked list implementation of Stack and Linear Queue ADTs
- 4. Implementation of Evaluating Postfix Expressions, Infix to Postfix conversion
- 5. Implementation of Binary Search Trees and AVL Trees
- 6. Implementation of Heaps using Priority Queues
- 7. Implementation of Dijkstra's Algorithm
- 8. Implementation of Prim's Algorithm
- 9. Implementation of Linear Search and Binary Search
- 10. Implementation of Insertion Sort and Selection Sort
- 11. Implementation of Merge Sort and Quick Sort
- 12. Implementation of Open Addressing (Linear Probing and Quadratic Probing)

TOTAL: 30

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|------------|-----|-----|------------|-----|------------|------------|------------|-----|------|------|------|------|------|
| CO1 | 3 | 2 | 1 | - | - | - | - | - | 2 | 2 | - | 2 | 2 | - |
| CO2 | 3 | 2 | 1 | - | - | - | - | - | 2 | 2 | - | 2 | 2 | - |
| CO3 | 3 | 2 | 1 | - | - | - | I | - | 2 | 2 | I | 2 | 2 | - |
| CO4 | 3 | 2 | 1 | - | - | - | I | - | 2 | 2 | I | 2 | 2 | - |
| CO5 | 3 | 3 | 2 | 1 | - | - | - | - | 2 | 2 | - | 2 | 2 | _ |
| Average | 3 | 3 | 2.4 | - | - | - | - | - | 2 | 2 | - | 2 | 2 | - |

CO-PO MAPPING

2023-2024

SEMESTER-II

23BTCC242B OBJECT ORIENTED PROGRAMMING WITH PYTHON 6H-5C

Instruction Hours/week: L:4 T:0 P:2

Marks: Internal:40 External:60 Total:100 End Semester Exam:3 Hours

(i) THEORY

COURSEOBJECTIVES:

The goal of this course is for the students:

- To learn basic python language syntax, semantics and control structures.
- To apply list, tuple, set and dictionary to handle data.
- To solve the problems using functions and modules.
- To infer the object-oriented programming concepts in python.
- To interpret inheritance and exception handling in python.

COURSE OUTCOMES:

Upon completion of this course the students will be able to:

- Apply python control flow statements to solve problems.
- Model data structures for string, tuple, list, set, and dictionary.
- Identify Python built-in functions to write user defined functions.
- Apply object-oriented programming concepts in python.
- Analyze the concepts of exception handling to a real world scenario.

UNIT I PYTHON FUNDAMENTALS

Introduction to Python – language classification - python language syntax - keywords - identifiers - indentation - comments - input - output - escape characters – variables – operators - Control Statements.

UNIT II DATA STRUCTURES IN PYTHON

String - Mutable vs immutable types – indexing and slicing – String functions - Tuple - Tuple operations – List - List operations – List as array – List comprehension - Set - Set operations – Dictionary – Dictionary operations.

UNIT III FUNCTIONS AND MODULES

Python built in functions - User defined functions - Creating function – Invoking functions – Types of function arguments – Recursion and lambda or anonymous functions - Defining, Creating and Accessing a Package, importing packages and user defined modules.

UNIT IV CLASSES AND OBJECTS

Object Oriented terminologies (class, object, method, inheritance, abstraction, encapsulation, polymorphism) – UML Class diagram - access specifiers – Creating classes – Creating object – Accessing members - __init__() method - instance, static and class methods - Importance of self – Implementing encapsulation.

9

9

9

UNIT V INHERITANCE, POLYMORPHISM AND EXCEPTION HANDLING 9

Implementing inheritance – Types of inheritance – Implementing Polymorphism - Method overloading – Method overriding – Operator overloading - Abstract Classes - Association and Aggregation - Errors vs exceptions – Handling exceptions – Raising exception – Creating user defined exception.

TOTAL: 45

TEXTBOOKS:

- 1. Think Python: How to Think Like a Computer Scientist AnanyLevitin, Allen B. Downey Second Edition, O'Reilly, 2016.
- 2. Python 3 Object-oriented Programming, Dusty Phillips, Third Edition, Packet Publishing, 2018.

REFERENCESBOOKS:

- 1. The Absolute Beginner's Guide to Python Programming, Kevin Wilson, Apress Media LLC, First Edition, 2022.
- 2. Python 3 The Comprehensive Guide, Johannes Ernesti, Peter Kaiser, Rheinwerk Publishing Inc., First Edition, 2022
- 3. Fundamentals of Python Programming, Richard L. Halterman, Southern Adventist University, First Edition, 2019

WEBSITES:

- 1. <u>www.docs.python.org/3/</u>
- 2. www.programiz.com/python-programming
- 3. <u>www.scaler.com/topics/python/</u>
- 4. <u>www.geeksforgeeks.org/python-oops-concepts/</u>
- 5. www.edureka.co/blog/object-oriented-programming-python/

(ii) LABORATORY

LIST OF EXPERIMENTS:

- 1. Programs using operators and control structures.
- 2. Programs using string functions.
- 3. Programs using tuple.
- 4. Programs using list.
- 5. Programs using set.
- 6. Programs using dictionary.
- 7. Programs using built-in functions.
- 8. Implementing user defined functions with various parameter options
- 9. Implementation of class & objects.
- 10. Implementation of inheritance and association.
- 11. Implementation of overloading and overriding.
- 12. Implementation of exception handling.

TOTAL: 30

CO-PO MAPPING

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|-----|-----|-----|------------|-----|------------|------------|------------|-----|------|------|------|------|------|
| CO1 | 3 | 2 | 1 | - | - | - | - | - | 2 | 2 | - | 2 | - | 2 |
| CO2 | 3 | 2 | 1 | - | - | - | - | - | 2 | 2 | - | 2 | - | 2 |
| CO3 | 3 | 2 | 1 | - | - | - | - | - | 2 | 2 | - | 2 | - | 2 |
| CO4 | 3 | 2 | 1 | - | - | - | - | - | 2 | 2 | - | 2 | - | 2 |
| CO5 | 3 | 3 | 2 | 1 | - | - | - | - | 2 | 2 | - | 2 | - | 2 |
| Average | 3 | 2.2 | 1.2 | 1 | - | - | - | - | 2 | 2 | - | 2 | - | 2 |

2023-2024

4H-2C

23BTCC211

WORKSHOP PRACTICES

SEMESTER-II

Instruction Hours/week: L:0 T:0 P:4

COURSE OBJECTIVES

The goal of this course is for the students to built

- To prepare the students to gain the knowledge about various manufacturing methods.
- To impart knowledge on the operations in CNC machining.
- To prepare the students to use the techniques, skills, and modern engineering tools necessary for engineering practice.
- To provide practical knowledge on the use of Basic Mechanical Components.
- To provide practical knowledge on the use of Mechanical components.

COURSE OUTCOMES

Upon completion of this course the students will be able to:

- Inspect machined component in lathe operation
- Identify the mating gap in the filed work piece and chiselled work piece
- Develop soldering processes for the given circuit
- Apply the principles of carpentry techniques to make functional structures.
- Build plumbing exercises to install and connect plumbing fixtures.

(i) LECTURES and VIDEOS:

Detailed contents

- 1. Study on various manufacturing methods- Casting and Forming.
- 2. Study on Machining and Welding.
- 3. Study on Job fitting.
- 4. Study on CNC machine operation.
- 5. Study on Fitting operations and power tools.

(ii) WORKSHOP PRACTICE:

- 1. Fitting shop Filing and Matting practices.
- 2. Welding shop Arc welding practices.
- 3. Casting Foundry practices.
- 4. Machine shop Identifying components of Lathe machine and various Lathe operations.
- 5. Plumbing Exercises Identifying Plumbing components.

TEXT BOOKS:

- 1. Gowri S, Jeyapoovan, T.Engineering Practices Lab Manual, 5th edition, Vikas Publishing House Pvt. Ltd, Chennai. 2017.
- 2. Bawa, H.S, Workshop Practice, 2nd edition, Tata McGraw Hill Publishing Company Limited, New Delhi,2019.

REFERENCE BOOKS:

- 1. Choudhry S K, Elements of workshop technology, Vol 2, 13th edition, Indian book distributing company,Kolkatta, 2020.
- 2. D K Singh, Manufacturing Technology, 2nd edition, Pearson Education, 2018.

WEBSITES:

- 1. http://ecoursesonline.iasri.res.in/course/view.php?id=86
- 2. <u>https://engg.kkwagh.edu.in/workshop_about_engg</u>

CO-PO MAPPING

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|------------|-----|-----|-----|-----|------------|------------|------------|-----|-------------|------|------|------|------|
| CO1 | 3 | 3 | 2 | 1 | - | - | - | - | 2 | 1 | - | 1 | 2 | - |
| CO2 | 2 | 1 | - | - | - | - | - | - | 2 | 1 | - | 1 | 2 | - |
| CO3 | 3 | 2 | 1 | - | - | - | - | - | 2 | 1 | - | 1 | 2 | - |
| CO4 | 3 | 2 | 1 | - | - | - | - | - | 2 | 1 | - | 1 | 2 | - |
| CO5 | 3 | 2 | 1 | - | - | - | - | - | 2 | 1 | - | 1 | 2 | - |
| Average | 3 | 2 | 2 | 1 | - | - | - | - | 2 | 1 | • | 1 | 2 | - |
2023 -2024 SEMESTER-II

1H - 0C

23BTMC251

SOFT SKILLS

Marks: Internal:100 Total:100

Instruction Hours/week: L:1 T:0 P:0

COURSE OBJECTIVES:

The goal of this course is for the students to

- Encourage all round development of the students by focusing on soft skills.
- Make the students aware of critical thinking and problem-solving skills.
- Develop leadership skills and organizational skills through group activities.
- Function effectively with heterogeneous teams.
- Develop social and work-life skills as well as personal and emotional well-being.

COURSE OUTCOMES:

Upon completion of this course the students will be able to

- Memorize various elements of effective communicative skills.
- Interpret people at the emotional level through emotional intelligence.
- Apply critical thinking skills in problem solving.
- Analyze the needs of an organization for team building.
- Judge the situation and take necessary decisions as a leader.

Unit I Communication Skills

Introduction, meaning, significance of soft skills –definition, significance, types of communication skills -Intrapersonal & Inter-personal skills

Unit II Critical Thinking

Active Listening –Observation –Curiosity –Introspection –Analytical Thinking –Openmindedness –Creative Thinking- Public Speaking

Unit III Problem Solving & Decision Making

Meaning & features of Problem Solving –Managing Conflict –Conflict resolution –Methods of decision making –Effective decision making in teams –Methods & Styles - Time Management

TEXT BOOKS

- 1. Personality Development and Soft Skills (English, Paperback, Mitra Barun K.) Publisher: Oxford University Press; Pap/Cdr edition (July 22, 2012)
- 2. Personality Development and Soft Skills: Preparing for Tomorrow, Dr Shikha Kapoor Publisher: I K International Publishing House; 0 edition (February 28, 2018)
- 3. Soft skills: personality development for life success by Prashant Sharma, BPB publications 2018

23BTMC252 WOMEN SAFETY AND SECURITY

Marks: Internal:100 Total:100

1H - 0C

Instruction Hours/week: L:1 T:0 P:0

COURSE OBJECTIVES:

The goal of this course is for the students to

- Highlight the social construction of gender in Indian society and the role of social institutions in the socialization process.
- Make aware about the practical issues concerning gender and politics.
- Classify the students in engendering national policies and programmes.
- Observe the liability of women and women's work in the context of globalization.
- Acquaint knowledge about the political participation of women and the gendered structures of governance and polity.

COURSE OUTCOMES:

Upon completion of this course the students will be able to

- Infer into the basic concepts related to sex, gender, femininity etc.
- Demonstrate the rationale for women's studies
- Compare Gender Equality Issues and Movements in Women's Studies
- Summarize the Social construction of Gender, Gender Roles and Gender stereotyping.
- Illustrate Social Structures, Changing Status of Women in India.

Unit I Fundamental Concepts of Women's Studies

Definition- Objectives of Women's Studies; Importance of Women's Studies; Women's Studies as an Academic Discipline; Role of UGC Centre for Women's Studies

Unit II Social Empowerment

Women in Higher Education; Gender issues in Health, Environment, Family welfare Measures, Indecent representation of Women in media; Women in Difficult circumstances; Constitutional.

Unit III Political Empowerment

Women leaders in politics- Women in Local Governance- Barriers- Reservation policies-Women's Political Rights, Property Rights - Violence against Women - Women's work

TEXT BOOKS

- 1. Amy S. Wharton. (2005). "The Sociology of Gender: An Introduction to Theory and Research". (KeyThemes in Sociology) Blackwell Publishing, UK, Indian Reprint, Kilaso Books, New Delhi.
- 2. Devaki Jain and Pam Rajput (Ed). (2003). "Narratives from the Women"s Studies Family: Recreating Knowledge, Sage, and New Delhi.
- 3. Jasbir Jain (Ed). (2005). "Women in Patriarchy: Cross Cultural". Rawat Publication Jaipur.

SEMESTER- III

| B. Tech. – Food Tech | nology | 2023 - 2024 |
|----------------------|-------------------|---------------|
| | | Semester- III |
| 23BTFT301B | NUMERICAL METHODS | 4H-4C |
| | | |

Instruction Hours/week: L:3 T:1 P:0

Marks: Internal:40 External:60 Total:100 End Semester Exam:3 Hours

Course Objectives

The goal of this course is for students,

- To inculcate the basic concepts of solving algebraic and transcendental equations.
- To understand the numerical techniques of interpolation in various intervals
- To provide the knowledge of numerical differentiation and integration
- To provide the knowledge of solving ordinary differential equations numerically
- To inculcate various techniques of solving partial differential equations numerically.

Course Outcomes

Upon completion of this course, students will able to,

- Solve the systems of linear and nonlinear equations by iterative methods.
- Make use of interpolation methods for finding the missing terms.
- Apply numerical methods for finding differentiation and integration of a given function.
- Solve ordinary differential equations using Euler's, Taylor's, Runge Kutta and Milne Thomson's method.
- Utilize implicit and explicit methods in heat and wave equations.

UNIT I SOLUTION OF EQUATIONS

Regula Falsi Method - Newton Raphson method for solving algebraic and transcendental equations -Solution of a system of linear equations - Gauss elimination method - Gauss Jordan method Gauss-Seidel method

UNIT II INTERPOLATION

Interpolations with unequal intervals-Lagrange's interpolation -Newton's divided interpolation -

Interpolation with equal intervals-Newton's forward and backward interpolation

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION

Approximation of derivatives using Newton's forward and backward interpolation - Numerical integration using Trapezoidal, Simpson's 1/3 and 3/8 rule

UNIT IV NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS 9

Single step method- Euler's method-Taylor's series method-Fourth order Runge – Kutta method – Multi step method-Milne's predictor-corrector method.

9

9

UNIT V NUMERICAL SOLUTIONS OF PARTIAL DIFFERENTIAL EQUATIONS 9

Solutions of one-dimensional heat equation by Bender-Schmidt and Crank Nicholson methods – Numerical solutions of one-dimensional wave equation by explicit method

Total:45

TEXT BOOKS:

- Steven C.Chapra and Raymond P.Canale, "Numerical Methods for Engineers", McGraw Hill Education, Seventh Edition (2015).
- Curtis F. Gerald and Patrick O. Wheatley, "Applied Numerical Analysis", Addison Wesley, Thirteenth Edition (2004).
- Richard L. Burden and J. Douglas Faires, "Numerical Methods", Brooks/Cole, 4th edition, 2012.
- 4. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, Tenth Edition, 2011.

WEBSITES:

- 1. https://archive.nptel.ac.in/courses/111/107/111107105/
- 2. <u>https://ocw.mit.edu/courses/18-03-differential-equations-spring-2010/resources/lecture-2-</u> eulers-numerical-method-for-y-f-x-y/
- 3. <u>http://www.infocobuild.com/education/audio-video-courses/mathematics/numerical-analysis-iit-madras.html</u>
- 4. <u>http://www.infocobuild.com/education/audio-video-</u> courses/mathematics/NumericalMethods-FiniteDifference-IIT-Roorkee/lecture-06.html

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|-----|-----|-----|------------|-----|------------|------------|------------|-----|-------------|------|-------------|------|------|
| CO1 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | - | - |
| CO2 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | - | - |
| CO3 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | - | - |
| CO4 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | - | - |
| CO5 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | - | - |
| Average | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | - | - |

CO- PO MAPPING

2023 -2024 Semester- III

23BTFT302 POST-HARVEST TECHNOLOGY 3H-3C

Instruction Hours/week: L:3 T:0 P:0

Marks: Internal:40 External:60 Total:100 End Semester Exam:3 Hours

Course Objectives:

The goal of this course is for students,

- To explain the basics of postharvest storage practices.
- To outline the postharvest losses of different food grains.
- To infer the proper separation and storage practices.
- To classify various constraints of milling and their economy.
- To explain different methods used for material handling systems.

Course Outcomes

Upon completion of this course, students will able to,

- Extend their knowledge of post-harvest storage practices.
- Explain knowledge on the reduction of post-harvest losses.
- Outline new methods for the storage of food grains.
- Demonstrate the different methods of milling and their economic importance.
- Infer the methods of material handling systems.

UNIT I - OVERVIEW OF POST-HARVEST TECHNOLOGY

Concept and science, Introduction to different agricultural crops, their cropping pattern, production, harvesting and post-harvest losses- Transpiration, water loss and deterioration in quality. Respiration, maturation, ripening, senescence and biochemicalchanges affecting quality and marketability. Ethylene effect – application and control.Temperature effect – heat, chilling and freezing injury, reasons for losses, the importance of loss reduction, Post-Harvest Handling operations.

UNIT II - CLEANING SORTING AND GRADING

Cleaning of grains, washing of fruits and vegetables, types of cleaners, screens, typesof screens, rotary screens, vibrating screens, machinery for cleaning of fruits and vegetables (air cleaners, washers), cleaning efficiency, care and maintenance; PeelingSorting, grading, methods of grading; Grading- Size grading, color grading, specific gravity grading; screening, equipment for grading of fruits and vegetables, grading efficiency, care, and maintenance. Kinetics of quality changes: physical, chemical, sensory and nutritional changes during handling for processing.

UNIT III - SEPARATION, DECORTICATING AND SHELLING

Magnetic separator, destoners, electrostatic separators, pneumatic separator Principles of working, design and constructional details, operating parameters, maintenance, etc. of various decorticators/dehullers/shellers, description of groundnut decorticators, maize shellers, etc.

Karpagam Academy of Higher Education (Deemed to be University), Coimbatore

9

9

UNIT IV - MILLING AND MATERIALS HANDLING

Milling, polishing, grinding, milling equipment, de huskers, polishers (abrasion, friction, water jet), flour milling machines, pulse milling machines, grinders, cutting machines, oil expellers, machine efficiency and power requirement Introduction to different conveying equipment used for handling of grains, fruits and vegetables; Postharvest treatment to increase shelf life i.e. freezing, chilling, dehydration, canning, thermal processing. Scope and importance of material handling devices 9

UNIT V - STUDY OF DIFFERENT MATERIAL HANDLING SYSTEMS

Classification, principles of operation, conveyor system selection/design Belt conveyor: Principle, characteristics, design, relationship between belt speed and width, capacity, inclined belt conveyors, idler spacing, belt tension, drive tension, belt tripper Chain conveyor: Principle of operation, advantages, disadvantages, capacity and speed, conveying chain screw conveyor: Principle of operation, capacity, power, troughs, loading and discharge, inclined and vertical screw conveyors Bucket elevator: Principle, classification, operation, advantages, disadvantages, capacity, speed, bucket pickup, bucket discharge, relationship between belt speed, pickup and bucket discharge, buckets types, power requirement Pneumatic conveying system: types, air/product separators; Gravity conveyor design considerations, capacity and power requirement.

TEXT BOOKS:

- 1. Amalendu Chakraverty and R. Paul Singh. 2014. Post-Harvest Technology and Food Process Engineering. CRC Press, Boca Raton, FL, USA.
- 2. Chakraverty. 2008. Post-Harvest Technology of Cereals, Pulses and Oilseeds, 3rdEd. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

REFERENCE BOOKS

- 1. Don W. Green and Robert H. Perry. 2008. Perry's Chemical Engineers' Handbook. McGraw-Hill Co., Inc., NY, USA.
- 2. James G. Brennan. 2006. Food Processing Handbook. Wiley-VCHVerlag GmbH & Co. KGaA, Weinheim, Germany.
- 3. K.M. Sahay and K.K. singh. 2001. Unit Operations of Agricultural Processing. Vikas Publishing House Pvt. Ltd., Noida, UP.

WEBLINKS

- 1. https://onlinecourses.swayam2.ac.in/cec20 ag02/preview
- 2. https://www.classcentral.com/course/swayam-post-harvest-management-of-fruits-andvegetables-17733.

CO PO MAPPING

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|------------|-----|-----|-----|-----|-----|-----|------------|------------|------------|------|------|------|------|------|
| CO1 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | - | 2 | 1 |
| CO2 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | - | 2 | 1 |
| CO3 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | - | 2 | 1 |
| CO4 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | - | 2 | 1 |
| CO5 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | - | 2 | 1 |
| Average | 2 | 1 | - | - | - | - | - | - | - | - | 1 | - | 2 | 1 |

TOTAL: 45

23BTFT303 FOOD PROCESS CALCULATIONS

Instruction Hours/week: L:3 T:0 P:0 Marks: Internal:40 External:60 Total:100 End Semester Exam:3 Hours

Course Objectives:

The goal of this course is for students:

- To utilize the basic units, dimensions and basic related functions involved in food process engineering.
- To infer the various law governing the gases and vapors
- To apply material balance and law of conservation of energy.
- To solve problems in Energy balance in heat exchangers.
- To explain the types, properties, and agitation processes in fluids.

Course Outcomes:

Upon successful completion of the course, students will be able to:

- Apply the units and dimensions of various physical quantities.
- Explain the laws and theory of gases and vapors.
- Make use of material balance in food processing units.
- Utilize the energy balance involved in food processing operations.
- Infer the types and properties of fluid flow.

UNIT I - DIMENSIONS AND UNIT

Fundamental-derived units. Definitions of some basic physical quantities – Force, momentum, pressure, work and energy, power, heat and enthalpy. Dimensional analysis. Mole - atomical molar mass. Moisture content. -water activity. Conversions and calculations of RPM- RCF, normality, molality, molarity, PPM and PPB, Fundamental Calculations and Humidity: Calculation of absolute humidity, molal humidity, relative humidity and percentage humidity.

UNIT II – STOICHIOMETRY

Basic Principles of Stoichiometry - Importance of material balance and energy balance ina process Industry-Dimensions, Units, conversion factors and their use – Data sources, Humidity and applications. Material Balance: Stoichiometric principles, Application of material balance to unit operations like distillation, evaporation, crystallization, drying, extraction, Leaching

UNIT III - MATERIAL BALANCE

Law of Conservation of mass- Process flow diagram-system boundaries - overall massbalance – component mass balance –basis and tie material- Continuous vs. Batch- Recycle and by pass-unsteady state -mass balance problems on concentration, dehydration, evaporation, crystallization, mixing –solvent extraction –multi stage process.

2023 - 2024

3H-3C al:60 Total:100

SEMESTER-III

9

9

UNIT IV - ENERGY BALANCE

Heat capacity – gases – solids – liquids -Latent heat – sensible heat -energy balance for a closed system and open system -total energy balances. Energy balance problems in heat exchangers –Drying. Use of mean heat capacity in heat calculations, problems involving sensible heat and latent heats, evaluation of enthalpy.

UNIT V - FLUID MECHANICS AND AGITATION OF FLOW THROUGH PACKINGS 9

Fluid – properties – compressible, incompressible fluids, Newtonian and Non- Newtonian Fluids, Fluid statics for compressible & incompressible. Agitation – powerrequirement, Flow in packed columns, flow in fluidization columns, settling phenomena, Flow measurement, pumping of liquids and gases – equipment.

TOTAL: 45

TEXT BOOKS:

- 1. Romeo T. Toleda. (2000). "Fundamentals of Food Process Engineering ", Chapman & Hall, USA, CBS publications, New Delhi.
- 2. Smith, PG. (2004). "Introduction to Food Process Engineering ", Springer.

REFERENCE BOOKS:

- 1. Paul Singh R and Dennis R. Heldman (2004) "Introduction to Food Engineering". Academic Press – Elsevier India Private Ltd. New Delhi.
- 2. Bhatt, B.L and Vora, S.M., "Stoichiometry", Third Edition, McGraw-Hill, New York, 2004.
- 3. Venkata ramani, V. and Anantharaman, N., "Process Calculations", Prentice Hall of India, New Delhi, 2011.

WEBLINKS:

- 1. https://archive.nptel.ac.in/courses/112/103/112103290/
- 2. https://archive.nptel.ac.in/courses/102/106/102106069/

CO PO MAPPING

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|------------|-----|-----|------------|------------|------------|------------|------------|------------|------|------|------|------|------|
| CO1 | 3 | 2 | 1 | - | - | - | - | - | - | - | 1 | 1 | 2 | 1 |
| CO2 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 1 | 2 | 1 |
| CO3 | 3 | 2 | 1 | - | - | - | - | - | - | - | 1 | 1 | 2 | 1 |
| CO4 | 3 | 2 | 1 | - | - | - | - | - | - | - | 1 | 1 | 2 | 1 |
| CO5 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 1 | 2 | 1 |
| Average | 2.6 | 1.6 | 1 | - | - | - | - | - | - | - | 1 | 1 | 2 | 1 |

23BTFT304

THERMODYNAMICS

3H-3C

NAMICS

Instruction Hours/week: L:3 T:0 P:0

Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

Course Objectives:

The goal of this course is for students:

- To explain the fundamentals and calculations involved in the Zeroth law of thermodynamics.
- To utilize the applications of the first law of thermodynamics.
- To make use of second law of thermodynamics and entropy.
- To infer the thermodynamic properties of pure substances, its phase changeprocesses and to study the working principle of steam boilers.
- To explain the working principle of Carnot, vapor compression, vapor absorption and air refrigeration systems.

Course Outcomes:

Upon successful completion of this course, students will be able to:

- Explain the laws, concepts and principles of thermodynamics.
- Apply first law of thermodynamics to closed and open systems.
- Solve problems related to cycles and cyclic devices using second law of thermodynamics.
- Classify the thermodynamic properties of pure substances and phase change process.
- Demonstrate the classification, working and accessories of steam boilers.

UNIT I - BASIC CONCEPTS AND FIRST LAW

Thermodynamics, Terminologies, systems – classification – properties and state of a system. Thermodynamic process, cycle and equilibrium. Zeroth law of thermodynamics. Law of conservation of energy. Heat – specific heat – thermal capacity and water equivalent. Mechanical equivalent of heat, work – power - universalgas constant. Internal energy, enthalpy and molar specific heat of a gas. First law of thermodynamics – Limitations of first law of thermodynamics

UNIT II – APPLICATION OF FIRST LAW OF THERMODYNAMICS TO NON-FLOW AND FLOW PROCESS 9

Work done during a non-flow process - Work done for constant volume, constant pressure, constant temperature, adiabatic and polytropic process. Application of first law of thermodynamics to a steady flow system - boiler, condenser, evaporator, nozzle,turbine, rotary and reciprocating compressor.

UNIT III - SECOND LAW OF THERMODYNAMICS

Kelvin Planck and Clausius statements. Heat engine, heat pump and refrigeration. Relation between heat and entropy – Importance and units of entropy – Clausius inequality - available and unavailable heat energy.

UNIT IV - STEAM PROPERTIES AND BOILERS

Formation of steam at constant pressure – Temperature vs total heat during steam formation. Wet, dry saturated and, super-heated steam – Dryness fraction of wet steam -Enthalpy and specific volume of steam – uses of steam tables. Boilers: Classificationof steam boilers, Vertical and Cross tube Cradley boiler, Cochran, Lancashire, Locomotive and Babcock-Wilcox boilers. Boiler mountings and accessories.

UNIT V - REFRIGERATION SYSTEMS AND COMPONENTS

Principles of refrigeration, choice of refrigerants, components of refrigeration cycle. Types of refrigeration: Carnot refrigeration, vapor compression cycle, air refrigeration cycle, absorption refrigeration cycle.

TEXT BOOKS:

- Narayanan, K.V. (2013). A Text book of chemical engineering thermodynamics. 2nd Edition. PHI Learning Private Limited.
- 2. Rajput, R.K. (2009). Engineering Thermodynamics. 3rd Edition. Laxmi Publication. New Delhi.
- 3. Nag, P.K. (2017). Engineering Thermodynamics. 6th Edition. McGraw Hill Education (India) Private Limited.

REFERENCE BOOKS

- 1. Saggion, A., Faraldo, R., Pierno, M. (2019). Thermodynamics:Fundamental Principles and Applications. Germany: Springer International Publishing.
- 2. Klein, S., Nellis, G. (2012). Thermodynamics. United Kingdom: Cambridge University Press.

WEBLINKS

- 1. https://archive.nptel.ac.in/courses/127/106/127106135/
- 2. https://archive.nptel.ac.in/courses/112/105/112105266/

CO PO MAPPING

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|------------|-----|-----|-----|-----|------------|------------|-----|------------|------|------|------|------|------|
| CO1 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | 2 | 1 |
| CO2 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | - | 2 | 1 |
| CO3 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 2 | 1 |
| CO4 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | 2 | 1 |
| CO5 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | 2 | 1 |
| Average | 2.4 | 1.4 | 1 | - | - | - | - | - | - | - | - | - | 2 | 1 |

9

9

TOTAL: 45

23BTFT341

FOOD MICROBIOLOGY (Theory and Laboratory)

2023 -2024 SEMESTER-III

5H-4C

Instruction Hours/week: L:3 T:0 P:2

Marks: Internal:40 External:60 Total:100 End Semester Exam:3 Hours

(i) Theory

Course Objectives:

The goal of this course is for students:

- To apply the basic concepts and factors affecting the growth of microorganisms.
- To illustrate the preservation of foods using temperature as a parameter.
- To identify the role of drying, additives and radiation in the food preservation.
- To outline the microorganisms associated with the food fermentation processes.
- To explain about the food borne illness and sanitation in food industries.

Course Outcomes:

Upon successful completion of the course students will be able to:

- Utilize the general concepts and factors affecting the growth ofmicroorganisms.
- Infer the different temperature range as control agent for food preservation.
- Experiment with different methods of drying, additives and radiation to prevent microbialspoilage.
- Demonstrate the microbial cultures for preparing various fermented food products.
- Illustrate the pathogenesis of food borne pathogens and food poisoning.

UNIT I - FOOD AND MICROORGANISMS

General concepts about molds, bacteria and yeasts. Gram Positive and Gram-Negative bacteria Factors affecting growth of microorganisms – pH, water activity, oxidation – reduction potential, nutrient content, inhibitory substances and biological structure – combined effects of factors affecting growth. Microbial spoilage of food, Detection and enumeration of microorganisms, control of microbial growth.

UNIT – II MICROBIOLOGY OF PRESERVATION – HIGH AND LOW TEMPERATURES 9

Heat resistance of microorganisms and their spores, Determination of heat resistance Effect of high temperature on microbes – TDT, D value, Z value, 12D concept, F value. Pasteurization and canning Growth of microorganisms at low temperatures, temperatures employed in low temperature storage, freezing – preparation, freezing and changes occur in foods, response of microorganisms to freezing, Indicator Microorganisms, Tolerance of microorganisms to thermal processing.

UNIT III - MICROBIOLOGY OF PRESERVATION – DRYING, ADDITIVES AND RADIATION 9

Drying – Methods, factors in the control of drying, treatments before and after drying, microbiology of dried foods and specific dried foods, IMF. Additives – Antimicrobial preservatives, antibiotics and developed preservatives. Radiation – Ultraviolet radiation, factors influencing, ionizing radiations - effect on microorganisms and foods, Microwave processing. Tolerance of microorganisms to chemical processing.

UNIT IV - FOOD FERMENTATION

General principles of culture maintenance and preparation – Bacterial, Yeast and mold cultures. Manufacture, spoilage and defects of Bread, malt beverages – beer and related beverages, wines, distilled liquors, vinegar, fermented vegetables – sauerkraut and pickles, fermented dairy products – yogurt, kefir, kumiss, probiotics and prebiotics cheese, SCP, oriental fermented foods – soy sauce, tempeh, miso, ang-khak, idli, natto, soybean cheese, Minchin, fermented fish, preserved eggs, and poi.

UNIT V - FOOD BORNE ILLNESS AND SANITATION

Food borne diseases – Clostridium, E. coli, Listeria, Bacillus, Mycotoxins – Aflatoxin, Patulin and ochratoxin, seafood toxicants – shellfish poisoning, ciguatera, scombroid fish poisoning, Food borne viruses; Helminths, nematodes and protozoa, poisoning by chemicals, Bacteriology of water supplies – Sewage and waste treatment and disposal-Microbiology of the food product - Good Manufacturing Practices (GMP) – Hazard Analysis and Critical Control Points (HACCP).

TEXT BOOKS:

- 1. Adams M.R and Moss M.O, (2007). "Food Microbiology", 2nd Edition, Third reprint, Panima Publishing Corporation, New Delhi,
- 2. William C Frazier and Dennis C. Westoff, (2008). "Food Microbiology", Special Edition, Springer, The Mc Graw-Hill Companies.
- 3. Montville, Thomas J. and Karl R. Matthews "Food Microbiology: An Introduction". ASM Press, 2005.

REFERENCE BOOKS:

- 1. Doyle, Michael P. "Food Microbiology: Fundamentals and Frontiers". 2nd Edition, ASM Press, 2001.
- 2. Pawsey, R. K. "Case Studies in Food Microbiology for Food Safety and Quality". The Royal Society of Chemistry, 2001.

WEBLINKS:

- $1. \ \underline{https://onlinecourses.swayam2.ac.in/cec19_ag03/preview}$
- 2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7329975/

TOTAL: 45

9

(ii) Laboratory

LIST OF EXPERIMENTS

- 1. Microscopy: working and applications.
- 2. Sterilization techniques and applications.
- 3. Preparation of culture media, broth and slants.
- 4. Staining methods: simple and differential staining.
- 5. Demonstration of bacterial motility by hanging drop method.
- 6. Microbiological examination of water quality by MPN method.
- 7. Bacteriological testing of milk.
- 8. Enumeration of microbes in spoiled food.
- 9. Production of wine and estimation of alcohol content.
- 10. Demonstration of beer production.

TOTAL: 30

| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|------------|------------|-----|-----|-----|-----|------------|------------|------------|------------|-------------|------|------|------|------|
| CO1 | 3 | 2 | 1 | - | - | - | - | - | 1 | - | 1 | 1 | 2 | 1 |
| CO2 | 2 | 1 | - | - | - | - | - | - | 1 | - | 1 | 1 | 2 | 1 |
| CO3 | 3 | 2 | 1 | - | - | - | - | - | 1 | - | 1 | 1 | 2 | 1 |
| CO4 | 2 | 1 | - | - | - | - | - | - | 1 | - | 1 | 1 | 2 | 1 |
| CO5 | 2 | 1 | - | - | - | - | - | - | 1 | - | 1 | 1 | 2 | 1 |
| Average | 2.4 | 1.4 | 1 | - | - | - | - | - | 1 | - | 1 | 1 | 2 | 1 |

CO-PO MAPPING

23BTFT342

FOOD CHEMISTRY (Theory and Laboratory)

Instruction Hours/week: L:3 T:0 P:2

Marks: Internal:40 External:60 Total:100 End Semester Exam:3 Hours

2023 - 2024

5H-4C

SEMESTER-III

(i)Theory

Course Objectives:

The goal of this course is for students:

- To explain the properties of biomolecules and its reactions involved.
- To infer the different nature of proteins and their importance.
- To differentiate the various physical and chemical properties of lipids.
- To outline the importance micro nutrients in food products.
- To apply the functional role of bioactive components in terms of colour, flavour, texture and nutrient composition and their identification.

Course Outcomes:

Upon successful completion of this course, students will be able to:

- Summarize the structure of molecules, its reactions and interactions of food components in food products.
- Explain the importance of proteins and its application.
- Interpret the physic chemical properties of lipids and its role in food products.
- Infer the stability and degradation properties of micronutrients.
- Identify the bioactive components and nutrient composition through quantification method.

UNIT I – CARBOHYDRATES

Simple Sugars: mono and disaccharides, Hygroscopcity & solubility, optical rotation, muta rotation; sensory properties-sweetness index, caramelization, Maillard reaction; Glucose syrup, high fructose corn syrup, Dextrose Equivalent, Degree of polymerisation; Sugar alcohols; Oligosaccharides: structure, nomenclature, occurrence, uses in foods. Polysaccharides: Starch- amylose and amylopectin- properties, thickening &gelatinization, modified starches, resistant starch, Dextrins and dextrans, Starch hydrolysates – Maltodextrins and dextrins; Pectins, gums & seaweeds- gel formation & viscosity. Fiber Cellulose & hemicellulose; Food sources, functional roleand uses in foods. **UNIT II – PROTEINS 9**

Proteins in foods -classification, structure and properties of amino acids; Essential amino & Non- Essential amino acids. Review of protein structure & conformation;

Karpagam Academy of Higher Education (Deemed to be University), Coimbatore

53

Chemical and Physical properties of Proteins. Reactions of proteins in food systems: Dissociation, optical activity, solubility, hydration, swelling, foam formation &stabilization, gel formation, emulsifying effect, thickening & binding, amino acids in Maillard reaction, denaturation; Food enzymes- classification, kinetics, production and applications; Mechanism of enzyme action. Determination of proteins in food.

UNIT III – LIPIDS

Lipids in foods - occurrence, classification, structure of simple, compound and derived lipids. Nomenclature of fats. Non-glyceride components in fats& oils; Properties of fats & oils: crystal formation, polymorphism, melting points, plasticity, isomerization, unsaturation; Modification of fats: hydrogenation- cis and trans isomers, interesterification, acetylation, winterization; Hydrolytic rancidity & oxidative rancidity; radiolysis Shortening power of fats, tenderization, emulsification, frying – smoke point, autooxidation, polymerization; Fat replacements; Food sources, functional role and uses in foods.

UNIT IV - WATER, MINERALS AND VITAMINS

Water: Structure of water molecule, Chemical and physical properties of water, Typesof water: free, bound & entrapped water, water activity. Drinking water, mineral water, water hardness, water quality for food process in. Minerals & vitamins: Mineral & vitamin content of foods- Food and Pharmaceutical grades; Recommended daily intake, toxicities, deficiencies, factors affecting bioavailability, stability & degradationduring processing.

UNIT V - COLOR, FLAVORS AND OTHER COMPONENTS

Colour, flavour & aroma components: Naturally occurring colours, acids, other flavor& aroma components present in herbs, spices, coffee, tea, cocoa, fruits, vegetables & fermented products; Synthetic colours and naturally similar /artificial flavours, Threshold values, off flavours & food taints. Naturally occurring toxic substances (trypsin inhibitors, phytins, tannins, oxalates, goitrogen, toxic amino acids, glucosinolates, aflatoxins), protease inhibitors, bioactive components: phytates, polyphenols, saponins, phytoestrogens etc. Processing and storage techniques offlavoring compounds. Changes (color, flavor and other components) during processing and storage.

TOTAL: 45

TEXT BOOKS:

- 1. Belitz H.-D, Grosch W and Schieberle P. (2004), Food Chemistry, 3rd Revised Edition, Springer-Verlag.
- 2. Meyer, Lillian Hoagland (1987), Food Chemistry, CBS Publishers
- 3. Chopra, H.K. and P.S. Panesar, (2010), Food Chemistry, Narosa

9

9

REFERENCE BOOKS:

- 1. Vaclavik, V. A. and Christian E. W., (2003), Essentials of Food Science 2nd Edition, Kluwer Academic, Springer.
- 2. John W. Brady. 2013. Introductory Food Chemistry. Comstock Publishing Associates, Cornell University Press, Ithaca, USA.
- 3. Thayumanavan, B, Krishnaveni, S and Parvathi, K. 2004. Biochemistry for Agricultural Sciences, Galgotia Publications Pvt Ltd., New Delhi. ISBN: 81-7515-459-4.

WEBLINKS:

- 1. <u>https://onlinecourses.swayam2.ac.in/cec20_ag10/preview</u>
- 2. https://onlinecourses.nptel.ac.in/noc23_ag19/preview

(ii) Laboratory

List of Experiments:

- 1. Enzymatic Browning in foods.
- 2. Gelling properties of starch.
- 3. Study of gluten formation.
- 4. Foaming properties of proteins.
- 5. Iso-electric precipitation of casein.
- 6. Preparation of emulsions.
- 7. Estimation of free fatty acids.
- 8. Oxidative rancidity of fats.
- 9. Estimation of Carotenoids.
- 10. Rapid Detection of flavor Compounds.
- 11. Enzyme activity assay (protease / amylase).

TOTAL: 30

| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|------------|-----|-----|-----|-----|------------|------------|-----|-----|-------------|------|------|------|------|
| CO1 | 2 | 1 | - | - | - | - | - | - | 1 | - | 1 | 1 | 2 | 1 |
| CO2 | 2 | 1 | - | - | - | - | - | - | 1 | - | 1 | 1 | 2 | 1 |
| CO3 | 2 | 1 | - | - | - | - | - | - | 1 | - | 1 | 1 | 2 | 1 |
| CO4 | 2 | 1 | - | - | - | - | - | - | 1 | - | 1 | 1 | 2 | 1 |
| CO5 | 3 | 2 | 1 | - | - | - | - | - | 1 | - | 1 | 1 | 2 | 1 |
| Average | 2.2 | 1.2 | 1 | - | - | - | - | - | 1 | - | 1 | 1 | 2 | 1 |

CO-PO MAPPING

| B.Tech. Food Technology | | | 2023 - 2024 |
|-------------------------|-------------|------------------|-----------------------|
| | | | SEMESTER-III |
| 23BTFT343 | FIELD PROJI | ECTS/ INTERNSHIP | 0H-1C |
| Instruction Hours/week: | L:0 T:0 P:0 | Marks: I | nternal:100 Total:100 |

The students will be directed to do an internship in their domain industry for 3 weeks Their internship work will be evaluated for forty percentages by internal examiner and sixty percentage by external examiner for End Semester Examination. End Semester Examination evaluation will be based on the report submitted by the student after the completion of their internship report.

2023 - 2024

1H-0C

SEMESTER-III

23BTMC351

APTITUDE & REASONING

Marks: Internal:100 Total:100

Course Objectives:

The goal of this course is for the students:

Instruction Hours/week: L:1 T:0 P:0

- To Categorize, apply, and use thought processes to distinguish between concepts
- of Quantitative methods.
- To Prepare and explain the fundamentals related to various possibilities and
- probabilities related to quantitative aptitude.
- To Critically evaluate numerous possibilities related to puzzles.
- To Understand and solve puzzle-related questions from specific and other competitive tests.
- To Solve questions related to Time and distance and time and work etc.

Course Outcomes:

Upon completion of this course, the students will be able to:

- Understand the basic concepts of quantitative ability
- Understand the basic concepts of logical reasoning Skills
- Acquire satisfactory competency in the use of reasoning
- Solve campus placements aptitude papers covering Quantitative Ability, Logical
- Gaun Reasoning Ability Compete in various competitive exams like CAT, CMAT, GATE, GRE, GATE, UPSC, GPSC etc.

UNIT - I 1. Quantitative Ability (Basic Mathematics)

- 1.1. Number Systems
- 1.2. LCM and HCF
- 1.3. Decimal Fractions
- 1.4. Simplification
- 1.5. Square Roots and Cube Roots
- 1.6. Problems on Ages
- 1.7. Surds & Indices
- 1.8. Percentages

UNIT – II 2. Quantitative Ability (Applied & Engineering Mathematics)

- 2.1. Logarithm
- 2.2. Permutation and Combinations
- 2.3 Probability
- 2.4 Profit and Loss
- 2.5 Simple and Compound Interest
- 2.6. Time, Speed and Distance
- 2.7. Time & Work
- 2.8. Ratio and Proportion
- 2.9. Area
- 2.10 Mixtures and Allegation

UNIT – III 3. Verbal - Aptitude

- 3.1 Words
- 3.2 Idioms

3.3 Phrases in Context

3.4 Reading comprehension techniques

3.5 Narrative sequencing

3.6 Data interpretation

Textbooks:

1. A Modern Approach to Verbal & Non-Verbal Reasoning by R S Agarwal

2. Analytical and Logical Reasoning by Sijwali B S

3. Quantitative aptitude for Competitive examination By R S Agarwal

4. Analytical and Logical Reasoning for CAT and other management entrance tests By Sijwali B S

- 5. Quantitative Aptitude by Competitive Examinations by Abhijit Guha 4th edition
- 6. https://prepinsta.com/
- 7. https://www.indiabix.com/
- 8. https://www.javatpoint.com/

2023 - 2024

1H-0C

SEMESTER-III

23BTMC352A

FOREIGN LANGUAGE –GERMAN

Instruction Hours/week: L:1 T:0 P:0

Marks: Internal:100 Total:100

COURSE OBJECTIVES:

The goal of this course is for the students to

- Learn design thinking concepts and principles
- Use design thinking methods in every stage of the problem
- Learn the different phases of design thinking
- Apply various methods in design thinking to different problems
- Identify a solution to any problem of life and business

COURSE OUTCOMES:

Upon completion of this course the students will be able to

- Demonstrate the critical theories of design, systems thinking, and design methodologies
- Define key concepts of design thinking
- Practice design thinking in all stages of problem solving
- Apply design thinking approach to real world problems
- Use the concept of design thinking in their business world.

UNIT-I : Herzlich willkommen! -Wie ist dein Name ? -Ich trinke gern Kaffee.-Wir konjugieren die Verben.

UNIT-II : A bit of history and ZAHLEN - Verben, W-Fragen, Ja-Nein Fragen, Imperativ-das Alphabet, die Woche, das Jahr -Was sind deine Hobbys ? Formular $ausf\tilde{A}^{1/4}$ llen

UNIT-III : Mein Lehrbuch | Meine pers \tilde{A} ¶nlichen Daten-Mein Arbeitsbuch -Wir beginnen Lektion -Wir lesen Lektion 3

UNIT-IV : formeller Brief- Wie lernst du Deutsch? -Wir hören ein deutsches Lied- Wir lernen

Hörverständnis | Wir beginnen Lektion

UNIT V : Eine E-Mail schreiben | Eine Wohnung beschreiben- Im Kaufhaus | Welche/Diese-Gesund und munter

BOOKS AND REFERENCES:

- 1. NETZWERK Deutsch als Fremdsprache A1(Goyal, New Delhi, 2015)
- 2. Schulz-Griesbach: Deutsch als Fremdsprache. Grundstufe in einem Band (for Grammar)

WEB RESOURCES:

- https://www.tatsachen-ueber-deutschland.de/en
- https://www.goethe.de/en/spr/kup/prf/prf/sd1/ueb.html

2023 - 2024

1H-0C

SEMESTER-III

23BTMC352B

FOREIGN LANGUAGE – FRENCH

Instruction Hours/week: L:1 T:0 P:0

Marks: Internal:100 Total:100

COURSE OBJECTIVES:

The goal of this course is for the students to

- Learn design thinking concepts and principles •
- Use design thinking methods in every stage of the problem
- Learn the different phases of design thinking
- Apply various methods in design thinking to different problems
- Identify a solution to any problem of life and business •

COURSE OUTCOMES:

Upon completion of this course the students will be able to

- Demonstrate the critical theories of design, systems thinking, and design methodologies
- Define key concepts of design thinking
- Practice design thinking in all stages of problem solving •
- Apply design thinking approach to real world problems •
- Use the concept of design thinking in their business world.

UNIT-I

Recognize the French letters, Identify the letter-combinations that are characteristic of the French language, Identify the remaining letter-combinations that are characteristic of the French language, UNIT - II

Use the imperative in the affirmative form, Say the time in French, Talk about the weather in French, .Talk about actions that just happened, Speak about actions that are yet to happen

UNIT – III

Learn a few basic and commonly used 2nd group verbs, Understand the concept of French 'modal verb, Learn a few basic and commonly used 3rd group verbs, Learn what reflexive verbs, Distinguish between moods and tenses

UNIT - IV

Place an order in a restaurant, learn a third past tense, Identify a direct object, Identify an indirect object, Use direct and indirect objects pronouns in a single sentence

BOOKS AND REFERENCES:

- 1. Alter Ego Méthode de Français, A1 (2006): Berthet, Hugot et al., Hachette
- 2. Alter Ego Cahier d'activités, A1 (2006): Berthet, Hugot et al., Hachette
- 3. Écho Méthode de Français, A1 (2013): Girardet, Pecheur, CLE International

WEB RESOURCES:

- www.leo.org
- WWW. Nptel.com

Semester-IV

B.Tech. Food Technology Semester-IV **23BTFT401A PROBABILITY AND STATISTICS** Instruction Hours/week: L:3 T:1 P:0 Marks: Internal:40 External:60 Total:100

Course Objectives:

The goal of this course is for students:

- To provide the required fundamental concepts of probability theory and Random variables.
- To introduce the concept of Theoretical Distributions.
- To impart the knowledge of Measures of Central tendencies, Dispersions
- To impart the knowledge of correlation and Regression
- To inculcate the knowledge of testing of hypothesis using small and large sampling tests.

Course Outcomes:

Upon successful completion of the course, students will be able to:

- Infer the fundamentals of probability and random variables.
- Explain standard distributions of random variables. ٠
- Make use of statistical data for finding the measures of central tendency and measures of • dispersion.
- Interpret the data using correlation and regression.
- Apply small and large samples tests in testing of hypothesis.

UNIT I - PROBABILITY AND RANDOM VARIABLES

Probability - The axioms of probability - Conditional probability - Baye's theorem - Discrete and continuous random variables - Moments - Moment generating functions - Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

UNIT II - TWO - DIMENSIONAL RANDOM VARIABLES

Joint distributions - Marginal and conditional distributions - Covariance - Correlationand linear regression using SPSS tool- Transformation of random variables - Central limit theorem (for independent and identically distributed random variables).

2023 - 2024

4H-4C

9

9

End Semester Exam: 3 Hours

UNIT III - TESTING OF HYPOTHESIS

Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample tests based on Normal distribution for single mean and difference of means - Tests based on t, Chi-square and F distributions for mean, variance and proportion - Contingency table (test for independent) - Goodness of fit.

UNIT IV - DESIGN OF EXPERIMENTS

One way and Two-way classifications - Completely randomized design – Randomized block design – Latin square design – 2^2 factorial design using SPSS tool.

UNIT V - STATISTICAL QUALITY CONTROL

Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.

TEXT BOOKS

- 1. Johnson, R.A., Miller, I and Freund J., "Miller and Freund 's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.
- 2. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2007.
- 3. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.
- 4. Papoulis, A. and Unnikrishnapillai, S., "Probability, Random Variables and Stochastic Processes", McGraw Hill Education India, 4th Edition, New Delhi, 2010.
- 5. Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 3rd Edition, Elsevier, 2004.
- 6. Spiegel. M.R., Schiller. J. and Srinivasan, R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 2004.
- 7. Walpole. R.E., Myers. R.H., Myers.S.L. and Ye.K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 8th Edition, 2007.
- 8. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
- 9. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint).
- 10. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.

Websites:

- 1. www.cut-theknot.org/probability.shtml
- 2. www.mathworld. Wolfram.com
- 3. www.mathcentre.ac.uk

TOTAL: 45

9

9

9

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|-----|-----|-----|-----|-----|-----|------------|-----|-----|------|------|------|------|------|
| CO1 | 2 | 1 | - | - | - | - | - | - | - | - | - | 2 | - | - |
| CO2 | 2 | 1 | - | - | - | - | - | - | - | - | - | 2 | - | - |
| CO3 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 2 | - | - |
| CO4 | 2 | 1 | - | - | - | - | - | - | - | - | - | 2 | - | - |
| CO5 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 2 | - | - |
| Average | 2.4 | 1.4 | 1 | - | - | - | - | - | - | - | - | 2 | - | - |

CO- PO MAPPING

B.Tech. Food Technology

Course Objectives:

23BTFT402

The goal of this course is for students:

- To explain the concepts of fluid mechanics.
- To identify the pressure variations in fluids and measurement devices. •
- To analyze the fluid statics on variable surface conditions. •
- To apply the equations of motion and kinetics of fluid flow. .
- To explain the flow of fluids in various geometries of pipes. •

Course Outcomes:

Upon successful completion of the course students will be able to:

- Interpret the various properties of fluids.
- Explain the pressure differences in fluids. •
- Classify the devices to measure the pressure of fluids
- Identify the forces acting on bodies submerged in different positions in liquids. •
- Demonstrate the basic design calculations for fluid flow in pipes •

UNIT I - PROPERTIES OF FLUIDS

Introduction- units and Dimensions - Properties of fluids-Density - Specific weight -Specific Volume- Specific gravity- equation of state – perfect gas - Viscosity-Thermodynamic properties- Compressibility and Bulk modulus- Surface tension and capillarity -vapor pressure and cavitation.

UNIT II - PRESSURE AND ITS MEASUREMENT

Fluid pressure at a point- Pascal's law- Pressure variation in a fluid at rest-Absolute, Gauge, Atmospheric and vacuum pressures- Measurement of pressure Simple Manometers-Differential manometers, micro manometers, Mechanical gages calibration

UNIT III - FLUID STATICS

Hydro static forces on surfaces- Total pressure and center of pressure- Vertical plane surface submerged in liquid- Horizontal plane surface submerged in liquid- Inclined plane surface submerged in liquid- curved surface submerged in liquid, Pressure diagram – total pressure on curved surface. Archimedes principles – buoyancy – meta centre - metacentric height.

9

66

FLUID MECHANICS

3H-3C Marks: Internal:40 External:60 Total:100

End Semester Exam: 3 Hours

UNIT IV - BASIC CONCEPTS OF FLUID FLOW AND MEASUREMENT 9

Kinematics of flow-Types of fluid flow-Rate of flow-continuity equation- continuity equation in three dimensions- velocity and acceleration velocity potential function and stream function- Dynamics of Fluid flow- Equations of motion- Euler's equation of motion- Bernoulli's equation- Practical applications of Bernoulli's equation – Venturimeter- Orifice meter Pitot tube. Rotameter, Flow measurement in channels – notches – rectangular, Cippollette and triangular – float method.

UNIT V - FLOW THROUGH PIPES

Reynolds Experiment, Darcy – Weisbach equation for friction head loss – Chezy's formula Laminar and turbulent flow- Loss of energy in pipes- Loss of energy due to friction- Minor energy Losses-Hydraulic gradient and Total Energy line- Flow through pipes in series- Equivalent pipe-Flow through parallel pipes- Flow through branched pipes-Power transmission through pipes- Water hammer in pipes.

TOTAL: 45

9

TEXT BOOKS:

- 1. Bansal, R.K., (2011). "Fluid Mechanics and Hydraulic Machines",9th edition, Laxmi Publications, New Delhi.
- 2. Modi, P.N. and Seth, S.M., (2007). "A Text book of Fluid Mechanics and Hydraulic Machines", Standard Book House, New Delhi.

REFERENCE BOOKS

- 1. Som, S.R and Biswas, (2007). "Introduction to Fluid Mechanics and Fluid Machines" 2nd edition, Tata McGraw Hill.
- 2. Streeter, V.L. Wylie, E. B. and Bedford K.W, Fluid Mechanics. (9th ed) Tata McGraw Hill, New Delhi, 1998

3. Grade, RJ.,. "Fluid mechanics through problems". Wiley eastern Ltd., Madras, 2002. **WEBLINKS**

- 1. https://archive.nptel.ac.in/courses/112/105/112105171/
- 2. https://archive.nptel.ac.in/courses/112/105/112105287/

CO-PO MAPPING

| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|------------|-----|-----|-----|-----|-----|-----|------------|-----|-----|------|------|------|------|------|
| CO1 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | 1 | 1 |
| CO2 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | 1 | 1 |
| CO3 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | 1 | 1 |
| CO4 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 1 |
| CO5 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | 1 | 1 |
| Average | 2.2 | 1.2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 1 |

9

9

Semester-IV

23BTFT403 PLANTATION PRODUCTS AND SPICE PROCESSING 3H-3C TECHNOLOGY

Instruction Hours/week: L:3 T:0 P:0

Marks: Internal:40 External:60 Total:100 End Semester Exam:3 Hours

Course Objectives:

The goal of this course is for students:

- To summarize the chemistry and technology of coffee.
- To explain the chemistry and technology of tea.
- To illustrate the basic views on the chemistry and technology of cocoa and its products.
- To extend the views on chemistry of major spices and its technology.
- To explain the chemistry and technology of minor spices.

Course Outcomes:

Upon completion of this course, students will be able to:

- Explain the chemistry and manufacturing of coffee.
- Extend the views on tea production and its chemistry.
- Interpret the basic knowledge on manufacturing of cocoa products and its chemistry.
- Explain the manufacturing of major spices and its chemistry.
- Infer the production of minor spices and chemistry behind its production.

UNIT I - CHEMISTRY AND TECHNOLOGY OF COFFEE

Coffee – Occurrence – chemical constituents– harvesting – fermentation of coffee beans – changes taking place during fermentation – drying – roasting –Process flow sheet for the manufacture of coffee powder – Instant coffee, technology – Chicory chemistry -Quality grading of coffee.

UNIT II - CHEMISTRY AND TECHNOLOGY OF TEA

Occurrence – chemistry of constituents – harvesting – types of tea – green, oolong and CTC – Chemistry and technology of CTC tea – Manufacturing process – Green tea manufacture – Instant tea manufacture – Grading of tea.

UNIT III - CHEMISTRY AND TECHNOLOGY OF COCOA AND COCOA PRODUCTS

Occurrence – Chemistry of the cocoa bean – changes taking place during fermentation of cocoa bean – Processing of cocoa bean – cocoa powder – cocoa liquor manufacture Chocolates – Types – Chemistry and technology of chocolate manufacture – Quality control of chocolates.

UNIT IV - CHEMISTRY AND TECHNOLOGY OF MAJOR SPICES

Pepper, Cardamom, ginger, Chili, mint, and turmeric – Oleoresins and essential oils – Method of manufacture-machineries and equipment, grades, products and standards-

Chemistry of the volatiles -Enzymatic synthesis of flavor identical - Quality control of major spices -Conditions in storage of spices-Types of dryers used in spice processingmilling of spices-selection of raw materials-Standards of ground spices.

UNIT V - CHEMISTRY AND TECHNOLOGY OF MINOR SPICES

Cumin, Coriander, Cinnamon, fenugreek, Garlic, Clove Vanilla, Coconut, Areca nut, Oil palm and Cashew - Oleoresins and essential oils -Method of manufacturemachineries and equipment, grades, products and standards – Chemistry of the volatiles - Quality control of minor spices- -Conditions in storage of spices-Types of dryers used in spice processing-Different uses of minor spices-milling of spices-selection of raw materials-Standards

TEXT BOOKS:

- 1. Peter, K.V. Hand book of herbs and spices. Volume 2. Wood head publishing Ltd., 2004. eBook ISBN: 9780857095688
- 2. Chakravarty, A., Mujumdar, A.S., Raghavan, G.S.V., Ramaswamy, H.S. Handbook of post-harvest technology – cereals, fruits, vegetables, tea and spices. Marcel Dekker Inc., New York (Special Indian Reprint). 2010. ISBN 13: 9780824705145
- 3. Tainter, D.R. Grenis, A.T. Spices and Seasonings A food technology hand book. 2nd edition. John Wiley and Sons, Inc., Canada. 2001. ISBN: 978-0-471-35575-5

REFERENCE BOOKS

- 1. Salunkhe, D.K. and Kadam S.S. Ed. 1998. Hand book of Vegetable Science and Technology, Marcel Dekker, New York, USA. ISBN: 0824701054
- 2. Minifie Bernard W. Chocolate, Cocoa and Confectionery Technology, 3rdEdition, Aspen Publication, 1999. ISBN: 9780834213012
- 3. Handbook on Spices, National Institute of Industrial Research (NIIR) Board, Asia Pacific Business Press Inc., New Delhi 2004. ISBN: 8178330946
- 4. Banerjee B. 2002. Tea Production and Processing 3rdedition, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

WEBLINKS

- 1. https://onlinecourses.nptel.ac.in/noc23_ag16/preview
- 2. https://auece.digimat.in/nptel/courses/video/126105023/L28.html

9

9

TOTAL: 45

CO-PO MAPPING

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|------------|-----|-----|-----|-----|------------|------------|------------|------------|-------------|------|------|------|------|
| CO1 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 1 | 2 | 1 |
| CO2 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 1 | 2 | 1 |
| CO3 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 1 | 2 | 1 |
| CO4 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 1 | 2 | 1 |
| CO5 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 1 | 2 | 1 |
| Average | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 1 | 2 | 1 |

2023 - 2024

Semester-IV 3H-3C

9

9

HEAT AND MASS TRANSFER

Instruction Hours/week: L:3 T:0 P:0

Marks: Internal:40 External:60 Total:100 End Semester Exam:3 Hours

Course Objectives:

23BTFT404

The goal of this course is for students to:

- To apply laws of heat conduction and theories of insulation.
- To summarize the different modes of convection heat transfer.
- To differentiate the different modes of radiation heat transfer.
- To classify the types of heat exchangers and their applications in the food industry.
- To summarize the diffusion mass transfer.

Course Outcomes:

Upon completion of the course, students will be able to:

- Identify the conduction mode of heat transfer in simple and composite systems.
- Interpret heat transfer coefficients for natural convection.
- Infer the influence of radiation in food processing operations.
- Explain heat exchanger performance by using the method of heat exchanger effectiveness.
- Apply heat exchanger performance by using the method of log meantemperature difference.

UNIT I - HEAT TRANSFER – CONDUCTION

Modes of heat transfer – Conduction, Convection and Radiation. Fourier's Law of Heat Conduction-Thermal Conductivity for gases, liquids and solids-Thermal diffusivity-Thermal Resistance-Steady heat conduction in simple geometries: Plane wall, hollow cylinder and hollow sphere through solids in series -plane wall and multilayer cylinder. Heat conduction through materials in parallel. Theory of insulation, critical radius of insulation.

UNIT II - HEAT TRANSFER – CONVECTION

Convection heat transfer – forced and natural; Evaluation of convection heat transfer coefficient, Dimensionless numbers- Forced convection- Heat Transfer Coefficient for Laminar flow inside a tube -heat transfer coefficient for turbulent flow inside a pipe. – Heat Transfer outside various Geometries in Forced Convection – Flow parallel to flat

plate - Natural convection from vertical planes and cylinders –boiling and condensationmechanisms

UNIT III - HEAT TRANSFER – RADIATION

Basics of Radiation heat transfer- Types of surfaces – Concept of Black and Grey body-Kirchhoff's Law-radiation from a body and emissivity (Stephan Boltzmann Law), absorptivity, reflectivity, transmissivity to a small object from surroundings, heat exchange through non-absorbing media –Planck's Distribution law-Wein's Displacement law- combined Radiation and Convection Heat Transfer.

UNIT IV - HEAT EXCHANGERS

Types-Overall Heat Transfer Coefficient-Shell and Tube1-1, 1-2, 2-4 passes –Plate Heat Exchanger-tubular heat exchanger-Parallel Flow and Counter Flow- Cross flow Types- Scraped surface exchangers-Compact Heat exchanger- Heat exchanger Analysis-Log mean Temperature Difference. Fouling factor-applications of heat exchangers, Effectiveness – NTU method.

UNIT V - MASS TRANSFER

Mass transfer – introduction – Fick's law for molecular diffusion - molecular diffusion in gases – equimolar counters diffusion in gases and diffusion of gas A through non diffusing or stagnant B - diffusion through a varying cross-sectional area and diffusion coefficients for gases - molecular diffusion in liquids, biological solutions and gels. Concept of mass transfer coefficients, Interphase mass transfer and over all mass transfer coefficients in binary systems.

TOTAL: 45

TEXT BOOKS:

- 1. Rao, D.G. Fundamentals of Food Engineering. PHI learning Pvt Ltd. New Delhi, 2009.
- 2. Mccabe W.L., Smit J.C and Harriott P. Unit Operations of Chemical Engineering. McGraw- Hill International. New York, 7th Edition, 2017.

REFERENCE BOOKS

1. Paulsingh R, Dennis R. Heldman. Introduction to Food Engineering. Academic press 5th edition. 2013.

WEBLINKS

- 1. https://nptel.ac.in/courses/112101097
- 2. https://archive.nptel.ac.in/courses/112/108/112108149/

9

9

CO-PO Mapping

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|------------|-----|-----|-----|------------|-----|------------|------------|------------|------------|-------------|------|------|------|------|
| CO1 | 3 | 2 | 1 | - | - | - | - | 1 | - | - | - | 1 | 3 | 2 |
| CO2 | 2 | 1 | - | - | - | - | - | 1 | - | - | - | 1 | 3 | 2 |
| CO3 | 2 | 1 | - | - | - | - | - | 1 | - | - | - | 1 | 3 | 2 |
| CO4 | 2 | 1 | - | - | - | - | - | 1 | - | - | - | 1 | 3 | 2 |
| CO5 | 3 | 2 | 1 | - | - | - | - | 1 | - | - | - | 1 | 3 | 2 |
| Average | 2.4 | 1.4 | 1 | - | - | - | - | 1 | - | - | - | 1 | 3 | 2 |

23BTFT441

2023 - 2024

Semester-IV 5H-4C

9

9

UNIT OPERATIONS IN FOOD PROCESSING (Theory & Laboratory)

Instruction Hours/week: L:3 T:0 P:2

Marks: Internal:40 External:60 Total:100 End Semester Exam:3 Hours

(i)Theory

Course Objectives:

The goal of this course is for students,

- To demonstrate various types of equipment involved in drying and dehydration.
- To explain the operations involved in mechanical separations.
- To choose the various attributes of evaporators in food processing.
- To identify role of milling equipment in size reduction.
- To summarize the agitation and types of impellers employed in mixing.

Course Outcomes

Upon completion of the course, students will be able to,

- Explain the models involved in the moisture and its measurements.
- Summarize the various dryers employed in drying of food.
- Demonstrate the filtration, sedimentation and centrifugal separations.
- Apply the heat transfer coefficients and economy of different types of evaporators.
- Outline the energy and power requirement for the different size reductionoperations.

UNIT I - DRYING AND DEHYDRATION

Moisture and its measurements - direct and indirect methods – Equilibrium moisture – methods of determination – EMC Models – Henderson, Kelvin, PET and GAB models – importance of EMC- water activity – psychrometry — Drying theory – Drying rate – Mechanical Drying – hot air dryers – Types- fixed -fluidized bed – LSU drier-Spray drier- Osmotic dryer - vacuum shelf dryer - freeze dryer. Cleaning and Grading operations and equipments used in food industry

UNIT II - MECHANICAL SEPARATION

Screening: Types, Equipments; Filtration: Filter media types and requirement – constant rate filtration – constant pressure filtration – filter cake resistance – filtration equipments – filter press – rotary drum filters – sedimentation – sedimentation of particles in gas - cyclones – settling under sedimentation - gravitational sedimentation – Stoke's law – sedimentation in cyclones. Centrifugal separations – rate of separation centrifuge equipment.

UNIT III – EVAPORATION

Definition – liquid characteristics – Types of evaporators -single and multiple effect evaporators - once through and circulation evaporators – Agitated film evaporators. Performance – evaporator capacity – boiling point elevation and Duhring's rule. Heat transfer coefficients – Evaporators economy – enthalpy balance of single effect evaporator – multiple effect evaporator – methods of feeding. Capacity and economy of multiple effect evaporator.

UNIT IV - SIZE REDUCTION

Principles of comminuting – characteristics of comminuted products – particle size distribution in comminuted products – energy and power requirements – crushing efficiency – Rittinger's, Kick's and Bond's law – Size reduction equipment's – crushers – hammer mill – Ball Mill-Colloidal mill-attrition mills, grinders – construction and operation.

UNIT V – EXTRUDERS

Extrusion – methods – cold extrusion - Extrusion cooking – principles and types of extruders - single and double screw extruder- construction and working - Effect of different operational parameters – Effect on food - quality of the extruded products.

TOTAL: 45

TEXT BOOKS:

- 1. Rao DG. Fundamentals of Food Engineering. PHI Learning Private Limited, New Delhi, 2009.
- 2. Geankoplis CJ. Transport Processes and Separation Processes Principles. Prentice Hall India, New Delhi, 5th Edition, 2018.
- 3. Warren, L McCabe, J.C. Smith and Peter Harriot. Unit Operations of Chemical Engineering McGraw Hill International Edition, Singapore, 7th Edition, 2004.

REFERNCE BOOKS:

- 1. Earle, R.L. Unit Operations in Food Processing". Pergamon Press. UK, 2nd Edition, 2003.
- 2. Khurmi, R.S. and J.K. Gupta. 2003. A Text book of thermal Engg., S. Chand & Co. Ltd., Ram Nagar, New Delhi.
- 3. Zeki Berk. 2009. Food Process Engineering and Technology. Academic press, New York, USA.

WEBLINKS:

- 1. https://egyankosh.ac.in/handle/123456789/12069
- 2. https://www.ignouhelp.in/ignou-dvapfv-study-material/
- 3. https://onlinecourses.nptel.ac.in/noc20_ag01/preview
- 4. https://onlinecourses.nptel.ac.in/noc23_ag14/preview

9

9
(ii) Laboratory List of Experiments:

- 1. Experiment on drying of food samples in tray dryer
- 2. Study of fluidized bed dryer and drying process
- 3. Study of working principle of spray dryer and spray drying process
- 4. Study of freeze dryer and freeze-drying process
- 5. Experiments on reverse osmosis
- 6. Determination of particle size of granular foods by sieve analysis
- 7. Performance evaluation of ball mill
- 8. Performance evaluation of a hammer mill
- 9. Experiments on ultra-filtration
- 10. Solving problems on single effect evaporator and multiple effect evaporators

TOTAL: 30

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|------------|------------|-----|-----|-----|-----|------------|------------|------------|------------|-------------|------|-------------|------|------|
| CO1 | 2 | 1 | - | - | - | - | - | I | 1 | - | 1 | 1 | 2 | 1 |
| CO2 | 2 | 1 | - | - | - | - | - | I | 1 | - | 1 | 1 | 2 | 1 |
| CO3 | 2 | 1 | - | - | - | - | - | - | 1 | - | 1 | 1 | 2 | 1 |
| CO4 | 3 | 2 | - | - | - | - | - | - | 1 | - | 1 | 1 | 2 | 1 |
| CO5 | 2 | 1 | - | - | - | - | - | - | 1 | - | 1 | 1 | 2 | 1 |
| Average | 2.2 | 1.2 | - | - | - | - | - | - | 1 | - | 1 | 1 | 2 | 1 |

CO PO Mapping

23BTFT442

2023 - 2024

Semester-IV 5H-4C

FOOD BIOCHEMISTRY AND NUTRITION (Theory & Laboratory)

Instruction Hours/week: L:3 T:0 P:2

Marks: Internal:40 External:60 Total:100 End Semester Exam:3 Hours

(i)Theory

Course Objectives:

The goal of this course is for students:

- To apply the digestion, absorption and metabolic pathways of carbohydrates.
- To interpret the digestion, absorption, synthesis and metabolic pathways of fatty acids, proteins, and amino acids.
- To illustrate the important aspects of food relating to nutrition.
- To summarize the diets suitable for managing specific nutritional disorders.
- To infer new range of food products and dietary management systemfor different age group people.

Course Outcomes:

Upon successful completion of the course students will be able to:

- Identify the quantification methods for determining carbohydrates and proteins.
- Explain the stages in the catabolism of food molecules and describe what occurs during each stage.
- Summarize the biochemistry process, basic concept of human nutrition and the relationship of the consumption of foods to nutritional status and health.
- Outline the biological functions of foods for health in addition to nutritional values.
- Infer the dietary management system for nutrition and disorder with organs and inborn errors.

UNIT I – METABOLISM OF CARBOHYDRATES AND PROTEINS

9

Carbohydrate – Digestion and absorption, physicochemical and metabolic functions, Glycolysis (EMP) pathway, CORI's cycle, Energy yield from glycolysis, TCA cycle, pentose phosphate pathway – Energetics, HMP or PP pathway, Gluconeogenesis, Glycogenolysis, Glycogenesis, oxidative phosphorylation. Proteins – Digestion and absorption, General metabolism of amino acids – trans deamination, transamination and oxidative deamination, Urea cycle, Metabolism of serine, cysteine, valine, leucine, isoleucine, tryptophan.

UNIT II-METABOLISM OF FATTY ACIDS, VITAMINS, MINERALS AND NUCLEIC ACIDS 9

Fatty acids – Digestion and absorption, Synthesis of TAG's, Metabolism of adipose tissue – fatty liver and lipotropic factors, Cholesterol – biosynthesis and metabolism. - Metabolism of fat soluble and water-soluble vitamins. Metabolism of micro and macro minerals. Nucleic acids; physicochemical and metabolic functions, metabolism – metabolism of purine and pyrimidine nucleotides.

UNIT III-CONCEPTS OF FOOD AND NUTRITION

Food as a source of nutrients, Food intake and regulations, Food groups, Utilization of nutrients and digestion process, calorific value of food, dietary need and recommended dietary allowances, Vegetarian diet – health, problems and advantages, Nutrition in phytochemicals and non- nutrient components, Malnutrition – PEM, Food fortification, Effect of processing on nutritive value of foods, vitamins and storage of nutrients, Food allergy, intolerance and sensitivity, Nutrigenomics, Molecular nutrition, e-Nutrition and personalized nutrition.

UNIT IV-NUTRITIONAL DISORDERS

Dietary management – Fever – definition, effects on metabolic processes and diet modifications: Overweight, underweight and obesity – definitions, types, causes, factors responsible, measurement of obesity, importance of weight regulation, diet during obesity, psychological disorders during dieting, practical suggestions for reducing weight: Burns – types and nutritional management: CVD – types of cardiac disorders, risk factors, dietary management in atherosclerosis and hyperlipidaemia, fat replacers, dietary management in acute diseases of the heart, cardiological society of India: Cancer – diets and effects of cancer: Skin care, Diabetes – causes, factors predisposing diabetes, classification, symptoms, tests, acute and chroniccomplications, use of artificial sweeteners, hypoglycaemic drugs, oral hypoglycaemic drugs, medicinal plants in control of diabetes: Inborn errors of metabolism – diet therapy, amino acid disorders, carbohydrate disorders.

UNIT V-SPECIALIZED NUTRITION

Nutritional requirement for infants – food and feeding, advantages and disadvantages of formula feeding, advantages of breast feeding for infants and mothers, feeding of solid foods: Food and feeding of toddler, preschool, school children and adolescent: Nutrition for aging and the aged- young, middle and older adulthood, biological changes in the aging process, problems of the aging process, nutritional requirement for adults, complications commonly occurring in late adulthood: Sports and fitness – measurement of body composition, energy from major nutrients, factors affecting fuel utilization, nutrition and athletic performance, effective hydration for fitness and sports, nutrition requirement for athletes, water and other fluids, sport supplements, broad guidelines for sports persons, pre-competition, during competition and post competition meal: Pregnancy and lactation – exercise, nutrition requirement, complications during pregnancy, nutrition during lactation.

9

9

TEXT BOOKS:

- 1. Sunetra Roday. Food Science and Nutrition. Oxford Education/Oxford University Press, 2nd Edition, 2012.
- 2. Shubhangini AJ. Nutrition and Dietetics. McGraw Hill education, 4th Edition, 2015.
- 3. Srilakshmi.B. 2011. Dietetics (sixth edition). New Age Intl. Publishers, New Delhi.

REFERENCE BOOKS:

- Vasudevan DM and Sreekumari S. Textbook of Biochemistry. Jaypee Brothers Medical Publishers Pvt Ltd. New Delhi, 3rd Edition, 2001.
- Norman. N. Potter and Joseph H. Hotchkiss. 1996. Food Science, 5thredition, CBS publishers and Distributors, New Delhi.
- 3. John W. Brady. 2013. Introductory Food Chemistry. Comstock Publishing Associates, Cornell University Press, Ithaca, USA.

WEBLINKS:

- 1. https://nptel.ac.in/courses/102105034
- 2. https://onlinecourses.swayam2.ac.in/cec20_ag01/preview

(ii) Laboratory

List of Experiments

CO PO Monning

- 1. Estimation of proteins by Lowry's method.
- 2. Estimation of proteins by Biuret method.
- 3. Estimation of amino acid by ninhydrin method.
- 4. Estimation of total carbohydrate by anthrone method.
- 5. Estimation of reducing sugar by dinitro-salicylic acid (DNS) method.
- 6. Estimation of ascorbic acid content in the food.
- 7. Estimation of ash content and preparation of sample for AAS analysis.
- 8. Estimation of fat by Soxhlet method.
- 9. Estimation of cholesterol by Zak's method.
- 10. Estimation of Protein using Bradford's method

TOTAL: 30

| | | J-1 O h | Tappin | g | | | | | | | | | | |
|---------|-----|----------------|--------|-----|-----|-----|-----|------------|-----|------|------|------|------|------|
| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 2 | 1 | - | - | - | - | - | 1 | - | 1 | 1 | 3 | 2 |
| CO2 | 2 | 1 | - | - | - | - | - | - | 1 | - | 1 | 1 | 3 | 2 |
| CO3 | 2 | 1 | - | - | - | - | - | - | 1 | - | 1 | 1 | 3 | 2 |
| CO4 | 2 | 1 | - | - | - | - | - | - | 1 | - | 1 | 1 | 3 | 2 |
| CO5 | 2 | 1 | - | - | - | - | - | - | 1 | - | 1 | 1 | 3 | 2 |
| Average | 2.2 | 1.2 | 1 | - | - | - | - | - | 1 | - | 1 | 1 | 3 | 2 |

23BTMC451

FOUNDATION OF **ENTREPRENEURSHIP**

Semester-IV

2023 - 2024

1H-0C

Instruction Hours/week: L:1 T:0 P:0

Marks: Internal:100 Total:100

COURSE OBJECTIVES:

The goal of this course is for the students to

- Equip and develop the learners entrepreneurial skills and qualities essential to undertake business.
- Impart the learners entrepreneurial competencies needed for managing business efficiently and – effectively.
- Understand basic concepts in the area of entrepreneurship
- Develop personal creativity and entrepreneurial initiative
- Adopt the key steps in the elaboration of business idea

COURSE OUTCOMES:

Upon completion of this course the students will be able to

- Gain entrepreneurial competence to run the business efficiently.
- Undertake businesses in the entrepreneurial environment ٠
- Prepare business plans and undertake feasible projects. •
- Be efficient in launching and develop their business ventures successfully •
- Monitor the business effectively towards growth and development •

Unit I -ENTREPRENEURAL COMPETENCE

Entrepreneurship concept - Entrepreneurship as a Career - Entrepreneurial Personality -Characteristics of Successful Entrepreneurs – Knowledge and Skills of an Entrepreneur.

Unit II -ENTREPRENEURAL ENVIRONMENT

Business Environment - Role of Family and Society - Entrepreneurship Development

Unit III - BUSINESS PLAN PREPARATION

Sources of Product for Business - Prefeasibility Study - Criteria for Selection of Product -Ownership

Unit IV -LAUNCHING OF SMALL BUSINESS

Finance and Human Resource Mobilization - Operations Planning - Market and Channel **Selection - Growth Strategies**

Unit- V MANAGEMENT OF SMALL BUSINESS

Monitoring and Evaluation of Business - Effective Management of small Business - Case Studies.

TEXT BOOKS:

- 1. S.S.Khanka, Entrepreneurial Development, S.Chand and Company Limited, New Delhi, 2016.
- 2. R.D.Hisrich, Entrepreneurship, Tata McGraw Hill, New Delhi, 2018.
- 3. Rajeev Roy, Entrepreneurship, Oxford University Press, 2nd Edition, 2011.
- 4. Donald F Kuratko, T.V Rao. Entrepreneurship: A South Asian perspective. Cengage Learning, 2012.

23BTMC452

ESSENCE OF TRADITIONAL INDIAN KNOWLEDGE AND HERITAGE

Instruction Hours/week: L:1 T:0 P:0

Marks: Internal:100 Total:100

COURSE OBJECTIVES:

The goal of this course is for the students to

- Impart a holistic understanding about Indian Culture and Thoughts from a Historical perspective.
- Encourage critical appreciation of the Indian thoughts and cultural manifestations.
- Introduce the students to important concepts from the diverse intellectual traditions of India.
- Make use of Indian cultural heritage and various epistemological inquiries.
- Gain knowledge of Indian heritage.

COURSE OUTCOMES:

Upon completion of this course the students will be able to

- Understand the cultural diversity
- Infer the need of cultural unity
- Know the Dravidian culture
- Realize the power of Indian educational system called gurukul
- Come to know the concepts of Vedic thought

UNIT I Introduction to Indian thought and Culture

Plurality of Indian culture - Cultural Diversity and Cultural Unity -Different manifestations of Indian Culture: Indus valley culture -Vedic culture and Dravidian culture-The Medieval Bhakti Culture

UNIT II Traditional knowledge Systems of India

Introduction to the Traditional Indian Education system of Gurukul - Parampara -Understanding Indian Philosophy: Vedic thought and the nine schools of philosophy -Indigenous Knowledge and Women in India

TEXT BOOKS:

- 1. Chatterjee, Satishchandra and Dhirendramohan Datta. (2007) Introduction to Indian Philosophy. Rupa Publications, New Delhi.
- 2. Husain, S. Abid. (2003). The National Culture of India. National Book Trust, New Delhi.

2023 - 2024

1H-0C

B. Tech. - Food Technology

23BTFT501 REFRIGERATION, AIR CONDITIONING AND COLD STORAGE FOR PERISHABLE FOODS

Instruction Hours/week: L:3 T:0 P:0

COURSE OBJECTIVES:

The goal of this course is for students:

- To infer various concepts behind refrigeration of food.
- To define the various aspects of cold storage.
- To explain the overall attributes of air conditioning in food industries.
- To summarize the food freezing concept and equipment involved.
- To illustrate the cold chain management in small- and large-scale refrigerators.

COURSE OUTCOMES:

Upon completion of the course, students will be able to:

- Explain refrigeration of food and its operational components.
- Illustrate food refrigeration in plants, stores and logistics.
- Apply food freezing concepts and techniques.
- Summarize the food safety aspects of chilled foods and frozen foods.
- Interpret the cold chain management system in the food distribution sector.

UNIT I - PRINCIPLES OF REFRIGERATION

Refrigeration – Ton of refrigeration, refrigeration cycles, Vapour Compression and Vapour Absorption cycles, Refrigerants, characteristics of different refrigerants, net refrigerating effect - Components of a Refrigeration system: Compressor, condenser, Evaporator, Expansion valves piping and different controls.

UNIT II - COLD STORAGE

Insulation, properties of insulating materials, air diffusion equipment, Cold load estimation; prefabricated systems, walk-in-coolers, and Refrigerated container trucks: Freezer Storages, Freezer room Temperatures, Cooling towers: introduction, Construction and Working; Cold Storage practice, Stacking and handling of materials, Optimum temperatures of storage for different food materials.

UNIT III - AIR-CONDITIONING

Psychrometry, Psychrometric Processes, Simple Air Conditioning System –State and Mass Rate of Air. Evaporative, winter and All Year Air Conditioning Systems. Design Conditions. Load Calculation and Psychrometry of Air Conditioning Systems –Design of Air conditioning apparatus – Transmission and Distribution of Air. Selection of Air

2023 - 2024 Semester-V

Marks: Internal:40 External:60 Total:100

End Semester Exam: 3 Hours

3H-3C

9

Karpagam Academy of Higher Education (Deemed to be University), Coimbatore

Conditioning System.

UNIT IV - FREEZING AND CHILLING OF FOODS

Freezing equipment, Freezing time, Freezing curve, Freezing rates, growth rate of ice crystals, crystal size and its effect of texture and quality of foods, Freezer types, Individual quick freezing. Cryogenic Freezing, Freezing practice as applied to different food sectors. Chilling equipment for liquid foods. Secondary refrigerants, Evaporative cooling and direct expansion techniques in chilling. Chilled food transport and retail cabinets - Basics of Chilled food microbiology, Packaging of Chilled foods.

UNIT V - COLD CHAIN MANAGEMENT

Supply chain system - Important Factors to consider- logistic supply- Protocols for Domestic, Sea and Air freight- Traceability and barcode – Product Temperature and Moisture monitoring- Refrigeration systems and Refrigerant types during field chilling, transportation via land, air and sea. Grocery stores and display cases, Home refrigerators - Cooling chain summary – Storage and packaging.

TEXT BOOKS:

- Clive. V. J Dellino. Cold and Chilled Storage Technology. Chapman Hall India. 2nd Edition, 2012.
- 2. C.P. Arora. Refrigeration and Air conditioning. Tata McGraw Hill, 3rd Edition, 2008.
- 3. Da-Wen Sun. Handbook of Frozen Food Processing and Packaging. CRC Press 2ndEdition, 2011.

REFERENCE BOOKS:

- 1. Florkowski W.J, Shewfelt R.L, Brueckner B and Prussia S.E. Post Harvest Handling and System Approach. Academic Press, 3rd Edition, 2014.
- 2. Colin Dennis and Michael Stringer. Chilled Foods A Comprehensive Guide Brown. M Wood Head Publishing, 3rd Edition, 2008.

WEB LINKS:

- 1. <u>https://www.csiro.au/en/research/production/food/refrigerating-foods</u>
- 2. https://coldchainmanagement.org/2021/07/15/seamless-solutions-for-cold-storage/

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|------------|-----|-----|-----|-----|-----|-----|------------|------------|------------|------|------|------|------|------|
| CO1 | 2 | 2 | - | - | - | - | - | - | - | - | - | 1 | 2 | 1 |
| CO2 | 2 | 2 | - | - | - | - | - | - | - | - | - | 1 | 2 | 1 |
| CO3 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 2 | 1 |
| CO4 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | 1 |
| CO5 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | 1 |
| Average | 2.2 | 1.6 | 1 | - | - | - | - | - | - | - | - | 1 | 2 | 1 |

CO-PO Mapping

9

9

TOTAL:45

23BTFT502

Instruction Hours/week: L:3 T:0 P:0

End Semester Exam:3 Hour

Marks: Internal:40 External:60-Total:100

COURSE OBJECTIVES:

The goal of this course is for students:

- To outline the concepts of physicochemical and functional properties of milk constituents.
- To demonstrate the construction and working of dairy processing equipment.
- To summarize the process involved in packaging and storage of milk.
- To explain the production of milk and milk-based products.
- To recall the working principle and construction of equipment like spray drier, drum drier.

COURSE OUTCOMES:

Upon completion of the course, students will be able to:

- Infer the physical, chemical and functional properties of milk.
- Interpret the dairy processing equipment for specific applications.
- Apply the processes involved in packaging and storage of milk.
- Summarize the various types of fermented milk products.
- Classify the different types of dehydrated milk products

UNIT I - DAIRY CHEMISTRY AND MICROBIOLOGY

Introduction - Basic dairy terminology - milk as raw material – composition - nutritive value - Physico-chemical constituents of milk and its constituents – contaminants - microbiology of milk- milk collection - cooling and milk transport – milk reception - Quality control tests application of enzymes in the dairy industry.

UNIT II - DAIRY PROCESSING AND EQUIPMENT'S

Milk processing equipment – filtration/clarification – Pasteurization – HTST –LTLT -UHT methods - storage tanks - Cream separating Centrifuges – Homogenization- theory - working principle of homogenizers – homogenization efficiency - cream separation – principles – gravity and centrifugal separation – centrifugal separator – partsconstruction and working principle – separation efficiency.

UNIT III - BOTTLE, CAN WASHING AND FILLING EQUIPMENT'S 9

Plant piping – Pumps - Bottle washers- and cappers- can washers-types of can washerscare and maintenance-factors affecting washing operation – Fillers - types of fillers-pouch filling form fill seal machines - aseptic filling - cleaning and sanitization - CIP cleaningtypes of CIP systems – Energy use in Dairy plant - sources of energy - cost of energy -

85

2023 - 2024

Semester-V 3H-3C

9

DAIRY TECHNOLOGY

Karpagam Academy of Higher Education (Deemed to be University), Coimbatore

Control of energy losses and Energy conservation.

UNIT IV - MILK PRODUCT PROCESSING

Butter – method of manufacture – theory of churning - operation of butter churn – over run— batch and continuous methods of butter making. Ghee – methods of manufacture-Cheese – classification – cheddar and cottage cheese - equipment's – cheese vats and press – construction details. Ice cream - ingredients – preparation of ice cream mix - freezing – calculation of freezing point and refrigeration - batch and continuous freezers – Special milks - Quality aspects of dairy products.

UNIT V - FERMENTED AND DEHYDRATED DAIRY PRODUCTS

Fermented products – Yoghurt – Curd – cultured butter milk Bulgarian buttermilk – Kefir – paneer - acidophilus milk etc. - Concept of Probiotics and prebiotic foods-Vacuum Evaporators - drying of milk - drum drier and spray drier - components - construction and working principles.

TEXT BOOKS:

- 1. Tomar S. An Introduction to Dairy Technology. Pragun Publication, 2012.
- 2. NIIR Board. Modern Technology of Milk Processing and Dairy Products. NIIR ProjectConsultancy Services, 4th Edition, 2013.
- 3. Tufail Ahmad. Dairy Plant Engineering and Management. Kitab Mahal Publishers. NewDelhi, 2016.
- 4. Sukumar De. Outlines of Dairy Technology. Oxford University Press. New Delhi. 23rdimpression, 2006.

REFERENCE BOOKS:

- 1. Walstra P, Wouters JTM, Geuris TJ. DairyTechnology. Taylor& Francis, 2005.
- 2. Frazier WC and Westhoff DC. Food Microbiology. McGraw Hill. 11th reprint, 2017.

WEB LINKS:

- 1. <u>https://www.dairyknowledge.in/dkp/link/30</u>
- 2. <u>http://ecoursesonline.iasri.res.in/mod/page/view.php?id=3131</u>

CO PO Mapping

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|-----|-----|-----|-----|-----|-----|------------|-----|-----|------|------|------|------|------|
| CO1 | 2 | 1 | - | - | - | - | 1 | - | - | - | 1 | 1 | 3 | 2 |
| CO2 | 2 | 1 | - | - | - | - | 1 | - | - | - | 1 | 1 | 3 | 2 |
| CO3 | 3 | 2 | 1 | - | - | - | 1 | - | - | - | 1 | 1 | 3 | 2 |
| CO4 | 2 | 1 | - | - | - | - | 1 | - | - | - | 1 | 1 | 3 | 2 |
| CO5 | 2 | 1 | - | - | - | - | 1 | - | - | - | 1 | 1 | 3 | 2 |
| Average | 2.2 | 1.2 | 1 | - | - | - | 1 | - | - | - | 1 | 1 | 3 | 2 |

TOTAL:45

2023 - 2024

Semester-V

9

9

5H-4C

23BTFT541

FOOD ANALYSIS (Theory & Laboratory)

Instruction Hours/week: L:3 T:0 P:2

Marks: Internal:40 External:60 Total:100 End Semester Exam: 3 Hours

(i) Theory

COURSE OBJECTIVES:

The goal of this course is for students:

- To illustrate the sampling and proximate analysis of food substances.
- To infer the physical, chemical, quality standards and adulterants of lipids, protein and carbohydrate.
- To make use of different spectroscopic techniques for food analysis.
- To explain the various chromatographic methods employed in analysis of foods.
- To outline the techniques on electrophoresis, refractometry, polarimetry and biosensors.

COURSE OUTCOMES:

Upon completion of the course, students will be able to:

- Illustrate the proximate composition of the given food sample.
- Experiment with the physical, chemical and quality standards of lipids, proteins and carbohydrates.
- Summarize the composition of foods using spectroscopic methods.
- Identify the food materials using chromatographic techniques.
- Demonstrate the tests on food substances using the principles of electrophoresis, refractometry, polarimetry and biosensors.

UNIT I - SAMPLING AND PROXIMATE ANALYSIS

Sampling methods - Sample preparation for analysis; Statistical evaluation of analytical data - Official Methods of Food Analysis. Moisture in foods - determination by different methods - ash content of foods, wet, dry ashing, microwave ashing methods; Significance of Sulphated Ash, water soluble ash and acid insoluble ash in foods; titratable Acidity in foods, determination of dietary fiber and crude fiber.

UNIT II - LIPIDS, PROTEIN AND CARBOHYDRATE ANALYSIS

Determination of Total fat in foods by different methods; Analysis of oils and fats for physical and chemical parameters, Quality standards, and adulterants; different methods of determination of protein and amino acids in foods; determination of total carbohydrates, starch, disaccharides and simple sugars in foods.

UNIT III – SPECTROSCOPIC TECHNIQUES

Basic Principles – Spectrophotometric analysis of food additives and food components -IR Spectroscopy in online determination of components in foods; AAS and ICP-AES in mineral element sand toxic metals analysis; use of fluorimeter in vitamin assay- specific use of Tintometer in vanaspathi analysis.

UNIT IV - CHROMATOGRAPHIC TECHNIQUES

Basic Principles, detection of adulterants in foods by paper chromatography and thin layer chromatography, column chromatography for purification analysis; analysis of food additives, sugars, phytochemicals and aflatoxins, contaminants and other food components by HPLC, GC analysis of fatty acids, cis, trans Isomers - volatile oils, flavours and pesticides, contaminants and other volatile derivatives of food components; Significance MS detector in HPLC and GC.

UNIT V - ELECTROPHORESIS, REFRACTOMETRY AND POLARIMETRY 9

Basic Principles, application of electrophoresis in food analysis, refractive indices of oils and fats, total soluble solids in fruit juice and honey, specific rotation of sugars, estimation of simple sugars and disaccharides by polarimeter; Immunoassay techniques and its applications in foods. Introduction to sensors and Instrumentation of sensors - biosensors - electronic nose and electronic tongue.

TOTAL:45

TEXT BOOKS:

- 1. Nielson, S. Suzanne. Food Analysis. Springer, 5th Edition, 2017.
- 2. Wood R, Foster L, Damant A and Key Pauline. Analytical Methods for Food Additives. CRC Wood head Publishing 2004.
- 3. Pomeranz, Yeshajahu and Clifton E. Meloan "Food Analysis: Theory and Practice", 3rdEdition, Springer, 2004.
- 4. Nollet, Leo M.L. "Handbook of Food Analysis" 2nd Edition, Vol. 1-3. Marcel Dekker, 2004.

REFERENCE BOOKS:

- 1. Hurst, Jeffrey W. "Methods of Analysis for Functional Foods and Nutraceuticals" 2nd Edition, CRC Press, 2008.
- 2. Bhalla, N., Jolly, P., Formiasano, N. Estrela, P. Introduction to biosensors, Essays in Biochemistry. 2016.

WEB LINKS:

- $1. \quad \underline{https://ncert.nic.in/pdf/publication/sciencelaboratorymanuals/classXII/chemistry/lel}{m111.pdf}$
- 2. <u>https://www.vedantu.com/physics/spectroscopy</u>

(ii) Laboratory:

List of Experiments:

- 1. Estimation of iodine value in lipids.
- 2. Estimation of saponification value in lipids.
- 3. Estimation of reducing sugars by Lane and Eynon's method.
- 4. Estimation of Iodine content in iodized salt.
- 5. Estimation of total extractives in tea.
- 6. Determine the swelling ratio and extract release.
- 7. Estimation of fat in milk by Gerber's method.
- 8. Estimation of curcumin in turmeric.
- 9. Estimation of gingerol in ginger.
- 10. Rapid detection of food adulterants.
- 11. Demonstration of nitrogen estimation by Kjeldhal method.

TOTAL:30

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|-----|-----|-----|-----|-----|-----|------------|-----|-----|------|------|------|------|------|
| CO1 | 2 | 1 | - | - | - | - | - | - | 1 | - | 1 | 1 | 3 | 2 |
| CO2 | 3 | 2 | 1 | - | - | - | - | - | 1 | - | 1 | 1 | 3 | 2 |
| CO3 | 2 | 1 | - | - | - | - | - | - | 1 | - | 1 | 1 | 3 | 2 |
| CO4 | 3 | 2 | 1 | - | - | - | - | - | 1 | - | 1 | 1 | 3 | 2 |
| CO5 | 2 | 1 | - | - | - | - | - | - | 1 | - | 1 | 1 | 3 | 2 |
| Average | 2.4 | 1.4 | 1 | - | - | - | - | - | 1 | - | 1 | 1 | 3 | 2 |

CO-PO Mapping

FRUITS AND VEGETABLES PROCESSING **5H-4C** 23BTFT542 **TECHNOLOGY** (Theory & Laboratory)

Instruction Hours/week: L:3 T:0 P:2

Marks: Internal:40 External:60 Total:100 End Semester Exam: 3 Hours

(i) Theory

COURSE OBJECTIVES:

The goal of this course is for students:

- To summarize the processing of fruits and vegetables by chemical methods. •
- To make use of drying and dehydration for preservation of fruits and vegetables. •
- To explain the various unit operations and fermented processes involved in fruits • and vegetables.
- To illustrate the canning and bottling operations in fruits and vegetables.
- To explain the set of parameters influencing the aseptic processing of fruit juices.

COURSE OUTCOMES:

Upon completion of the course, students will be able to:

- Identify the nutritionally important fruits and vegetables and understand its maturity indices and its processing methods.
- Demonstrate the manufacture, preservation and packaging of jam, jelly, marmalade, pickles and preserves.
- Experiment with different types of driers involved in the production of dehydrated fruit products.
- Illustrate the minimal processing and fermentation methods of fruits and vegetables.
- Show the canning and bottling operations of fruits and vegetables.

UNIT I – PROCESSING BY CHEMICAL METHOD

Importance and scope of fruit and vegetables preservation. Nutritive value, nutraceutical properties - Harvesting of fruits and vegetables - Maturity indices. Methods of fruit and vegetable preservation - Processing using sugar - Preparation of jam, jelly, marmalade, squash, RTS, crush, nectar, cordial, fruit bar, preserves, candies and carbonated fruit beverages. Processing using salt – Brining - Preparation of pickles, chutney and sauces, ketchup. Machineries involved in processing of fruits and vegetables products.

UNIT II - PRESERVATION BY DRYING AND DEHYDRATION

Drying and dehydration -Types of driers - Solar, cabinet, fluidized bed drier, spouted bed drier, heat pump drier, vacuum drier and freeze drier. Preparation of product. Changes

9

2023 - 2024

Semester-V

during drying and dehydration. Problems related to storage of dried and dehydrated products.

UNIT III - MINIMAL PROCESSING AND FERMENTATION

Primary processing and pack house handling of fruits and vegetables; Peeling, slicing, cubing, cutting and other size reduction operations for fruits and vegetables, Minimal Processing of Fruits and Vegetables. Preservation by fermentation - wine, vinegar, cider and sauerkraut.

UNIT IV- CANNING AND BOTTLING

Canning - principles, types of cans- preparation of canned products - packing of canned products - spoilage of canned foods. Bottling of fruit and vegetable. Fruit Pulper: Design and working principle. Precautions in canning operations. General considerations in establishing a commercial fruit and vegetable cannery, machineries involved in canning and bottling unit.

UNIT V - ASEPTIC PROCESSING

Aseptic processing and Bulk packing of Fruit juice concentrates. Aseptic heat exchangers for sterilizing and concentrating the product. Aseptic fillers. Tetra pack for small quantities, Dole system and Scholle system for bulk storage in Bag and Boxes andBag & Drums. Storage of Aseptically packed products.

TOTAL:45

9

9

9

TEXT BOOKS:

- Hui Y. H. Hand Book of Vegetable Preservation and Processing. Mercel Dekker, New York,2nd Edition, 2015.
- 2. Chakraverty, A., Mujumdar A.S., Raghavan G.S.V and Ramaswamy H.S. Handbook of Post-harvest Technology. Marcel Dekker Press, USA, 2003.
- 3. L. R. Verma and V. K. Joshi. Post-Harvest Technology of fruits and vegetables. IndusPublishing Co, New Delhi, 2000.
- 4. P. Fellows. Food processing Technology: Principles and Practice". Wood Head publishingLimited, Cambridge, England, 4th Edition, 2016.

REFERENCE BOOKS:

- 1. James G. Brennan. Food Processing Hand book. Wiley-Ych Verlag Gmbh & Co KgaA, Weinheim, Germany, 2006.
- 2. R.P. Srivastava and Sanjeev Kumar. Fruit and Vegetable Preservation: Principles and Practices, 3rd Ed. International Book Distribution Co., Delhi. 2002.

WEB LINKS:

- $1. \ \underline{http://ecoursesonline.iasri.res.in/mod/page/view.php?id{=}19472$
- 2. <u>https://ebooks.inflibnet.ac.in/ftp1/chapter/general-principles-of-canning-and-bottling-of-foods/</u>

(iii) Laboratory:

List of Experiments:

- 1. Preparation of RTS beverage.
- 2. Preparation of squash/cordial.
- 3. Preparation of jam mixed and individual fruits.
- 4. Preparation of jelly/marmalades/ nectar.
- 5. Preparation of ketchup and tomato sauce.
- 6. Preparation of pickles.
- 7. Preparation of sauerkraut.
- 8. Preparation fruits-based wine.
- 9. Osmotic concentration/dehydration of fruits and vegetables.
- 10. Basic physicochemical and sensory analysis for food samples.

TOTAL:30

| ~ ~ | | | F8 | | | | | | | | | | D 221 | - |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|--------------|------|
| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 2 | 1 | - | - | - | - | - | 1 | - | 1 | 1 | 3 | 2 |
| CO2 | 2 | 1 | - | - | - | - | - | - | 1 | - | 1 | 1 | 3 | 2 |
| CO3 | 3 | 2 | 1 | - | - | - | - | - | 1 | - | 1 | 1 | 3 | 2 |
| CO4 | 2 | 1 | - | - | - | - | - | - | 1 | - | 1 | 1 | 3 | 2 |
| CO5 | 2 | 1 | - | - | - | - | - | - | 1 | - | 1 | 1 | 3 | 2 |
| Average | 2.4 | 1.4 | 1 | - | - | - | - | - | 1 | - | 1 | 1 | 3 | 2 |

CO-PO Mapping

| B. Tech Food Technology | | | 2023 - 2024 |
|--------------------------------|----------------------|-------------------|---------------------|
| 23BTFT591 | FIELD PROJECTS/ INTE | RNSHIP | Semester-V 0H-1C |
| Instruction Hours/week | : L:0 T:0 P:0 | Marks: Internal:1 | 00 Total:100 |

The students will be directed to do an internship in their domain industry for 3 weeks. Their internship work will be evaluated internal examiner End Semester Examination evaluation will be based on the report submitted by the student after the completion of their internship report.

23BTMC551

CYBER SECURITY

Marks: Internal:100 Total:100

COURSE OBJECTIVES:

Instruction Hours/week: L:1 T:0 P:0

The goal of this course is for students:

- To understand the field of digital security and concepts of access control mechanism.
- To introduce keywords and jargons involved in securing browser
- To understand network basic and familiarize on security of network protocols
- To understand cyber-attacks and data privacy
- To learn the tools and methods used in cyber security

COURSE OUTCOMES:

Upon completion of the course, students will be able to:

- Infer the importance of a network basics and brief introduction on security of network protocols
- Apply a solid foundation in digital security and measures taken to protect device from threats.
- Discuss about cyber-attacks and data privacy issues and preventive measures.
- Make use of tools and methods used in cyber security.
- Explain Cyber security organizational implications.

UNIT I NETWORKING BASICS

Networking basics (home network and large-scale business networks), Networking protocols, Security of protocols, sample application hosted on-premises.

UNIT II BASICS OF DIGITAL SECURITY

Basics of digital security, protecting personal computers and devices, protecting devices from Virus and Malware, Identity, Authentication and Authorization, need for strong credentials, keeping credentials secure, protecting servers using physical and logical security, World Wide Web (www), the Internet and the HTTP protocol, security of browser to web server interaction

UNIT III INTRODUCTION TO CYBER-ATTACKS

Introduction to cyber-attacks, application security (design, development and testing), operations security, monitoring, identifying threats and remediating them, Principles of data

9

2023-2024

1H-0C

SEMESTER-V

security - Confidentiality, Integrity and Availability, Data Privacy, Data breaches, preventing attacks and breaches with security controls, Compliance standards, Computer Ethics.

UNIT IV TOOLS AND METHODS

Tools and methods used in cyber security: Proxy servers and anonymizers – Phishing – Password cracking – Keyloggers and spywares – Virus and worms – Trojan horse – Stegnography – DoS and DDoS attack – SQL Injection – Buffer overflow – Attacks on wireless networks – Phishing and Identity theft.

UNIT VCYBER SECURITY ORGANIZATIONAL IMPLICATIONS9

Cyber security organizational implications: Cost of cybercrimes and IPR – Web threads for organizations – Security and privacy implications – Social media marketing – Incident handling – Forensics best practices for organization.

TEXT BOOKS:

- 1. Sammons, John, and Michael Cross. The basics of cyber safety: computer and mobile device safety made easy. Elsevier, 2016.
- 2. Nina Godbole and Sunit Belapure, Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley Publisher, First Edition, 2011

REFERENCES BOOKS:

- 1. Charles P. Pfleeger, Shari Lawrence, Pfleeger Jonathan Margulies; Security in Computing, Pearson Education Inc. 5th Edition, 2015
- 2. Brooks, Charles J., Christopher Grow, Philip Craig, and Donald Short. Cyber security essentials. John Wiley & Sons, 2018
- 3. Harish Chander, Cyber Laws and IT Protection, PHI Learning, First Edition, 2012
- 4. James Graham, Ryan Olson and Rick Howard, Cyber Security Essentials, CRC Press, First Edition, CRC Press, First Edition

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|-----|-----|-----|------------|-----|------------|------------|------------|-----|-------------|------|------|------|------|
| CO1 | 3 | 3 | 2 | 2 | - | 2 | - | - | - | - | - | - | - | 1 |
| CO2 | 3 | 2 | 2 | 2 | - | 2 | - | - | - | - | - | - | - | 1 |
| CO3 | 3 | 3 | 2 | 2 | - | 2 | - | - | - | - | - | - | - | 1 |
| CO4 | 3 | 3 | 2 | 2 | - | 2 | - | - | - | - | - | - | - | 1 |
| CO5 | 3 | 2 | 2 | 2 | - | 2 | - | - | - | - | - | - | - | 1 |
| Average | 3 | 2.6 | 2 | 2 | - | 2 | - | - | - | - | - | - | - | 1 |

CO PO MAPPING

| B. Tech Food Technology | | | 2023 - 2024 |
|---------------------------|-------------|---|-------------------------------------|
| 23BTFT601 | FOOD SAFETY | REGULATIONS | Semester-VI 3H-3C |
| Instruction Hours/week: L | :3 T:0 P:0 | Marks: Internal:40 Exter End Semeste | rnal:60 Total:100 r Exam:3 Hours |

COURSE OBJECTIVES:

The goal of this course is for students:

- To identify the food safety and hygiene during food processing.
- To summarize the functions, responsibilities and concepts of various food • regulatory bodies.
- To summarize the overall functions and responsibilities of food authority of India.
- To infer the need, limitations and standards for labelling of various food products.
- To illustrate the importance and implementation of HACCP in food industries. •

COURSE OUTCOMES:

Upon completion of the course, students will be able to:

- Interpret the food hazards, physical, chemical and biological in the food industry.
- Summarize the functions, responsibilities and concepts of various food regulatory • bodies.
- Explain the overall functions and responsibilities of food authority of India.
- Apply the overall requirements needed for labeling of various food products. •
- Illustrate and implement the HACCP system in the food industries. •

UNIT I – FOOD SAFETY

Introduction to food safety and security: Hygienic design of food plants and equipments, Food Contaminants (Microbial, Chemical, Physical), Food Adulteration (Common adulterants), Food Additives (functional role, safety issues), Food Packaging & labeling. Sanitation in warehousing, storage, shipping, receiving, containers and packaging materials. Control of rats, rodents, mice, birds, insects and microbes. Cleaning and Disinfection.

UNIT II – GLOBAL REGULATIONS

Food and Agriculture Organization - FAO in India, Technical Cooperation programmes, Biosecurity in Food and Agriculture, World Health Organization (WHO), World Animal Health Organization (OIE), International Plant Protection Convention (IPPC) - Codex Alimentarius Commission - Codex India - Role of Codex Contact point, National Codex contact point (NCCP), National Codex Committee of India - ISO 22000 – Importance and Implementation.

UNIT III - FOOD AUTHORITY IN INDIA

Food safety and Standards Act - organizational chart - role of individual authority -

9

Karpagam Academy of Higher Education (Deemed to be University), Coimbatore

97

principles to be followed -Provisions as to articles of food -imported items -Licensing and registration of food business - Food safety officer and their powers - Analysis of food regulations regarding labs involved in food analysis – Laws relating to Food Processing Industries in India - FPO, MMPO, PFA, AGMARK, Essential Commodities Act, BIS.

UNIT IV - FOOD LABELLING

Need for labeling – Developing labeling standards at the world level – Limitations of labeling safety issues - Labeling regarding methods of processing - Irradiated Products-Products derived from modern biotechnology - organic produce -Genetically modified foods - EU rules on nutritional labeling – US rules on nutritional labelling – Health claims – Approach of US and EU.

UNIT V – HACCP

Concept of HACCP – PRPs - Assembling the team – Product description – Describing the product's intended use - Establishing a process flow diagram - on site confirmation - Listing potential hazards and control measures - Determination of critical points - decision tree for CCP - Establishing monitoring procedures- establishing corrective actions establishing verification.

TOTAL:45

TEXT BOOKS:

- Kees A. van der Heijden and Sanford Miller. International Food Safety Handbook 1. Science,1999.
- 2. Mehta R. and George J. Food Safety Regulation Concerns and Trade- The Developing Country Perspective. Published by Macmillan India Ltd., New Delhi, 2005.
- Fortin ND. Food Regulation. Wiley, 2nd Edition, 2016. 3.
- Mariott NG, Schilling MW and Gravani RB. Principles of Food Sanitation. Springer, 4. 6thEdition. 2018.

REFRENCAE BOOKS:

- 1. Government of India. Guide to the Food Safety and Standards Act. Tax-mann Allied ServicesPvt. Ltd. 2006.
- 2. Shaw IC. Food Safety: The science of keeping food safe. Wiley-Blackwell Publishing. 2ndEdition. 2018.
- 3. Barach JT. FSMS and Food Safety Systems: Understanding and implementing the rules.Wiley, Ist Edition, 2017.

WEB LINK:

- 1. fao.org/food-safety/food-control-systems/policy-and-legal-frameworks/food-laws-andregulations/en/
- 2. https://ssrana.in/corporate-laws/food-laws/

9

CO PO Mapping

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|------------|-----|-----|-----|-----|------------|------------|------------|------------|------|------|------|------|------|
| CO1 | 2 | 1 | - | - | - | - | - | 1 | - | - | - | 1 | 3 | 2 |
| CO2 | 2 | 1 | - | - | - | - | - | 1 | - | - | - | 1 | 3 | 2 |
| CO3 | 2 | 1 | - | - | - | - | - | 1 | - | - | - | 1 | 3 | 2 |
| CO4 | 3 | 2 | 1 | - | - | - | - | 1 | - | - | - | 1 | 3 | 2 |
| CO5 | 2 | 1 | - | - | - | - | - | 1 | - | - | - | 1 | 3 | 2 |
| Average | 2.2 | 1.2 | 1 | - | - | - | - | 1 | - | - | - | 1 | 3 | 2 |

Karpagam Academy of Higher Education (Deemed to be University), Coimbatore

FOOD ADDITIVES

2023 - 2024 Semester-VI

Semester-VI 5H-4C

(Theory & Laboratory)

Instruction Hours/week: L:3 T:0 P:2

Marks: Internal:40 External:60 Total:100 End Semester Exam:3 Hours

(i) Theory

COURSE OBJECTIVES:

The goal of this course is for students:

- To explain the basic concepts of food additives.
- To classify the types, chemical properties, levels of addition and toxicity of acidulants.
- To explain the types, chemical properties, levels of addition and toxicity of humectants.
- To outline the types, chemical properties, levels of addition and toxicity of fat substitutes and replacers.
- To summarize the types, chemical properties, levels of addition and toxicity of sweeteners, chelating agents, anti-browning agents and nutritional additives.

COURSE OUTCOMES:

Upon completion of the course, students will be able to:

- Illustrate the classification, safety levels and toxicity of food additives.
- Interpret the properties, levels of addition and toxicity data of various food additives.
- Demonstrate the importance of additives in maintaining or improving food quality.
- Identify the various instant premixes by addition of preservatives within the permissible limits.
- Explain the principles of food additives to study the toxicity, identify and design newer products, with better quality using additives which are economical and safe.

UNIT I – INTRODUCTION

Definition, role of food additives, classification of food additives based on their role, dual role of certain additives, INS numbering system of food additives, safety requirements of food additives, Acceptable daily intake of food additives, JECFA and Food Chemical Codex standards for food additives, status of food additives with respect to Indian laws, GMP and permissible upper levels of food additives under Indian food laws.

UNIT II - ACIDITY REGULATORS AND PRESERVATIVES

Acidity Regulators – definition, chemical structure, role and importance, pH modulation and taste, acidity profile, permitted acidity regulators, levels of usage and food applications. Preservatives of chemical and microbial origin; mode of action on spoilage organisms and pathogens, factors affecting the performance of preservatives, active forms of preservatives, necessity in a food and levels of usage; permitted preservatives and food applications. Case studies / illustrations.

UNIT III - EMULSIFIERS, STABILIZERS AND THICKENERS

Emulsion, surface tension, oil in water and water in oil emulsion, Hydrophilic and Lipophilic balance (HLB), role of emulsifiers, different classes of emulsifiers and their

9

9

Q

chemical structure, their HLB values and role in emulsion stabilization; role of different stabilizers and other substances in emulsion stability; emulsion formation process and equipment; measurement of emulsion stability; permitted emulsifiers and stabilizers and food applications. Thickeners – definition, chemical structure, role in food processing and product end characteristics, list of permitted thickeners and food applications.

UNIT IV - ANTIOXIDANTS AND ANTI-CAKING AGENTS

Antioxidants - Chemistry of oxidative deterioration of food and its constituents and its effect on the quality; defining antioxidant; water soluble and oil soluble antioxidants and their chemical structure, permitted antioxidants; mechanism of action, permitted levels and food application. Anti-foaming and propellants, Anti-caking agents – definition, role in preventing spoilage, mode of action, permitted list of anti-caking agents and food application.

UNIT V - COLOR AND ARTIFICIAL SWEETENERS

Color – Natural and synthetic food colors, their chemical structure, shades imparted, stability, permitted list of colors, usage levels and food application. Artificial Sweeteners – list, structure, taste profile, permitted list, usage levels and food applications.

TOTAL:45

9

9

TEXT BOOKS:

- 1. Mahindru, S. N. "Food Additives- Characteristics Detection and Estimation", TATA McGraw Hill, 2000.
- 2. Wilson, R. "Ingredient Handbook Sweeteners", Blackwell, 2007.
- 3. Emerton, V. "Food Colors", Blackwell, 2008

REFERNCE BOOKS:

- 1. Peter A Williams and Glyn O Philips, "Gums and stabilizers for the Food Industry", RSC, 2006.
- 2. Branen, A. L. "Food Additives" 2nd Edition, CRC press, 2002.

WEB LINK:

- 1. https://www.who.int/news-room/fact-sheets/detail/food-additives
- 2. <u>https://www.britannica.com/topic/food-additive</u>

ii) Laboratory:

List of Experiments

- 1. Estimation of Sulphur-Di-Oxide.
- 2. Estimation of Sodium Benzoate.
- 3. Estimation of Sorbic Acid.
- 4. Estimation of Butylated hydroxyl toluene.
- 5. Estimation of Propyl Gallate.
- 6. Determination of Saccharin.
- 7. Estimation of capsaicin.
- 8. Estimation of salt in pickled products.
- 9. Identification of adulterants in solid foods.
- 10. Identification of adulterants in liquid foods.

TOTAL:30

| | | 0 ուսլ | 'Pmg | | | | | | | | | | | |
|---------|-----|--------|------|-----|-----|-----|------------|------------|-----|------|------|------|------|------|
| CO No | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 2 | 1 | - | - | - | - | - | - | 1 | - | 1 | 1 | 3 | 2 |
| CO2 | 2 | 1 | - | - | - | - | - | - | 1 | - | 1 | 1 | 3 | 2 |
| CO3 | 2 | 1 | - | - | - | - | - | - | 1 | - | 1 | 1 | 3 | 2 |
| CO4 | 3 | 2 | 1 | - | - | - | - | - | 1 | - | 1 | 1 | 3 | 2 |
| CO5 | 2 | 1 | - | - | - | - | - | - | 1 | - | 1 | 1 | 3 | 2 |
| Average | 2.2 | 1.2 | 1 | - | - | - | - | - | 1 | - | 1 | 1 | 3 | 2 |

CO PO Mapping

23BTFT642

BAKERY AND CONFECTIONARY TECHNOLOGY

(Theory & Laboratory)

Instruction Hours/week: L:3 T:0 P:2

Marks: Internal:40 External:60Total:100 End Semester Exam: 3 Hours

(i) Theory

COURSE OBJECTIVES:

The goal of this course is for students:

- To summarize the principles of baking on bread and cake.
- To explain the baking skills in the production of biscuits and cookies.
- To outline the various types of sugar and flour based confectionary products.
- To interpret the working of equipment used in baking processes.
- To outline the packaging materials and quality control systems applied in food industry.

COURSE OUTCOMES:

Upon completion of the course, students will be able to:

- Identify the different types of breads, cakes, biscuits and cookies.
- Summarize the preparation of biscuits and cookies. the various types of confectionary • products.
- Explain the different types of confectionary products and their importance.
- Illustrate the different types of machineries for baking.
- Classify the appropriate packaging materials and audit quality standards required for baking and confectionary.

UNIT I BAKING PRINCIPLES, BREAD AND CAKE

Types of wheat, Dough rheology, baking principles - Role of ingredients and its chemistry. Bread-Ingredients, additives - Varieties of bread. Methods of bread preparation - bread spoilage and remedies. Advantages and disadvantages of various methods of bread-making. cake- types of cakes - role of ingredients-essential and optional ingredients - cake mixing methods - Preparation. Fancy cakes and preparation-Bread, cake- faults and remedies.

UNIT II BISCUIT AND COOKIES

Biscuits and cookies - role of ingredients. Types of biscuit dough – Developed dough, soft dough, semi-sweet and enzyme modified dough - consistency of the dough and its importance. Production of biscuits and cookies. Selection and preparation of mould. Cookies classification - Quality control for biscuits and cookies. Faults and causes

Semester-VI **5H-4C**

9

UNIT III CONFECTIONERY PRODUCTS

Introduction - importance of sugar confectionery and flour confectionery. Stages of Sugar Boiling-Ingredients used in confectionery. Role of chemical additives in confectionery. Cocoa products and its uses in confectionery. Types of confectionery products-chocolate boiled sweets, caramels toffees, fondants.

UNIT IV BAKERY EQUIPMENTS

Machineries for a bakery unit - Bulk handling of ingredients, Dough mixers, Dividers, rounding, sheeting, and laminating machines. Ovens and Slicers, Packaging materials and equipment. Mixing and forming characteristics of mixtures-measurements of mixing – particles mixing- rates of mixing, energy input in mixing, liquid mixing-power & Froude number-mixing equipment- liquid, powder and particles mixtures, dough and paste mixtures, emulsification and homogenization. Forming-Pie & biscuit formers- Bread and confectionery moulders.

UNIT V PACKAGING AND QUALITY CONTROL FOR BAKERY AND CONFECTIONERY PRODUCT

Packaging requirements and materials. Standards and regulations for bakery and confectionery products. Production standards and quality control - Good Manufacturing Practices (GMP) and other practices.

TOTAL: 45

9

TEXT BOOKS:

- 1. Amsterdam, Cakes and pastries, Time life books, 1985.
- 2. Baker's Handbook on Practical Baking, US Wheat Associates, New Delhi, 1994.
- 3. Bernard, W. Minifie, Chocolate, cocoa and confectionery: CBS Publishers and Distributors, New Delhi, 1997.
- 4. Manley, Duncan., Biscuit Doughs Manual 2, Woodhead Publishing Ltd., England, 1998.

REFERENCE BOOK:

1. Pomeranz. Y. Modern Cereal Science and Technology, MVCH Publications, New York, 1987.

2. Samuel A. Matz., Equipment for Bakers, Pan Tech International Publication, 1988. **WEB LINK:**

- 1. http://ecoursesonline.iasri.res.in/course/view.php?id=647
- 2. <u>https://www.nipabooks.com/info/9789394490512/bakery-confectionery-technology</u>

9

(ii) Laboratory:

List of Experiments

- 1. Study of ingredients (major and minor): characteristics of flour, yeast, shortening, sugar, egg and salts.
- 2. Experiment on leavening action of baking powder, sodium- bicarbonate and ammonium-bicarbonate.
- 3. Determination sedimentation value of flour
- 4. Estimation of water absorption power (atta, and maida)
- 5. Determination dough rising capacity of yeast
- 6. Preparation of cake
- 7. Preparation of biscuits-different types.
- 8. Preparation of bread-different types.
- 9. Preparation of toffees and chewing gum.
- 10. Preparation of sugar boiled confectionary.

TOTAL: 30

| | 00 | | <u>appins</u> | | | | | | | | | | | |
|---------|-----|-----|---------------|-----|-----|------------|------------|------------|-----|------|------|------|------|------|
| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 2 | 1 | - | - | - | - | - | 1 | - | 1 | 1 | 3 | 2 |
| CO2 | 2 | 1 | - | - | - | - | - | - | 1 | - | 1 | 1 | 3 | 2 |
| CO3 | 2 | 1 | - | - | - | - | - | - | 1 | - | 1 | 1 | 3 | 2 |
| CO4 | 2 | 1 | - | - | - | - | - | - | 1 | - | 1 | 1 | 3 | 2 |
| CO5 | 2 | 1 | - | - | - | - | - | - | 1 | - | 1 | 1 | 3 | 2 |
| Average | 2.2 | 1.2 | 1 | - | - | - | - | - | 1 | - | 1 | 1 | 3 | 2 |

CO -PO Mapping

| B. Tech Food Technology | | | 2023 - 2024 |
|-----------------------------|-------------|-------------------|---|
| 23BTFT691 | MINI PROJEC | СТ | Semester-VI 2H-2C |
| Instruction Hours/week: L:0 | T:0 P:2 | Marks: I End S | nternal:100 Total:100 emester Exam:3 Hours |

The students will be directed to do a mini project in their domain field for 3 months. Their project work will be evaluated for forty percentages by internal examiner and sixty percentage by external examiner for End Semester Examination. End Semester Examination evaluation will be based on the report submitted by the student after the completion of their project report.

Semester-VII

| B. Tech. – Food | | 2023 - 2024 | | | |
|-----------------|----------------------|-----------------------|-----------------------|--|--|
| | | | Semester-VII | | |
| 23BTFT701 | PROFESSIONAL F | CTHICS AND IPR | 3H-3C | | |
| Instruction Hou | rs/week: L:3 T:0 P:0 | Marks: Internal:40 Ex | External:60 Total:100 | | |
| | | End Seme | ster Exam:3 Hours | | |

Course Objectives

The goal of this course is for students to,

- To summarize the importance of awareness in engineering ethics. •
- To infer the role of moral and social values and loyalty.
- To outline the needs of IPR in general & engineering.
- To illustrate the protection of research work and investment in R&D by IPR.
- To summarize the role of IPR in creation of new and better products.

Course Outcomes

Upon completion of this course, students will be able to,

- Explain the engineering ethics.
- Illustrate the Moral, Social Values and Loyalty.
- Outline that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
- Demonstrate that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property right to be promoted among students in general & engineering in particular.
- Infer that IPR protection provides an incentive to inventors for further research work ٠ and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

UNIT I ENGINEERING ETHICS

Senses of 'Engineering Ethics' – variety of moral issued – types of inquiry – moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy -Models of Professional Roles - theories about right action - Self-interest - customs and religion – use of ethical theories.

UNIT II FACTORS OF CHANGES

Forces that shape culture, social control – Meaning, Agencies, Institution, Customs, Values, Folkways, Norms and Laws. Social changes – Meaning and nature – Theories. 9

UNIT III- INTELLECTUAL PROPERTY

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT IV- PATENT RIGHTS

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

106

9

9

UNIT V- NEW DEVELOPMENTS IN IPR

Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

TOTAL: 45

TEXT BOOKS:

- 1. Sharma S. Entrepreneurship Development. PHI Learning Pvt. Ltd. 2016.
- 2. Charles E Harris and Michael J Rabins. Engineering Ethics Concepts and Cases. Wadsworth Thompson, Cengage Learning. New Delhi, 2013.
- 3. Whitebeck C. Ethics in Engineering research and Practice. Cambridge University Press, 2nd Edition, 2011.

REFERENCE BOOKS:

- 1. Halbert, "Resisting Intellectual Property", 2007. Taylor & Francis Ltd
- 2. Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", 2016.

WEBLINKS:

1. https://archive.nptel.ac.in/courses/110/105/110105139/

| | ~~ . | - man | P8 | | | | | | | | | | | |
|---------|------------|-------|-----|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|------|------|
| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 2 | 1 | - | - | - | - | - | 1 | - | - | - | 1 | 2 | 1 |
| CO2 | 2 | 1 | - | - | - | - | - | 1 | - | - | - | 1 | 2 | 1 |
| CO3 | 2 | 1 | - | - | - | - | - | 1 | - | - | - | 1 | 2 | 1 |
| CO4 | 2 | 1 | - | - | - | - | - | 1 | - | - | - | 1 | 2 | 1 |
| CO5 | 2 | 1 | - | - | - | - | - | 1 | - | - | - | 1 | 2 | 1 |
| Average | 2 | 1 | - | - | - | - | - | 1 | - | - | - | 1 | 2 | 1 |

CO-PO Mapping

23BTFT702

PROCESS ECONOMICS AND PLANT LAYOUT DESIGN

Instruction Hours/week: L:3 T:0 P:0

Marks: Internal:40 External:60 Total:100 End Semester Exam:3 Hours

Course Objectives

The goal of this course is for students to,

- To infer the different specifications and processes involved in the design and development of food processing plant.
- To explain the processes involved in layout design.
- To illustrate the projects and cost estimation of designing food plant.
- To outline the product cost and plant overheads.
- To summarize the profitability analysis in food processing industry.

Course Outcomes

Upon completion of this course, students will be able to,

- Construct the well-equipped food processing plant for effective processing along with the government regulations and specifications for plant layout.
- Explain the capital investments and methods of cost estimation of designing food plants.
- Summarize the overall production cost, profitability and factors involved in the costestimation of products manufactured.
- Illustrate the problems involved in deciding the level of manufacture of a food product.
- Interpret own industry or plan turn-key projects based on the request from customers.

UNIT I - FOOD PROCESS DESIGN DEVELOPMENT

Technical feasibility survey of Food Industry, process development, Food Process flow sheets - Hygienic food process design – CIP Systems- Working principles and operating procedures. Equipment design and specifications – Computed-aided process design – Principles of spread-sheet aided process design (Basic concepts only).

UNIT II - PLANT LAYOUT

Marketability of the product, availability of technology, raw materials, equipments, human resources, land and utilities, site characteristics, waste disposal, Government regulations and other legal restrictions, community factors and other factors affecting investment and production costs. Plant Layout based on process and product. Systematic plant layout, Richard Muther's Simple Systematic Plant Layout.

UNIT III - PROJECT EVALUATION AND COST ESTIMATION

Capital investments – fixed capital investments including land, building, equipments and utilities, installation costs (including equipments, instrumentation, piping, electrical installation and other utilities), working capital investments. Methods of Cost estimation

9

9

- Cost Indices.

UNIT IV - PRODUCT COST AND PLANT OVERHEADS

resources, maintenance and repair, operating supplies, power and other utilities, royalties, etc.). – Process Profitability - Application to a Food Processing plant e.g. Tomato processing- Administration, safety and other auxiliary services, payroll overheads, warehouse and storage facilities etc. Depreciation, Amortization and methods of determining the same. Introduction to Food Safety Management System.

UNIT V - PROFITABILITY ANALYSIS

Return on original investment, interest rate of return, accounting for uncertainty and variations and future developments. Cash flow diagram and its importance – Optimization techniques - Linear and Dynamics programming, Optimization strategies.

TEXT BOOKS:

- 1. Peters and Timmer haus. Plant design and Economics for Chemical Engineers. McGraw Hill5thEdition, 2017.
- 2. Rudd D F and Watson C C. Strategy of Process Engineering. John Wiley & Sons Inc. 2013.

REFERENCE BOOKS:

- 1. Maroulis Z.B. and Saravacos G.D. Food Process Design. Marcel Dekker Inc, 2003.
- 2. Towler G and Sinnott R.K. Chemical Engineering design principles, practice and Economicsof Plant and Process. 2nd Edition. Elsevier, 2012.

WEBLINKS:

1. https://archive.nptel.ac.in/courses/103/105/103105166/

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|------------|------------|-----|-----|------------|-----|------------|------------|------------|------------|-------------|------|------|------|------|
| CO1 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 2 | 1 |
| CO2 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | 1 |
| CO3 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | 1 |
| CO4 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | 1 |
| CO5 | 2 | 1 | _ | - | - | _ | _ | _ | - | - | _ | 1 | 2 | 1 |
| Average | 2.2 | 1.2 | 1 | - | - | - | - | - | - | - | - | 1 | 2 | 1 |

CO PO Mapping

9

9

TOTAL: 45

23BTFT741

FOOD PACKAGING TECHNOLOGY (Theory & Laboratory)

Instruction Hours/week: L:3 T:0 P:2

Marks: Internal:40 External:60 Total:100 End Semester Exam:3 Hours

(i) Theory

Course Objectives

The goal of this course is for students to,

- To utilize packaging for various food materials.
- To explain the various factors of different packaging materials, include metallic cans and glass.
- To explain the types, production and applications of paper, paperboards and polymers in food packaging.
- To summarize the filling, sealing, labeling, barcodes and printing on packages along with the legislative requirements.
- To outline the various types of innovative packaging technologies to improve the shelf life of the products.

Course Outcomes

Upon completion of this course, students will be able to,

- Identify the functions of packaging based on their physical and chemical property.
- Compare different packaging materials, their manufacturing process and equipment involved.
- Interpret the various closures and sealing mechanisms for different packaging materials.
- Compare the different printing and labeling methods with legislative requirements.
- Illustrate the innovations in food packaging and their applications.

UNIT I - INTRODUCTION TO FOOD PACKAGING

9

Functions of packaging, Effect of environmental factors - light, Oxygen, Moisture, Temperature, mechanical forces and biological factors on quality of food - general principles of control of the spoilage agents - General Approach, analysis of storage requirement, accelerated storage studies: Vacuum and Inert Gas Packaging- Retort packaging, principles, application -Tests on packaging materials, Mechanical strength (Tension, notch and tearing strengths), Gas and water vapour transmission rates.

UNIT II - METAL CANS AS PACKAGING

Metallic can types - Tin cans and Aluminum cans. Specialty of Open top sanitary cans, Lacquers and their use, Three piece cans and Two piece cans, Aerosol Cans, Basics of Canning operations – Can Reformer, Flanger, Seaming, Can closures. Glass jars and Bottles in food packaging, types of glass used in food packaging, manufacture of glassand glass containers, closures for glass containers -Design features effect of these materials on packed commodities.

UNIT III - FLEXIBLE FILMS PACKAGING

Formation of Films and pouches, Plastics used and their Specific applications - Polyethylene (LDPE and HDPE), Cellulose, Polypropylene (PP), Polyesters, Poyvinylidene Chloride, Polyvinyl chloride, Copolymers their applications. Co- extruded films and Laminates. Rigid and Semi rigid plastic packaging – fabrication methods – Thermo forming, Blow moulding, Injection moulding, Extrusion. LaminatedPaper board Cartons, Fibre Board and Corrugated Card Board packaging and their applications.

UNIT IV - FILLING AND SEALING OPERATIONS FOR VARIOUS TYPES OF PACKAGES 9

Closing and sealing of rigid containers. Filling and sealing of Flexible plastic containers, Hot wire sealing, hot bar sealing and impulse sealing – differences and relative advantages, Form fill Seal equipment: Printing on packages, Bar codes, Nutrition labeling and legislative requirements. Filling and Sealing of pouches, pouch from fill seal machines – Applications of form fill seal machines.

UNIT V - INNOVATIONS IN FOOD PACKAGING

Aseptic Packaging. Active packaging, Moisture control, CO2 and Oxygen scavenging. Modified atmosphere packaging – principles, applications. Green packaging, Permeability of gases in packs. Antimicrobial Packaging, Edible packaging films and coating. Packaging for non-thermal food processing. Sensors in food packaging with their applications, Intelligent Packaging – Time-temperature indicators, RFID, Tamperevident packaging.

TEXT BOOKS:

1. Coles R and Kirwan J. Food and Beverage Packaging Technology. Wiley-Blackwell Publishing. 2nd Edition, 2011.

2. Coles, R., Dowell, D.M., Kirwan, J. Food Packaging Technology, Black Well Publishing Ltd, 2009.

3. Gordon L. Robertson. Food Packaging Principles & Practice. CRC Press, 2016.

REFERENCE BOOKS:

- 1. Kit L Yam and Dong Sun Lee. Emerging Food Packaging Technologies: Principles and Practice. Wood head Publishing Ltd, 2012.
- 2. Robertson, G. L. 2001. Food Packaging and Shelf life: A Practical Guide. Narendra Publishing House

9

TOTAL: 45
- 3. Gosby, N.T. 2001. Food Packaging Materials. Applied Science Publication John, P.J. 2008. A Handbook on Food Packaging Narendra Publishing House.
- 4. Mahadevia, M., Gowramma, R.V. 2007. Food Packaging Materials. Tata McGraw Hill.

WEBLINKS:

1.<u>https://onlinecourses.nptel.ac.in/noc23_ge32/preview</u> 2.https://archive.nptel.ac.in/courses/126/105/126105015/

(ii) Laboratory

List of Experiments

- 1. Measurement of thickness of packaging materials.
- 2. Measurement of basic weight and grammage of paper and paperboards.
- 3. Measurement of water absorption of paper and paper boards (Cobb Test).
- 4. Study of vacuum packaging machine, bottle filling machine and form-fill-seal machine.
- 5. Determination of lacquer integrity test.
- 6. Determination of Water Vapor Transmission rate of Packaging Material.
- 7. Determination of grease resistance of papers used in food industry butter paper & toffee wraps.
- 8. Determination of adhesive test of tapes.
- 9. Experiment on sealing of plastic cups.
- 10. Estimation the shelf life of edible coated Food Samples.

TOTAL: 30

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|------------|-----|-----|-----|-----|------------|------------|------------|------------|------|------|------|------|------|
| CO1 | 3 | 2 | 1 | - | - | - | - | - | 1 | - | 1 | 1 | 3 | 2 |
| CO2 | 2 | 1 | - | - | - | - | - | - | 1 | - | 1 | 1 | 3 | 2 |
| CO3 | 2 | 1 | - | - | - | - | - | - | 1 | - | 1 | 1 | 3 | 2 |
| CO4 | 2 | 1 | - | - | - | - | - | - | 1 | - | 1 | 1 | 3 | 2 |
| CO5 | 2 | 1 | - | - | - | - | - | - | 1 | - | 1 | 1 | 3 | 2 |
| Average | 2.2 | 1.2 | 1 | - | - | - | - | - | 1 | - | 1 | 1 | 3 | 2 |

CO-PO Mapping

| B. Tech. – Food Technology | | 2023 - 2024 |
|----------------------------|--------------|--------------|
| | | Semester-VII |
| 23BTFT791 | PROJECT WORK | 8H-4C |
| | PHASE I | |

Instruction Hours/week: L:0 T:0 P:8

Marks: Internal:100 Total:100 End Semester Exam:3 Hours

The students will be directed to do a project work which will be Phase I of their mainproject work that will be performed in the eighth semester. Their projects willbe evaluated Continuous Internal Assessment. End semester Examination evaluation will be based on the report submitted by the student after the completion of the project work.

Semester-VIII

| B. Tech. – Food Techn | ology | | 2023 - 2024 |
|-----------------------|------------------|-----------------|----------------------------|
| | | | Semester-VII |
| 23BTFT891 | PROJECT | WORK | 16H-8C |
| | PHAS | E II | |
| Instruction Hours/we | ek: L:0 T:0 P:16 | Marks: Internal | :160 External:240Total:400 |
| | | En | d Semester Exam:3 Hours |

The students will be directed to do a project work which will be Phase II of their mainproject work. Their projects will be evaluated through Continuous Internal Assessment and Ed Semester Examination. End Semester Examination evaluation will be based on the viva -voce and report submitted by thestudent after the completion of the project work.

PROFESSIONAL ELECTIVE – I SEMESTER – V

Instruction Hours/week: L:3 T:0 P:0 Marks: Internal:40 External:60 Total:100 End Semester Exam: 3 Hours

Course Objectives:

The goal of this course is for students:

- To explain the physical and chemical properties of fats and oils.
- To identify the extraction and refining processes of various oils and fats.
- To classify the packaging, quality standards of fats and oils.
- To explain the industrial applications of oils.
- To summarize the quality standards and specifications followed in oil processingindustries

Course Outcomes:

Upon completion of this course, students will be able:

- Illustrate the importance of fats and oils. •
- Explain the manufacturing process of oils and fats. •
- Outline the manufacturing of designer fats.
- Infer the quality attributes of oils and fats.
- Identify the suitable packaging materials.

UNIT I - PHYSICAL AND CHEMICAL PROPERTIES

Introduction - Fats and oils - formation - functions of oil in human body - fatty acids double bonds and their position in oil - Geneva type classification - sources of vegetable oils - production status-oil content - coconut, palm, peanut, rice bran, sesame, mustard and sunflower seeds oil - physical and chemical properties of fats and oils - chemical reactions of oil – hydrolysis – hydrogenation, oxidation and polymerization.

UNIT II - EXTRACTION METHODS

Oil extraction methods -mechanical expression - ghani, power ghani, rotary, hydraulic press, screw press, expellers, filter press - principle of operation and maintenance solvent extraction process - steps involved, batch and continuous-continuous solvent extraction process for rice bran, soy bean and sunflower-oil extraction process for groundnut and cotton seed-production of special oils – palm oil, virgin coconut oil – extraction process.

9 **UNIT III - REFINING OF OILS** Refining of oils – objectives – characterization - degumming – Zeneath process –

Karpagam Academy of Higher Education (Deemed to be University), Coimbatore

9

3H-3C

deacidification process – continuous acid refining-bleaching of oil – continuous

bleaching process – decolourising agents-deodorization process winterization processes-hydrogenation of oil –selectivity – catalyst –batch type hydrogenation – regeneration of Catalyst-Vanaspati, ghee and margarine – production process-partial sterilization, emulsification, chilling, kneading and rolling, incorporation of salt, colouring substances production of special fats – butter – types - production and storage. **UNIT IV - PACKAGING OF EDIBLE OILS AND ITS** 9 **ANALYTICAL PROPERTY**

Packaging of edible oils – requirements – types – tinplate, semi rigid, glass, Polyethylene Terephthalate, Poly Vinyl Chloride, flexible pouches – packaging for Vanaspati and ghee changes during storage of oil –rancidity – causes – atmospheric oxidation and enzyme action – free fatty acid – colour-non edible oils – castor oil, linseed oil, vegetable waxes – production and processing. Analytical property-melting behaviour, low temperature properties, unsaturation, saponification, GC, NIR, FTIR, NMR, mass spectrometry.

UNIT V - INDUSTRIAL APPLICATIONS AND QUALITY STANDARDS 9 Industrial applications of fats and oils – quality regulations - manufacture of soap, candle, paints and varnishes - ISI and Agmark standards – site selection for oilextraction plant- safety aspects- HACCP standards in oil industries.

TOTAL: 45

TEXT BOOKS:

- 1. Harry Lawson, (1997) "Food oils and Fats Technology, Utilization and Nutrition", CBS Publishers and Distributors, New Delhi.
- 2. Gunstone F.D., (2008) "Oils and Fats in Food Industry", Blackwell Publishing, United Kingdom, ISBN 13: 9781405171212.
- Gunstone F.D., (2011) "Vegetable Oils in Food Technology: Composition, Properties and Uses", 2nd Edition, Wiley - Blackwell Publishing Ltd., ISBN 9781444332681.

REFERNCE BOOKS:

1. Bailey's Industrial Oil & Fat Products, Daniel Swern, 2000, 4th ed.John Wiley & Sons.

WEBLINKS:

- 1. https://www.britannica.com/science/fatprocessing#:~:text=It%20consists%20of%2 0cutting%20or,it%20is%20collected%20by%20skimming.
- 2. https://onlinelibrary.wiley.com/journal/14389312

CO PO Mapping

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|------------|------------|------------|------------|-----|------------|------------|------------|------------|-------------|------|-------------|------|------|
| CO1 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO2 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO3 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO4 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO5 | 3 | 2 | 1 | _ | - | _ | - | _ | - | - | - | 1 | 3 | 2 |
| Average | 2.2 | 1.2 | 1 | - | - | - | - | - | - | - | - | 1 | 3 | 2 |

Karpagam Academy of Higher Education (Deemed to be University), Coimbatore

3H-3C

23BTFT5E02 NON-THERMAL TECHNIQUES IN FOOD PROCESSING

Instruction Hours/week: L:3 T:0 P:0 Marks: Internal:40 External:60 Total:100 End Semester Exam: 3 Hours

Course Objectives:

The goal of this course is for students:

- To illustrate the principles, applications and effect on foods of highpressure processing.
- To infer the principle, types, effects and limitations of radiation processing of foods.
- To explain the complete processes of osmotic dehydration of foods.
- To demonstrate the ohmic heating and ultrasound processing of foods.
- To summarize the application of pulsed light and hurdle technology in foodprocessing.

Course Outcomes:

Upon completion of this course, students will be able to:

- Illustrate the overall processes involved in the high-pressure processing of foods.
- Explain the multiple aspects of radiation processing of foods.
- Apply the principle, mechanism, applications and limitations of osmotic dehydration of foods.
- Infer the application of ultrasound in processing and preservation of food.
- Summarize the basics, electrical properties and treatment of foods using ohmicheating technology. 9

UNIT I - HIGH PRESSURE PROCESSING OF FOODS

Non thermal technologies in preservation of foods - necessity and advantages - status and trends of non-thermal technologies in processing and preservation of foods-Principles – applications to food systems – effect on quality – textural, nutritional and Microbiological quality – factors affecting the quality – modelling of high-pressure processes – High Pressure Freezing, Principles and Applications.

UNIT II - RADIATION PROCESSING OF FOODS

Principle, Types of radiation sources. Biological effects of irradiation, Irradiation of Foods-Gamma Irradiation, X-Ray Irradiation, UV Irradiation-Combined treatments. -Mechanism of microbial and enzyme inactivation - Applications and Limitations.

UNIT III - OSMOTIC DEHYDRATION OF FOODS & MICROWAVE

Principle – Mechanism of osmotic dehydration – Effect of process parameters on mass transfer - Methods to increase the rate of mass transfer - Applications - Limitations of osmotic Dehydration - Management of osmotic solutions - Microwave -Principles-

9

sterilization, tempering, drying, puffing, -Applications and Limitations.

UNIT IV - OHMIC AND ULTRASOUND PROCESSING OF FOODS

Principle of ultrasound – Fundamentals – Ultrasound as a processing and preservation aid – Effect on properties of foods Basics of ohmic heating – Electrical conductivity - generic configurations- treatment of products- Mechanism of microbial and enzyme inactivation.

UNIT V - Pulsed Electric Field Processing of Foods

Principles – Mechanism of action – PEF treatment systems – Main processing parameters – PEF Technology – Equipments – Mechanism of microbial and enzyme inactivation- safety aspects– Processing of liquid foods using PEF – Process models – Comparison of High-pressure processing and PEF – Enzymatic Inactivation by PEF, Examples – Microbiological and chemical safety of PEF foods.

TOTAL: 45

TEXT BOOKS:

- 1. Da-wen Sun: Emerging Technologies for Food Processing, Elsevier Academic Press and Marcel Dekker Inc, 2014.
- Gustavo V. Barbosa- Canovas, Maria S. Tapia, M. Soledad Tapia, M. Pilar Cano, Novel Food Processing Technologies (Food Science and Technology Series), CRC Press,2004.
- Cullen, P.J., Tiwari, B.K. and Valdramidis V.P. Novel thermal and non-thermal technologies for fluid foods. Academic press, 32 Jamestown Road, London NW1 7BY, UK. 2012.

REFERENCE BOOKS:

- 1. Sun, D. Emerging Technologies for Food Processing, Academic Press, 2005.
- 2. Ohlsson, T. and Bengtsson, N. Minimal Processing technologies in the food industry, Woodhead Publishing Limited, 2002.

WEB LINKS:

- 1. https://www.frontiersin.org/articles/10.3389/fnut.2021.657090
- 2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8217760/

CO PO Mapping

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|------------|-----|-----|------------|-----|------------|------------|------------|------------|------|------|-------------|------|------|
| CO1 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | 3 |
| CO2 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | 3 |
| CO3 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 2 | 3 |
| CO4 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | 3 |
| CO5 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | 3 |
| Average | 2.2 | 1.2 | 1 | - | - | - | - | - | - | - | - | 1 | 2 | 3 |

9

23BTFT5E03

CEREALS AND PULSES TECHNOLOGY

Instruction Hours/week: L:3 T:0 P:0 Marks: Internal:40 External:60 Total:100 End Semester Exam: 3 Hours

Course Objectives:

The goal of this course is for students:

- To explain the processing of major cereals like paddy, maize, etc.
- To summarize the milling techniques of cereals and pulses.
- To outline the byproducts obtained during processing along with their uses. •
- To utilize value-added products from maize. •
- To illustrate various aspects of the milling of pulses. •

Course Outcomes:

Upon completion of the course, students will be able to:

- Explain the processing of major cereals like paddy, maize, etc.
- Illustrate the milling techniques of cereals and pulses.
- Outline the byproducts obtained during processing along with their uses.
- Infer the value-added products from the byproducts obtained during milling. ٠
- Interpret the value-added products from maize.

UNIT I - PADDY PROCESSING

Present status and future prospects of cereals; Morphology, Classification and types -Chemical composition - Structure and Composition of paddy - Cleaning of paddy - Pre Cleaners, -Paddy Parboiling Processes. Physico-chemical changes during parboiling effect of parboiling on cooking qualities - Parboiling methods - Methods of grain drying-LSU, rotary, columnar, recirculatory dryers – Byproducts of paddy processing - Paddy husk and its uses as husk ash, activated carbon, furfural and other by products - Value added products - Flattened and Puffed Rice.

UNIT II - RICE MILLING

Rice milling flow chart - Modern Rice Milling equipments - paddy milling - Dehusking of paddy - Engelberg Huller, Under runner disc shellers, rubber roll sheller and Centrifugal dehusker- Paddy Separators - Satake and Schule Designs - Rice Polishers -Cone polishers and other types - Bran and Brokens separators - Rice mill yields and loss due to brokens at different stages of milling - milling efficiency -Use ofRice Bran in Edible oil Industry

UNIT III - WHEAT MILLING

Structure and composition of wheat – flow chart for wheat milling – milling process – equipment's used in wheat milling - parboiling of wheat - bulgur wheat - products and

9

9

byproducts of wheat.

UNIT IV - PROCESSING OF MAIZE/CORN

Structure and composition of maize – milling methods - Precleaning-cleaning equipment degermination and dehusking- Dry milling of maize – wet milling – flow chart- Products of milling – Flour – Semolina - Brewers' grits etc. and their applications - Branand Fibre separation - Gluten and Starch Separation - Equipment used - Starch conversion into other value-added products – Acid Hydrolysis, Enzyme Hydrolysis, Isomerization processes - Processing for Dextrose, Malto Dextrin and other products - Extraction and refining of Corn oil in brief.

UNIT V - MILLING OF PULSES

Structure and composition – need for pulse milling – Unit operations of pulse milling – domestic and commercial scale pulse milling methods – Dry and wet milling, CFTRI, CIAE, Jadavpur methods - Process flow chart – Pulse milling machineries - dehusking in Pulse Pearler - splitting of pulses in Pulse splitter - Mini dhal mill - working principle - advantages and disadvantages – pulse milling efficiency – Grinding of split pulses - pulse flour products - their applications and equipments used.

TEXT BOOKS:

- 1. KM. Sahay and KK. Singh. Unit operations of Agricultural Processing, Vikash Publishing house PVT Ltd. Delhi, 2nd Edition, 2004.
- 2. Chakraverty, A. Post-Harvest Technology of Cereals, Pulses and Oilseeds. Oxford and IBH Publishing Co, Calcutta, 3rd Edition, 2018.

REFERENCE BOOK:

 Karel Kulp and Joseph P Pante. Handbook of Cereal Science and Technology, Mercel Dekker, USA, 2nd edition, 2000.

WEB LINKS:

- 1. https://ifst.onlinelibrary.wiley.com/toc/13652621/2023/58/1
- 2. https://onlinelibrary.wiley.com/doi/book/10.1002/9781118229415

CO PO Mapping

| | | | <u> </u> | | | | | | | | | | | |
|---------|------------|-----|----------|------------|-----|------------|------------|------------|------------|------|------|------|------|------|
| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | 3 |
| CO2 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | 3 |
| CO3 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | 3 |
| CO4 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | 3 |
| CO5 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | 3 |
| Average | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | 3 |

TOTAL: 45

9

Professional Elective – II

| B. Tech. – Food Technology | | 2023 - 2024 |
|-----------------------------------|--------------------------|-----------------------------|
| | | Semester- V |
| 23BTFT5E04 | MILLING TECHNOLOGY | 3H-3C |
| Instruction Hours/week: L:3 T:0 I | P:0 Marks: Internal:40 H | External:60 Total:100 |
| | End Ser | nester Exam: 3 Hours |

Course Objectives:

The goal of this course is for students:

- To explain the structure and properties of grains and cereals.
- To summarize the milling process equipment used for rice.
- To explain the process of milling and separation of wheat and corn.
- To compare the steps involved in milling of pulses along with equipment.
- To illustrate the properties of oil seed and their extraction and refining techniques.

Course Outcomes:

Upon completion of this course, students will be able to:

- Explain the importance of grains and cereals along with storage.
- Infer the byproducts obtained from rice milling and its wastes.
- Summarize detailed knowledge of Wheat and corn milling and its waste utilization.
- Infer the techniques and processes involved in pulse milling.
- Outline the extraction, separation, and refining of oil seed milling.

UNIT I - GRAIN PROPERTIES

Importance of grains and cereals - definitions, Grain structure, physicochemical properties of grains,3 and its nutritional value. Storage of cereal grains in relation to maintaining grain quality – types of storage structures. Packaging systems, materials and machinery. Structure and quality standards of cereals.

UNIT II - RICE MILLING

Rice milling flow sheet. Paddy procurement Explanation of steps in milling operations - Cleaning, Parboiling- Physio – chemical changes during Parboiling and effects of qualities of rice. Methods of Parboiling, Milling, Shellers, Paddy Separator, Whitener, Polisher, Grader, and modern rice mill, Grain drying techniques and technology. Ageing of Rice Byproducts from rice milling and waste utilization. Rice economy in India.

UNIT III - WHEAT MILLING

Wheat milling flow sheet. Wheat Reception - Explanation of steps in milling, Cleaning Principles of Parboiling of wheat- Methods of Parboiling, Sifters, De-stoners, Roller milling – Break rolls, and reduction rolls, Sifting and purifying, plan sifters. Bran separation. Efficiency of milling process. Packaging of wheat products. Durrum wheat

9

9

9

products. By products from wheat milling and waste utilization. Milling of Corn: Corntypes. Dry and wet milling of corn- flow sheet and explanation, Byproducts from corn milling, corn starch, corn syrup, corn flakes. Waste utilization. Wheat economy in India.

UNIT IV - PULSE MILLING

Importance of legumes. Milling and processing of Legumes- Methods of milling (dry and wet) of pulses. Preconditioning of pulses before milling Processing methods- dehulling losses and effect of dehulling on nutritive value. Grading methods, cooking quality.

UNIT V - OIL SEED MILLING

Oil seed processing- natural sources of oil. Physio-chemical properties, mechanical extraction - Oil processing machinery, solvent extraction, factors influencing extraction, types of solvents. Refining of oil -Degumming, neutralization, bleaching, filtration, deodorization, their principles and process controls, hydrogenation, winterization, Purification of oil – gravity settling, filter press; changes during storage. Packaging. Oil seed flour concentrates and isolate. Utilization of oil seed meals of different food uses. Importance and application of oils in food and health. New technologies in oil seed processing. Handling and storage of oilseeds. Quality of oil – different standards;

TOTAL: 45

TEXT BOOKS:

- 1. Kulp K and Pont J G, —Handbook of Cereal Science and Technology, Second Edition, Chips Ltd. USA, 2000.
- 2. Khader, Vijaya and Vimala, V., —Grain Quality and Processing, Agrotech Publishing, Udaipur, 2007.
- 3. Harry Lawson. —Food Oils and Fats, Technology, Utilization and Nutrition, CBS Publishers and Distributors, New Delhi, 1997.

REFERENCE BOOKS:

- 1. Chakraverty, A. —Post Harvest Technology of Cereals, Pulses and Oil Seeds, Third Edition, Oxford & IBH publishing & Co., New Delhi, 2000.
- 2. Sahay, K.M. and Singh. K.K. Unit operations of Agricultural Processing, Vikas Publishing House, New Delhi, 1996.

WEB LINKS

- 1. https://www.encyclopedia.com/humanities/encyclopedias-almanacs-transcriptsand-maps/mills-and-milling-technology
- 2. https://www.mdpi.com/1424-8220/20/4/1147

CO PO Mapping

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|-----|------------|-----|------------|-----|------------|------------|------------|------------|-------------|-------------|-------------|------|------|
| CO1 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | 2 | 3 |
| CO2 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | 2 | 3 |
| CO3 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | 2 | 3 |
| CO4 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | 2 | 3 |
| CO5 | 2 | 1 | _ | _ | - | _ | - | _ | _ | - | - | - | 2 | 3 |
| Average | 2 | 1 | - | - | - | - | - | - | - | - | - | - | 2 | 3 |

Karpagam Academy of Higher Education (Deemed to be University), Coimbatore

Semester- V 3H-3C

23BTFT5E05 TECHNOLOGY OF OILSEEDS PROCESSING

Instruction Hours/week: L:3 T:0 P:0 Marks: Internal:40 External:60 Total:100 End Semester Exam:3 Hours

Course Objectives:

The goal of this course is for students:

- To outline the nutritional value and future roles of oil seeds.
- To explain the importance of milling at different scale of operations.
- To interpret the equipment involved in oil seed milling processes.
- To infer the refining in oilseed processing.
- To summarize the use of oil seeds meals in protein products and byproducts.

Course Outcomes:

Upon completion of this course, students will be able to:

- Explain the composition, nutritional values and classification of oil seeds.
- Illustrate the problems affecting milling and develop new methods in different scales of operations.
- Infer knowledge about the principles and working of oil seed milling equipments.
- Interpret the importance of refining stage in oil processing.
- Outline the use of higher protein products and their byproducts.

UNIT I – INTRODUCTION

Present status and future prospects of oilseeds; Morphology of oilseeds; Classification and types of oilseeds; Chemical composition, nutritional value and anti- nutritional compounds in oilseeds; Methods of removal of anti- nutritional compounds.

UNIT II - OILSEED PROCESSING

Oil seed milling: Ghanis, hydraulic presses, expellers, solvent extraction methods, machines, Milling quality, milling efficiency, factors affecting milling quality and quantity; Problems in oil milling industry.

UNIT III - STAGES OF REFINING

Refining of oils and its types: Degumming, neutralization, bleaching, filtration, deodorization, winterization and their principles and process controls; Hydrogenation of oils; Purification of oil – gravity settling, filter press. Rancidity of oils & its prevention; Aflatoxin in oil bearing materials.

UNIT IV - PACKAGING AND STORAGE

Packaging and storage of edible oils. New technologies in oilseed processing; Oilseed economy in India. Industrial applications of oils - quality regulations, Protein texturization, fibre spinning.

9

9

9

9

UNIT V - UTILIZATION OF BYPRODUCTS

Utilization of oil seed meals for different food uses: Oil seeds as direct edible products. High protein products like protein concentrates and isolates; Oil cake analysis; defating of oil meals / cakes; Oil meal/ cake as raw material for animal / poultry feed; Oil cake export - By-products of oil milling and their value addition.

TEXT BOOKS:

- Guriqbal Singh, Harbhajan Singh Sekhon, Jaspinder Singh Kolar and Masood Ali. 2005. Pulses. Agrotech Publishing Academy, Udaipur.
- 2. Chakraverty. 2008. Post-Harvest Technology of Cereals, Pulses and Oilseeds, 3rdEd. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
- 3. Frank D. Gunstone. 2008. Oils and Fats in the Food Industry. John Wiley and Sons, Ltd., West Sussex, UK.
- 4. Fereidoon Shahidi. 2005. Bailey's Industrial Oil & Fat Products, 6th Ed., Vols. 1 to 6. John Wiley and Sons, Inc. Hoboken, New Jersey, USA.

REFERENCE BOOKS:

- Amalendu Chakraverty, Arun S. Mujumdar, G.S. Vijaya Raghavan and Hosahalli, S. Ramaswamy.2003. Handbook of Post-Harvest Technology: Cereals, Fruits, Vegetables, Tea, and Spices.Marcel Dekker, Inc., NY, USA.
- K.M. Sahay and K.K. Singh. 2001. Unit Operations of Agricultural Processing,2nd Ed. Vikas Publishing House Pvt. Ltd., Noida.

WEB LINKS:

- 1. https://idl-bnc-idrc.dspacedirect.org/bitstream/handle/10625/11596/IDL-11596.pdf?sequence%5Cu003d1
- 2. https://onlinelibrary.wiley.com/doi/abs/10.1111/jfpe.13851

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|------------|------------|-----|-----|------------|------------|------------|------------|------------|------------|-------------|------|-------------|------|------|
| CO1 | 2 | 1 | - | - | - | - | - | - | _ | - | 1 | 1 | 3 | 2 |
| CO2 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 1 | 3 | 2 |
| CO3 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 1 | 3 | 2 |
| CO4 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 1 | 3 | 2 |
| CO5 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 1 | 3 | 2 |
| Average | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 1 | 3 | 2 |

CO PO Mapping

9

TOTAL: 45

DESIGN AND FORMULATION OF FOODS

2023 - 2024 Semester- V 3H-3C

Instruction Hours/week: L:3 T:0 P:0 Marks: Internal:40 External:60 Total:100 End Semester Exam:3 Hours

Course Objectives

The goal of this course is for students,

- To explain the importance of nutrition and nutritive value of different foods inrelation with health.
- To illustrate the terms, principles and steps involved in menu planning.
- To explain the vital role of geriatric and therapeutic balanced diet in human life.
- To identify the methods involved in the measurement and estimation of energy requirements in individuals.

• To summarize the concepts of nutraceuticals designing and Anti-nutritional factors. **Course Outcomes.**

Upon completion of this course, students will be able to,

- Explain the nutritional value of different food groups.
- Outline the nutritional requirements of infants, preschool going children and athletes.
- Summarize the principles of menu planning process and understand and use the conceptof food exchange lists.
- Illustrate the therapeutic diets for diseases like diabetes, and CHD.
- Summarize the overall terms and methods applied in the measurement and estimation of energy.

UNIT I - NUTRITION AND BALANCED DIET

Nutritive value and anti- nutritional factors present in cereals, pulses, oil seeds, fruits, vegetables, fish, meat and eggs- effect of processing on nutritive value of foods-Principles of Nutrition and Health-Food Preparation and Service: Principles and Methods. Basic terms used in study of food and nutrition, BMI and Nutritional Status, Understanding relationship between food, nutrition and health. Nutritional labelling in India

UNIT II - MENU PLANNING

Explanation of terms- Principles of planning menus- Steps involved in planning menus-Food guide pyramid- Infant Foods: Formulation of weaning foods, Protein energy malnutrition- Formulating diet for preschool going (2-5 years) children-Food Selection and Meal Planning for different age groups. Factors affecting meal planning

9

UNIT III - BALANCED DIET

Diets during normal life cycle- Concept of Balanced Diet-Nutrition from infancy to adolescence- Nutritional requirements of different age groups- Geriatric nutrition-

Nutrition for athletes- Therapeutic Diet: Diet therapy and types of therapeutic diet- Diet for diabetic mellitus- Diet for cardio vascular disease- Diet for gastro intestinal disease.

UNIT IV - ENERGY REQUIREMENT

Definition- units of energy- Energy content of foods- Physiological fuel value-Measurement of energy expenditure- BMR- Thermic effect of food- SDA- Methods of measurement- Factorial methods of estimating energy requirement of individuals-Regulation of energy metabolism. Factors affecting absorption of the following in brief: Energy, Carbohydrates, lipids and proteins, Fat soluble vitamins-A, D, E and K, Water soluble vitamins - thiamin, riboflavin, niacin, pyridoxine, folate, vitamin B12 and vitamin C, Minerals – calcium, iron, iodine, fluorine, copper and zinc.

UNIT V - FUNCTIONAL AND SPECIAL FOODS

Concepts for functional foods design, prebiotics & probiotics- nutraceuticals- designer foods- Anti-Nutritional Factors in Foods: Trypsin inhibitors, Phytins, Tannins, Oxalates, Goitrogens, Aflatoxins, and Process induced toxins- Space Foods-Army foods-Athlete Foods-Packaged food supply in Flights.

TEXT BOOKS:

- C Gopalan, BV Ramshastri, S C Balasubramaniam, 1989, Nutritive Value of 1 Indian Foods Nation Institute of Nutrition, Hyderabad.
- 2 M Swaminathan, 1974, Essentials of Nutrition, Ganesh Co.

REFERENCE BOOKS:

- 1. K.H. Steinkrauss, 1995, Handbook of Indigenous Fermented Foods, Marcel Dekker.
- 2. J Pokorny, N Yanishlieva, and M Gordon, 2001, Antioxidants in Food, Published by Woodhe Publishing Limited, Abington Hall, Abington

WEB LINKS

- 1. https://onlinelibrary.wiley.com/doi/abs/10.1002/9781118597651.ch3
- 2. https://onlinelibrary.wiley.com/doi/10.1002/9781118597651.ch12

CO PO MAPPING

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|------------|-----|-----|------------|-----|------------|------------|------------|------------|-------------|-------------|-------------|------|------|
| CO1 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | 3 |
| CO2 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | 3 |
| CO3 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | 3 |
| CO4 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | 3 |
| CO5 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | 3 |
| Average | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | 3 |

TOTAL: 45

9

9

9

23BTFT5E07

FUNCTIONAL FOODS AND **NUTRACEUTICALS**

Instruction Hours/week: L:3 T:0 P:0 Marks: Internal:40 External:60 Total:100 End Semester Exam: 3 Hours

Course objectives

The goal of this course is for students,

- To identify the historical reviews, teleology, models, classification and sources of nutraceuticals.
- To explain the role of flavonoids and carotenoids as antioxidant agents.
- To illustrate the metabolism, mechanism, sources and analysis of omega-3 fatty • acids & CLA.
- To summarize the health implications of lycopene, garlic, olive oil, nuts, • prebiotics and probiotics.
- To illustrate the various aspects of herbs, stability testing, marketing strategies and regulatory issues in nutraceutical and functional foods.

Course outcomes

Upon completion of this course, students will be able to,

- Illustrate the historical, technological aspects and classification of nutraceuticals. •
- Explain the significance of flavonoids and carotenoids as antioxidants.
- Identify the potential health benefits, sources, mechanism of action and metabolismof omega- 3 fatty acids and CLA.
- Summarize the therapeutic diets for diseases like diabetes, and CHD.
- Interpret the role of herbs as a nutraceutical and conduct the accelerated shelf-life testing • of various nutraceuticals and functional foods.

UNIT I - NUTRACEUTICALS: HISTORICAL, TECHNOLOGICAL ASPECTS AND CLASSIFICATIONS 9

Nutraceuticals- concept and definition - Historical Reviews - Teleology of nutraceuticals - Organization models for nutraceuticals - Classification of Nutraceuticals based on the sources- Animal, Plant and Microbial - Perceived effect of functional foods - Nutraceuticals in specific foods - Mechanism of Action - Chemical nature - Relation of functional foods and nutraceutical (FFN) to foods and drugs.

UNIT II - FLAVANOIDS AND CAROTENOIDS AS ANTIOXIDANTS

General background on phytochemicals as antioxidants - Flavonoids and Lipoprotein oxidation - Evidence for specific Antioxidant mechanisms of Flavonoids - Antioxidant role as nutraceuticals and functional foods- health benefits of antioxidants - Anticancer

9

2023 - 2024 Semester-V **3H-3C**

and Cholesterol-lowering effect of citrus flavonoids - Dietary carotenoid and carotenoid absorption - Approaches to measurement of absorption - Metabolism of Carotenoids – Carotenoids as anticancer agents.

UNIT III - OMEGA-3 FATTY ACIDS AND CLA

Introduction to Lipoprotein metabolism – PUFA and Cardiac Arrhythmias - Preventative role of n-3 fatty acids in cardiac arrhythmias -Mechanism of action on n-3 PUFA's - ω – 3 fish oils and their role in Glycemic control- ω –3 fatty acids and rheumatoid arthritis - Chemistry and Nomenclature of CLA – Analysis of CLA in food and biological samples – CLA in food products and biological samples –Biological actions and potential health benefits of CLA – Mechanisms of CLA action – Potential adverse effects of CLA, Applications of CLA in foods.

UNIT IV - LYCOPENE, GARLIC, OLIVE OIL, NUTS, PROBIOTICS AND PREBIOTICS 9

Lycopene overview – lycopene and disease - Garlic – Chemistry – Implication in Health -Olive oil – CHD – Cancer - Nuts – Nutrient components and Composition – Nut Consumption and CHD epidemiological evidence, Human nutritional studies on nut consumption and serum lipid changes, Mechanism of action- Probiotics- criteria – products on market – probiotic products – Microbiology of the gastrointestinal tract -Prebiotics – effect of processing, physiological effects, effects on human health and potential applications in risk reduction of diseases- future for probiotics and prebiotics.

UNIT V - HERBS AS FUNCTIONAL FOODS, STABILITY, TESTING AND MARKETING ISSUES FOR NUTRACEUTICALS AND FUNCTIONAL FOODS 9

Herbal medicine – Herbs as ingredients in functional foods – actions of herbal and evidence of efficacy -Kinetic modelling of chemical reactions – Accelerated shelf life testing - Cruciferous vegetables and cancer prevention – Dietary fiber and coronary heart disease - Evolution of marketing environment for Functional foods and nutraceuticals - Regulatory background - Introduction to consumer marketing issues for nutraceuticals -Potential product positioning.

TOTAL: 45

TEXT BOOKS:

- Shi, John, Fereidoon Shahidi and Chi-Tang Ho "Asian Functional Foods". CRC/Taylor & Francis, 2007.
- 2. Watson, Robald Ross "Functional Foods and Nutraceuticals in Cancer Prevention". Blackwell Publishing, 2007.

REFERENCE BOOKS:

1. Gibson, G.R. and C.M.Willams. "Functional Foods: Concept to Product". Woodhead, 2000

WEB LINKS:

- 1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3257668/
- 2. https://onlinelibrary.wiley.com/doi/book/10.1002/9781119048961

| CO PO | MAPPING |
|-------|---------|
|-------|---------|

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|------------|-----|-----|------------|-----|------------|------------|------------|------------|-------------|------|-------------|------|------|
| CO1 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO2 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO3 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO4 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO5 | 2 | 1 | _ | _ | _ | _ | - | - | _ | - | - | 1 | 3 | 2 |
| Average | 2.2 | 1.2 | 1 | - | - | - | - | - | - | - | - | 1 | 3 | 2 |

23BTFT5E08

SNACK FOODS TECHNOLOGY

Instruction Hours/week: L:3 T:0 P:0Marks: Internal:40 External:60 Total:100End Semester Exam:3 Hours

Course Objectives

The goal of this course is for students,

- To explain the diversity and common features of snack foods.
- To classify the different techniques of snack food manufacture.
- To outline the types of packages used for snack foods.
- To classify value added products from traditional Indian snack foods.
- To summarize the various equipment's used for the preparation of snack foods.

Course Outcomes

Upon completion of the course, students will be able to,

- Explain the wide diversity and common features of snack foods.
- Infer the knowledge of the different techniques of snack foods manufacture.
- Identify various types of packages used for snack foods.
- Illustrate the unique features of traditional Indian snack foods.
- Demonstrate different equipment used for preparation of snack foods

UNIT I – INTRODUCTION

Introduction - Importance and scope of snack food technology. Present status of snack foods industries.

UNIT II – GRAIN BASED SNACKS

Various types of snack foods - Technology for grain-based snacks: whole grains – roasted, toasted, puffed, popped and flakes, coated grains-salted, spiced and sweetened; flour based–batter and dough based snack foods. Savory products; - formulated chips and wafers, instant premixes of traditional Indian snack foods.

UNIT III – FRUITS AND VEGETABLE BASED SNACK

Technology for fruit and vegetable-based snacks: Chips, wafers, fruit base confectionery bars. Technology for baked snack.

UNIT IV – REGIONAL SNACK FOODS

Regional snack foods that have gone Pan Indian / Global. Popular regional foods; Traditional fermented foods, pickles and preserves, beverages, snacks, desserts and sweets, street foods; IPR issues in traditional foods

3H-3C

2023 - 2024

Semester- V

9

9

9

UNIT V – EQUIPMENTS

Equipment's used for preparation of snack foods. Packaging of snack foods Laws and regulations

TOTAL: 45

TEXT BOOKS:

- 1. Edmund WL.1996 Snack Foods Processing. AVI Publ.
- 2. Frame ND.1994. The Technology of Extrusion Cooking. Blackie Academic.

REFERENCE BOOKS:

- 1. Gordon BR.1997 Snack Food.AVI Publ.
- 2. Samuel AM.1996. Snack Food Technology. AVI Publishers.

WEB LINKS:

- 1. https://books.google.com/books/about/Snack_Foods.html?id=nXB_zgEACAAJ
- 2. https://www.taylorfrancis.com/books/edit/10.1201/9781003129066/snack-foods-sergio-serna-saldivar

CO PO MAPPING

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|------------|------------|------------|------------|-----|------------|------------|------------|------------|-------------|------|-------------|------|------|
| CO1 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO2 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO3 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO4 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO5 | 2 | 1 | - | _ | _ | _ | _ | - | - | - | - | 1 | 3 | 2 |
| Average | 2.2 | 1.2 | 1 | - | - | - | - | - | - | - | - | 1 | 3 | 2 |

PROFESSIONAL ELECTIVE - III

| B. Tech Food Technology | | 2023 - 2024 |
|--------------------------------|---|----------------------|
| 23BTFT6E01 | ANALYTICAL METHODS FOR FOOD PRODUCTS | Semester-VI 3H-3C |

Instruction Hours/week: L:3 T:0 P:0

Marks: Internal:40 External: 60 Total:100 End Semester Exam:3 Hour

COURSE OBJECTIVES:

The goal of this course is for students to:

- To explain about the techniques of water analysis.
- To illustrate the methods involved in the analysis of plantation products.
- To demonstrate a different knowledge on analysis methods of fruit and vegetable products.
- To summarize the basic analysis concepts of bakery products.
- To outline the processes involved in livestock food product analysis.

COURSE OUTCOMES

Upon completion of this course, students will be able to:

- Explain the various food analysis techniques.
- Identify the methods used for water evaluation.
- Summarize the analysis methods involved in plantation and fruit products.
- Illustrate the basic concepts of bakery and confectionary product analysis.
- Interpret the various strategies involved in the product analysis and its standard methods.

UNIT I - ANALYSIS OF WATER

Parameters tested as per FSSAI Regulations- Organoleptic and Physico-chemical Parameters- Colour, Odour, pH, Taste, Turbidity, General Chemical parameters-Ammoniacal nitrogen, Anionic surface active agent, Boron, Nitrate, Chloride, Magnesium, Fluoride, Total hardness, Alkalinity, Sulphates, Residual free chlorine& Chloramines Sulphide , Cyanide, Calcium, Total Dissolved Solids, Phenol, Sodium , Hexavalent chromium ,Total solids, Nitrite , Mineral Oil, Estimation of Anions in Drinking water by Ion Chromatography, Metals A By AAS- By Flame AAS (Zn, Mg, Ca,), By Graphite furnace AAS(Al, Cu, Fe, Mn, Se, Ag, Cd, Pb, Hg, Mo, Ni, As, Cr), By Cold Vapour AAS (Hg) B. By ICP-MS (Zn, Mg, Ca, Al, Cu, Fe, Mn, Se, Ag, Cd, Pb, Hg, Mo, Ni, As, Cr, Hg), Toxic substances- Pesticide Residues, Polychlorinated Biphenyls, Polyaromatic Hydrocarbons, IS protocol 10500 and 14543.

UNIT II-ANALYSIS OF PLANTATION PRODUCTS

Tea & Coffee- Preparation of sample, Moisture content, Total ash, Water soluble ash, Determination of Caffeine content by different methods, microscopic examination,

9

Determination of solubility in boiling water, Determination of Iron filings and size of the particles, Test for presence of added colouring matter - Spices- Sample preparation, Determination of moisture, Acid insoluble ash, Determination of Cold Water Extract,

Determination of Alcohol Soluble Extract, Calcium Oxide, Non Volatile Ether Extract, Volatile Oil, Crude Fibre, Allyl isothiocyanate in Mustard, p-hydroxybenzyl isothiocyanate in white mustard, Microscopic Examination of Spices, Black Pepper-Determination of Bulk density, Light berries, Piperine content, Turmeric-Determination of curcumin content, Starch content, Detection of chromate content, Detection of Argemone seeds in Mustard, Detection of Mineral Oil in Black Pepper, Detection of Papaya seeds in Black Pepper, Detection of Turmeric in Chillies and Coriander, Detection of Oil Soluble Colour, Determination of Light and Heavy Filth in Spices and Condiments, Determination of capsaicin content in chilli powder.

UNIT III - ANALYSIS OF FRUIT & VEGETABLE PRODUCTS, OILS & FATS

Thermally Processes fruits and vegetables- Physical examination, Determination of Vacuum, Drained weight, Internal conditions of can, Determination of sodium chloride in brine; Jams and Jellies- Insoluble matter, pH, Titratable Acidity, Volatile oils, Total sugars, Vitamin C, Determination of fruit content.

UNIT IV - ANALYSIS OF BAKING AND CONFECTIONERY PRODUCTS

Bread- Sample preparation, Determination of alcoholic acidity, Acid-insoluble ash, Non-Fat milk, solids in milk bread, Biscuits- Determination of acidity of extracted fat, Confectionery- Preparation of Sample, Determination of Moisture, Determination of Sulphated Ash, Determination of Sulphated Ash on salt free basis, Determination of Ash in dil. HCl, Test for presence of added synthetic colour, Determination of Total Protein, Determination of Fat, Determination of Reducing Sugar, Determination of Sucrose, Determination of Sulphur dioxide, Determination of Lead, Copper and Zinc.

UNIT V - ANALYSIS OF MEAT AND FISH PRODUCTS

Preparation of Sample for Meat and Processed Meat products, Determination of Nitrite in Processed animal foods, Determination of Ascorbic acid, Alternate method for Determination of Ascorbic acid, Determination of Total Phosphorous, Test for presence of Polyphosphates, Determination of Glucono-delta-lactone, Additional tests, Determination of physico-chemical quality of meat and meat products- pH, Extract Release Volume (ERV), Meat Swelling Capacity (MSC), Total Volatile Basic Nitrogen (TVBN), Picric Acid Turbidity (PAT), Determination of dye reduction capacity. Preparation of sample for Fish and Processed Fish, Frozen Fish- Determination of Histamine, Dried fish- Moisture content, Sodium chloride content, Acid insoluble ash. Milk & Milk products- Preparation of sample, Detection test for adulterants and contaminants, Alkaline phosphatase test, Turbidity test, Determination of Total solids, Determination of fat.

TOTAL:45

135

TEXT BOOKS:

- 1. FSSAI Lab Manual 6, "Manual of Methods of Food Analysis- Meat& Meat Products/ Fish & Fish Products", 2016.
- 2. FSSAI Lab Manual 3, "Manual of Methods of Food Analysis- Cereal & Cereal Products", 2016.
- FSSAI Lab Manual 4, "Manual of Methods of Food Analysis- Beverages, Sugar & Confectionery Products", 2016.

REFERENCE BOOKS:

- 1. FSSAI Lab Manual 10, "Manual of Methods of Food Analysis- Spices and Condiments", 2016.
- 2. FSSAI Lab Manual 5, "Manual of Methods of Food Analysis- Fruit & Vegetable Products", 2016.
- 3. FSSAI Lab Manual, "Manual of Methods of Food Analysis- Water", 2016.

WEB LINKS:

- 1. https://www.mdpi.com/2304-8158/11/10/1512
- 2. https://www.rsc.org/journals-books-databases/about-journals/analytical-methods/

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|------------|------------|-----|-----|-----|------------|------------|------------|------------|------------|------|------|------|------|------|
| CO1 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO2 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO3 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO4 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO5 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| Average | 2.2 | 1.2 | 1 | - | - | - | - | - | - | - | - | 1 | 3 | 2 |

Semester-VI

23BTFT6E02 BEVERAGE PROCESSING TECHNOLOGY 3H-3C

Instruction Hours/week: L:3 T:0 P:0 Total:100 Marks: Internal:40 External:60

End Semester Exam:3 Hour

COURSE OBJECTIVE:

The goal of this course is for students:

- To explain the types of ingredients used in beverage production.
- To apply knowledge on processes involved in carbonated beverage production.
- To interpret the processes and unit operations involved in noncarbonated beverage production.
- To summarize the various grades, equipment's used and ingredients for the production of alcoholic beverages.
- To infer the quality standards, regulations and sanitation for beverage processing industries.

COURSE OUTCOME:

Upon completion of this course, students will be able:

- Infer the formulation of the beverages using various ingredients.
- Demonstrate various unit operations involved in the food beverage manufacturing.
- Summarize the various production techniques in beverages.
- Explain the knowledge obtained to produce nonalcoholic beverages.
- Identify the quality parameters of all beverages.

UNIT I - INGREDIENTS IN BEVERAGES

Beverage-definition-ingredients- water, quality evaluation and raw and processed water, bulk and intense sweeteners, water miscible and water dispersible flavoring agents, colors – natural and artificial, Micro and Nano-emulsions of flavors and colors in beverages, preservatives, emulsifiers and stabilizers.

UNIT II - CARBONATED BEVERAGES

Procedures- ingredients- preparation of Syrup making, carbonation of soft drinks. Carbonation equipment's and machineries- -containers and closures. low-calorie and dry beverages; isotonic and sports drinks; Fruit based carbonated beverages, carbonated water.

UNIT III - NON-CARBONATED BEVERAGES

Beverages based on tea, coffee, cocoa, spices, plant extracts, herbs, nuts, dairy based beverages, RTS beverages, isotonic Beverages. Flash pasteurization, Canning and Aseptic Packaging of beverages. bottled. Water; mineral water, natural spring

9

9 .

UNIT IV - ALCOHOLIC BEVERAGES

Alcoholic beverages- types, manufacture and quality evaluation; the role of yeast in beer and other alcoholic beverages, ale type beer, lager type beer, technology of brewing process, equipment's used for brewing and distillation, wine and related beverages, distilled spirits.

UNIT V - FOOD ADDTIVES AND MISCELLANEOUS BEVERAGES AND QUALITY CONTROL 9

Sweeteners, colourants, acidulants, clouding, clarifying and flavouring agents, preservatives for beverages. Carbon di oxide and carbonation. Quality tests and control in beverages. Miscellaneous beverages- coconut water, coconut milk, sweet toddy, sugarcane juice and flavoured syrups -Quality control, Filling-inspection and quality controls-sanitation and hygiene in beverage industry-Quality of water used in beverages threshold limits of ingredients. FSSAI, EFSA and FDA regulations.

TOTAL:45

TEXT BOOKS:

- 1. L. Jagan Mohan Rao and K. Ramalakshmi (2011) "Recent trend in Soft beverages", Woodhead Publishing India Pvt. Ltd.
- 2. Boulton, Christopher, and David Quain (2008) Brewing yeast and fermentation. John Wiley & Sons.
- 3. Hui, Yiu H., et al., eds (2004) Handbook of food and beverage fermentation technology. Vol. 134. CRC Press.
- 4. Mitchell, Alan J. (1999) "Formulation and Production Carbonated Soft Drinks". Springer Science & Business Media.
- 5. Woodroof, Jasper Guy, and G. Frank Phillips. (1981) Beverages: carbonated and noncarbonated. AVI Pub. Co.

REFERENCE BOOKS:

- 1. Ashurst, P.R, "Chemistry and technology of Soft drink and fruit juices", 2nd edition, Blackwell Publishing Ltd. 2005.
- 2. Steen, D.P and Ashurst, P.R, "Carbonated soft drinks Formulation and manufacture", Blackwell Publishing Ltd. 2000.
- 3. "Brewing yeast and fermentation Chris Boulton and David Quain", Blackwell Science Ltd Prevention of Food Adulteration Acts and Rules Manual".
- 4. Philip R. Ashurst. 2005. Chemistry and Technology of Soft Drinks and Fruit Juices, 2nd Ed. Blackwell Publishing Ltd., Oxford, UK

WEB LINKS:

- 1. https://books.google.com/books/about/Beverages_Processing_and_Technology.ht ml?id=3Q2NDwAAQBAJ
- 2. https://www.omicsonline.org/scholarly/food-and-beverage-technology-journalsarticles-ppts-list.php

CO PO Mapping

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|------------|------------|-----|------------|-----|------------|------------|------------|------------|-------------|-------------|-------------|------|------|
| CO1 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO2 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO3 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO4 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO5 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| Average | 2.2 | 1.2 | 1 | - | - | - | - | - | - | - | - | 1 | 3 | 2 |

Semester-VI

23BTFT6E03 NEW PRODUCT DEVELOPMENT AND SENSORY 3H-3C SCIENCE

Instruction Hours/week: L:3 T:0 P:0

Marks: Internal:40 External: 60 Total:100 End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course is for students to,

- To explain about the importance and applications of sensory analysis.
- To illustrate the methods and different types of tests used for sensory analysis.
- To describe a different knowledge on assessors and its role on sensory valuation.
- To apply the basic concepts of product development along with their success and flaws.
- To identify the processes involved in product development.

COURSE OUTCOMES:

Upon completion of this course, students will be able to,

- Explain the applications of sensory analysis.
- Identify the methods used for various sensory evaluations.
- Summarize the assessor's role in sensory test.
- Explain the basic concepts of product development.
- Relate the various strategies involved in the new product development process.

UNIT I - INTRODUCTION TO SENSORY ANALYSIS

Background and importance of Sensory Analysis, Definition of Sensory Analysis, Fields of Application of Sensory Analysis, Legislation on Sensory Analysis, Sensory perception and the organs of senses.

UNIT II - METHODOLOGY OF SENSORY ANALYSIS

Preparation of trial, Location of test and tasting Rooms, Sample preparation, supplies and equipment, materials, preparation procedure, sample preparation, order, coding, number of samples, product sampling Sensory evaluation techniques, Types of tests Differentiation sensory tests, Variables and scales, Descriptive sensory tests Affective sensory tests. Factors affecting sensory verdicts, physiological factors, psychological factors, poor physical condition.

UNIT III – ASSESSORS

Selection, training and monitoring, Assessors, Types of assessors, Factors influencing sensory evaluations, features of assessors, Selection, training and monitoring of assessors: Recruitment, Selection, Training, Monitoring. Applications and Advances inElectronic-Nose Technologies, Aroma Types and Characteristics, Conceptual Development of the Electronic Nose and instrumentation, Data Analysis for ElectronicNoses, E nose applications. Computer aided sensory evaluation of

9

9

Karpagam Academy of Higher Education (Deemed to be University), Coimbatore

food & beverage, statistical analysis of sensory data.

UNIT IV – CONCEPTS

Concept of product development - product success and failure, factors for success, process of product development, managing for product's success. Innovation strategy -possibilities for innovation, building up strategy, product development programme.

UNIT V - PRODUCT DEVELOPMENT PROCESS

The product development process - Open Innovation Stage Gates Processes - product strategy, product design and process development, product commercialization, product launch and evaluation. Legal issues in product development.

TEXT BOOKS:

- 1. Meilgaard Morten; Sensory evaluation techniques Stone Herbert; Sensoryevaluation practices. ISBN: 0-12-672690-6
- Schaffner, D. J., W. R. Schroeder e M. D. Earle; Food Marketing: An InternationalPerspective 2nd ed, McGraw Hill, 2003. ISBN: 978-0072952889

REFERENCE BOOKS:

1. Varela, P. e G. Ares; Novel Techniques in Sensory Characterization and Consumer Profiling, CRC Press, 2014. ISBN: ISBN 9781466566293

WEB LINKS:

- 1. https://www.researchgate.net/publication/349438296_Trends_of_Using_Sensor y_Evaluation_in_New_Product_Development_in_the_Food_Industry_in_Count ries_That_Belong_to_the_EIT_Regional_Innovation_Scheme
- 2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7922510/

| | | | pping | | | | | | | | | | | |
|------------|------------|-----|-------|------------|-----|------------|------------|------------|------------|------|------|------|------|------|
| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 2 | 1 | - | - | - | - | - | - | - | I | 1 | 1 | 3 | 2 |
| CO2 | 3 | 2 | 1 | - | - | - | - | - | - | I | 1 | 1 | 3 | 2 |
| CO3 | 2 | 1 | - | - | - | - | - | - | - | I | 1 | 1 | 3 | 2 |
| CO4 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 1 | 3 | 2 |
| CO5 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 1 | 3 | 2 |
| Average | 2.2 | 1.2 | 1 | _ | - | _ | _ | _ | _ | _ | 1 | 1 | 3 | 2 |

CO PO Manning

9

9

TOTAL:45

9

9

9

Semester-VI

23BTFT6E04 MARKETING MANAGEMENT AND INTERNATIONAL 3H-3C TRADE

Instruction Hours/week: L:3 T:0 P:0

Marks: Internal:40 External: 60 Total:100 End Semester Exam:3 Hour

COURSE OBJECTIVES:

The goal of this course is for students to:

- To summarize the concepts in marketing management and realize its scope.
- To explain the consumers buying behavior and information systems in marketing.
- To apply the marketing planning processes and classify the types of food consumption across the globe.
- To interpret the concepts involved in international marketing and trading.
- To explain the major role of government in trading process.

COURSE OUTCOMES:

Upon completion of this course, students will be able to:

- Explain the concepts of marketing and market Structure.
- Interpret the policies in marketing planning and advertisements.
- Infer the overall concepts involved in international marketing and trade developments.
- Apply the role of export and import strategies and government roles inmarketing.
- Summarize the marketing principles, its structure and government policies inexport and import tradings.

UNIT I - CONCEPTS OF MARKETING AND MARKET STRUCTURE

Concept of marketing, functions of marketing, Concepts of marketing management, scope of marketing management, Marketing management process, Concepts of marketing- mix, elements of marketing- mix, Types of marketing channel, Concept of market structure, Marketing environment -Micro and macro environments.

UNIT II - CONSUMERS BUYING BEHAVIOR

Consumers buying behaviour, consumerism, Marketing opportunities analysis: marketing research and marketing information systems, Market measurement- present and future demand, market forecasting, Market segmentation – bases of market segmentation- industrial market segmentation, targeting and positioning, Allocation andmarketing resources.

UNIT III - MARKETING PLANNING PROCESS AND ADVERTISING

Marketing planning process, Product policy and planning: product-mix, product line, product life Cycle, New product development process, Product brand, packaging, services decisions, Marketing channel decisions. Retailing, wholesaling and distribution, Pricing decisions, Price determination and pricing policy of milk products organized and unorganized sectors of dairy industry, Promotion-mix decisions, Advertising, how advertising works, deciding advertising objectives, Advertising budget, Advertising message, media planning, personal

selling, publicity, sales, promotion. World consumption of food: Patterns and types of food consumption acrossthe globe.

UNIT IV - INTERNATIONAL MARKETING AND TRADE

International marketing and international trade, salient features of international marketing Composition & direction of Indian exports, international marketing environment.

UNIT V - EXPORTS AND ROLE OF GOVERNMENT AGENCIES IN TRADE 9

Exports- direct exports, indirect exports, Licensing, Joint ventures, Direct investment, product price, place and promotion elements. Export trends and prospects of food products in Indian Government institutions related to international food trade: APEDA, Tea Board, Spice Board, MOFPI, etc. WTO and world trade agreements related to foodbusiness.

TOTAL: 45

9

TEXT BOOKS:

- 1. Philip Kotler, Kevin Lane Keller, Abraham Koshy, Mithileshwar Jha. 2013. Marketing Management: A South Asian Perspective, 14th Ed. Pearson Education.
- 2. Willium J. Stanton. 2010. Fundamentals of Marketing. Tata McGraw-Hill Publication, New Delhi.

REFERENCE BOOKS:

- 1. C.N. Sontakki. 2014. Marketing Management. Kalyani Publishers, New Delhi.
- John Daniels, Lee Radebaugh, Brigham, Daniel Sullivan. 2013. International Business, 15th Ed., Pearson Education. Aswathappa. International Business. Tata McGraw-Hill Education, New Delhi.

WEB LINKS:

- 1. http://ecoursesonline.iasri.res.in/course/view.php?id=102
- 2. https://sk.sagepub.com/books/international-marketing-management

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|------------|-----|-----|------------|-----|------------|------------|------------|------------|-------------|------|------|------|------|
| CO1 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO2 | 2 | 1 | - | - | - | - | - | 1 | - | - | - | 1 | 3 | 2 |
| CO3 | 2 | 1 | - | - | - | - | - | 1 | - | - | - | 1 | 3 | 2 |
| CO4 | 3 | 2 | 1 | - | - | - | - | 1 | - | - | - | 1 | 3 | 2 |
| CO5 | 2 | 1 | - | - | - | - | - | - | _ | - | - | 1 | 3 | 2 |
| Average | 2.2 | 1.2 | 1 | - | - | - | - | 1 | - | - | - | 1 | 3 | 2 |

CO PO Mapping

PROFESSIONAL ELECTIVE – IV SEMESTER - VI

B. Tech. - Food Technology

23BTFT6E05

FOOD PROCESS AUTOMATION

Instruction Hours/week: L:3 T:0 P:0

COURSE OBJECTIVES:

The goal of this course is for students to:

- To infer the automated evaluation of food quality
- To summarize the concepts for data acquisition
- To outline the modelling strategies
- To classify and predict samples for quality
- To interpret food process quality control using predictive models

COURSE OUTCOMES:

Upon completion of this course, students will be able to:

- Summarize the food quality measurements using automation.
- Illustrate the techniques for data acquisition.
- Compare and contrast theoretical and empirical modelling.
- Interpret the various methods to grade food samples.
- Demonstrate the methods for process control.

UNIT I –INTRODUCTION

Food quality, automated evaluation of food quality, food quality quantization and process control, typical problems in food quality evaluation e.g., beef quality evaluation; food odor measurement, continuous snack food frying quality.

UNIT II – DATA ACQUISITION

Sampling elaboration with examples, concepts and systems for data acquisition such as: ultrasonic signal acquisition for beef grading, electronic nose data acquisition for food odor measurement, snack food frying data acquisition for quality process control, Image acquisition: elaboration with examples.

UNIT III - DATA ANALYSIS AND MODELLING

Data preprocessing, Static data analysis, Dynamic data analysis, Image processing: Image segmentation, Image feature extraction etc. Modeling strategies: Theoretical and empirical modeling, Static and dynamic modeling, Linear statistical modeling, ANN modeling etc.

UNIT IV – PREDICTION

Prediction and classification, Sample classification for beef grading, examples such as, based on linear statistical and ANN models, electronic nose data classification for food odor pattern recognition, Snack food classification for eating quality evaluation based on linear statistical and

End Semester Exam:3 Hour

Marks: Internal:40 External: 60 Total:100

2023 - 2024 Semester-VI 3H-3C

9

9

9

ANN models, One-step-ahead prediction.

UNIT V CONTROL

9

Process control, Internal model control, Predictive control, Neuro-fuzzy PDC for snack food frying process, Systems integration: Food quality quantization systems integration, Food quality process control systems integration, Food quality quantization and process control systems development.

TOTAL:45

TEXT BOOKS:

- 1. Jain, M. K., Iyengar, S. R. K. and Jain, (New Age International, 2007)
- 2. Sastry, S. S. Introductory Methods of Numerical Analysis. (Prentice I fall of India, 2007)
- 3. I. Atkinson, K. Elementary Numerical Analysis, (Wiley, 2006)

REFERENCE BOOKS:

- 1. Grewal, B.S. Numerical Mehods in Engineering maths and Sciences, (Khanna Publishers, 2005)
- 2. Rao, K. S. Numerical Methods for Sciences and Engineers, (Prentice I fall of India, 2007) **WEB LINKS:**
 - $1. \ https://www.researchgate.net/publication/357732780_Development_of_automated_system s_for_the_implementation_of_food_processing$
 - 2. http://www.eolss.net/sample-chapters/c18/e6-43-35-01.pdf

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|------------|-----|-----|------------|-----|------------|------------|------------|------------|------|------|------|------|------|
| CO1 | 2 | 1 | - | - | _ | - | - | - | - | - | I | - | 3 | 2 |
| CO2 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | 3 | 2 |
| CO3 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | 3 | 2 |
| CO4 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | 3 | 2 |
| CO5 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | 3 | 2 |
| Average | 2 | 1 | - | - | - | - | - | - | - | - | - | - | 3 | 2 |

CO PO Mapping

Semester-VI

23BTFT6E06 ENERGY CONSERVATION IN FOOD DESIGN 3H-3C

Instruction Hours/week: L:3 T:0 P:0

Marks: Internal:100 External: 60 Total:100 End Semester Exam:3 Hour

COURSE OBJECTIVE:

The goal of this course is for students to:

- To explain the fundamentals of energy flow in a food industry.
- To illustrate the conservation technologies applied to food processing facilities.
- To demonstrate the energy saving opportunities in a food plant.
- To interpret the energy saving ways in emerging food processing systems.
- To outline the conversion of Food processing wastes into energy.

COURSE OUTCOMES:

Upon completion of this course, students will be able to:

- Summarize the importance of sustainability in food industry.
- Explain the thermodynamic cycles applied to food industry for improved efficiency.
- Infer the energy consumption pattern to save energy.
- Illustrate the energy efficiency and conservation in food processing.
- Interpret the food conversion technique for reuse.

UNIT I –INTRODUCTION

9

9

9

Fundamentals of Engineering Analysis and Management: Fundamentals of Meat Transfer, Fluid Mechanics, and Thermodynamics in Food Processing, Fundamentals of Energy Auditing, Sustainability in the Food Industry.

UNIT II – ENERGY CONSERVATION TECHNOLOGIES APPLIED TO FOOD PROCESSING FACILITIES 9

Energy Conservation in Steam Generation and Consumption System, in Compressed Air System, in Power and Electrical Systems, in Heat Exchangers, Waste-heat Recovery and Thermal Energy Storage in Food Processing Facilities, novel Thermodynamic Cycles Applied to the Food Industry for Improved Energy Efficiency.

UNIT III- ENERGY SAVING OPPORTUNITIES IN EXISTING FOOD PROCESSING

Facilities: Energy Consumption pattern, Energy Conservation in Grains and Oilseeds Milling Facilities, in Sugar and Confectionary Processing Facilities, in Fruit and Vegetable Processing Facilities, in Dairy Processing Facilities, in Meat Processing Facilities, in Bakery Processing Facilities.

UNIT IV- ENERGY CONSERVATION IN EMERGING FOOD PROCESSING SYSTEMS

Membrane Processing of Foods, Energy Efficiency and Conservation in Food irradiation in Pulsed Electric Fields Treatment, in High- Pressure Food Processing, in Microwave Heating, in

Supercritical Fluid Processing.

UNIT V- CONVERSION OF FOOD PROCESSING WASTES INTO ENERGY 9

Food Processing Wastes and Utilizations, Anaerobic Digestion of Food Processing Wastes, Fermentation of Food Processing Wastes into Transportation Alcohols, Bio-diesel Production from Waste Oils and Fats, Thermo-chemical Conversion of Food Processing Wastes for Energy Utilization.

TOTAL:45

TEXT BOOKS:

- 1. Wang, L. Energy Efficiency & Management in Food Processing (CRC Press, 2009)
- 2. Mattsson, B.and Sonesson, U. Environmemally Friendly Food Processing, (CRC Press, 2003)

REFERENCE BOOKS:

1. Singh, R. P.Energy in Food Processing, (Elsevier Publishing Co.. 1986)

WEB LINKS:

- 1. https://www.researchgate.net/publication/318967494_Energy_Consumption_and_Reduction_ Strategies_in_Food_Processing
- 2. https://onlinelibrary.wiley.com/doi/10.1002/9781118634301.ch16

CO -PO Mapping

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|------------|-----|-----|------------|-----|------------|------------|------------|------------|------|------|-------------|------|------|
| CO1 | 2 | 1 | - | - | - | - | - | - | - | - | I | 1 | 3 | 2 |
| CO2 | 2 | 1 | - | - | - | - | - | - | - | - | I | 1 | 3 | 2 |
| CO3 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO4 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO5 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| Average | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
Semester-VI

23BTFT6E07 PROCESS CONTROL FOR FOOD ENGINEERS 3H-3C

Instruction Hours/week: L:3 T:0 P:0

Marks: Internal:40 External:60 Total:100 End Semester Exam:3 Hour

COURSE OBJECTIVES:

The goal of this course is for students to:

- To summarize the fundamentals of sensors and control concepts.
- To explain the concepts of system analysis and control.
- To summarize the knowledge about the working of various sensors.
- To illustrate mathematical model for a system.
- To interpret the suitable control schemes of particular system.

COURSE OUTCOMES:

Upon completion of this course, students will be able to:

- Summarize the mathematical model of a system.
- Outline the response of different order systems for various test inputs.
- Identify the stability of the system.
- Apply the knowledge of various Measuring Instruments design a simple Instrumentation system.
- Infer the Mathematical Model of a physical system. Analyze and decide suitable control schemes for a particular system.

UNIT I - INTRODUCTION TO PROCESS CONTROL

Introduction – measurement system - characteristics of instruments, static and dynamic characteristics System – steady state design – process control – process control block diagram – definition of a process, measurement, controller, and control element, loop –damped and cyclic response- feedback control – transient responses – lap lace transform of simple functions – step function, exponential function, ramp function and sine function.

UNIT II - CONTROL SYSTEMS

Open and closed loop systems, servo - mechanisms, hydraulic and pneumatic control systems, two-way control, proportional control, differential control and integral control. Control valve – Construction and working of pneumatically operated valve and spring – diaphragm Actuator.

UNIT III - STABILITY ANALYSIS

Signal flow graph – Mason's Gain formula, Block diagram algebra. Stability – conceptof stability, definition of stability in a linear system, stability criterion, characteristic equation, Routh test for stability

UNIT IV - PRESSURE AND TEMPERATURE SENSORS

Pressure measurement – Construction and working of capacitive pressure sensor, Inductive pressure sensor, strain gauge, pressure sensor, diaphragm, bourdon tube, differential pressure

9

9

9

cell Temperature sensors –Construction and working of RTD, Thermistors, Thermocouples, bimetallic strips.

UNIT V - LEVEL SENSOR

Simple float systems, capacitive sensing element, radioactive methods (nucleonic level sensing) – ultrasonic level sensor. Measurement of density – U-type densitometer, Buoyancy meter Measurement of composition – Electrical conductivity cell, non-dispersive photometers, pH meter, Gas chromatograph, Mass spectrometer.

TOTAL:45

9

TEXT BOOKS:

- 1. J.F Richardson A D. G. Peacock, Coulson & Richardson's (2006), "Chemical Engineering", Volume3, Butherworth Heinemann, an imprint of Elsevier.
- 2. Donald R. Coughanowr. (2008), "Process System analysis and control" Mc- GrawHill International Edition, Second Edition, singapore.
- 3. Nagoorkani. A (2012), "Control Systems", RBA publications, 2nd edition, ninteenth reprint.
- 4. S. Baskar (2004)," Instrumentation control system measurements and controls"Anuradha Agencies Publishers.
- 5. Nagrath, M and Gopal, I.J (2003), "Control Systems Engineering", Wiley Eastern Limited, Third Edition Reprint.

REFERENCE BOOKS:

- 1. Renganathan (2003), "Transducer engineering, Allied publishers, New Delhi.
- 2. Patranabis (2004), "Principles of industrial instrumentation", Prentice Hall India. Patranabis, D., (1997) Second Edit Tata McGraw Hill Publishing Co. Ltd. New Delhi. ISBN 0074623346.
- 3. Bakshi.U.A and A.V.Baksi 2004. Measurements and Instrumentation. Technical Publications Pune.
- 4. E.O.Doeblin. Measurement Systems application and design, McGraw-Hill Publishing Company Limited.

WEB LINKS:

- 1. https://onlinelibrary.wiley.com/doi/10.1002/9783527634361.ch18
- 2. https://nscpolteksby.ac.id/ebook/files/Ebook/Hospitality/Food%20Processing%20Handb ook%20(2006)/11%20-%20Process%20Control%20In%20Food%20Processing.pdf

CO -PO Mapping

| CO No | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|------|------|------|------|
| CO1 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO2 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO3 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO4 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO5 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| Average | 2.4 | 1.4 | 1 | - | - | - | - | - | - | - | - | 1 | 3 | 2 |

Semester-VI

23BTFT6E08 WASTE MANAGEMENT IN FOOD INDUSTRIES 3H-3C

Instruction Hours/week: L:3 T:0 P:0

Marks: Internal:40 External: 60Total:100 End Semester Exam:3 Hour

COURSE OBJECTIVES:

The goal of this course is for students to:

- To summarize importance of treating waste product from food industry.
- To explain the treatment methods and recycling of waste product from food industry.
- To identify the effective utilization or disposal of food waste.
- To explain the characterization and chemical properties of food waste.
- To relate or minimize the impact of food waste on the environment.

COURSE OUTCOMES:

Upon completion of this course, students will be able to:

- Explain the awareness of importance in treating waste product from food industry.
- Illustrate the knowledge of treatment methods and recycling of waste product from foodindustry.
- Relate the handling of industrial waste with necessary precautions to avoid infection and cross contamination.
- Summarize the methods of treatment.
- Interpret the controlling of environmental pollution by proper treatment of food waste.

UNIT I – ENVIRONMENTAL POLLUTION AND FOOD WASTE CHARACTERIZATION

Environmental problems – Pollution – air, water, soil, noise, and radiation pollution. Classification and characterization of waste from various food industries. Need for treating waste from various food industries. Pollution due to Food Industry wastes - solid and liquid wastes – characteristics and impact on environmental quality.

UNIT II – WASTE FROM FOOD INDUSTRIES AND BY-PRODCUT UTILIZATION

Wastes from fruit and vegetable processing, meat and poultry processing, fish processing, dairy processing, cereal processing and beverage processing industries– characteristics and effect on soil, water and air quality – by-product utilization.

UNIT III - WASTEWATER MANAGEMENT IN FOOD INDUSTRIES

Principles of Physical treatment - screening, sedimentation, filtration, back washing, membrane separation. Principles of Chemical treatment - coagulation, floculation, precipitation, flotation, disinfection and fluoridation. Principles of biological treatment

9

9

– aerobic process, activated sludge process, trickling filters, anaerobic digestion, UASB reactor.

UNIT IV – SOLID WASTE MANAGEMENT IN FOOD INDUSTRIES

Solid waste management techniques – Principles and practices, 4R concept. Composting – methods of composting, vermicomposting. Incineration, pyrolysis, briquetting – value addition – SCP, enzymes, pectin and other products.

UNIT V-ENVIRONMENTAL PROTECTION AND POLLUTION CONTROL IN FOODINDUSTRIES 9

International and national scenario on disposal of waste from food industries. Green chemistry - Principles and application in food Industries - CDM - Eco friendly products food industry - Biocolorants - Eco friendly packaging - ¬Eco labeling – Occupational and Bio safety in food industries. Global treaties, conventions – National and State Level Organizations – EnvironmentalLaws and Acts; Regulatory issues with food industry waste.

TOTAL:45

9

TEXT BOOKS:

- 1. Ioannis S. Arvanitoyannis, Waste Management for the Food Industries, Academic Press, 2008.
- 2. S.N. Jogdhand, Environmental Biotechnology: Industrial Pollution Management,(III ed), Himalaya Publishing House, New Delhi, 2010.
- 3. Lawrence K.Wang, Yung-Tse Hung, Howard H.L and Constantine Yapijakis, Waste Treatment in the Food Processing Industry, CRC press, Taylor and Francis Group, 2006.
- 4. Singh, N Shree and Tripathi D Rudra, Environmental BioremediationTechnologies, Springer Verlag Publishers, 2007.

REERENCE BOOKS

- 1. D. Hamilton and Stephen Crossley, Pesticide Residues in Food and Drinking Water Human Exposure and Risks, John Wiley & Sons Publishers, 2003.
- 2. Vasso Oreopoulou and Winfried Russ. "Utilization of by-products and Treatment of Waste in the Food Industry". Springer, 2007.
- 3. Patwardhan., Industrial Waste Water Treatment, Prentice-Hall of India Pvt Ltd,1stedition, 2008.

WEB LINKS:

- 1. https://www.diva-portal.org/smash/get/diva2:1111065/FULLTEXT01.pdf
- 2. https://www.sciencedirect.com/book/9780123736543/waste-management-for-the-food-industries

CO PO Mapping

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|------------|-----|-----|-----|-----|------------|------------|------------|------------|-------------|------|------|------|------|
| CO1 | 2 | 1 | - | - | - | - | - | 1 | - | - | - | 1 | 3 | 2 |
| CO2 | 2 | 1 | - | - | - | - | - | 1 | - | - | - | 1 | 3 | 2 |
| CO3 | 2 | 1 | - | - | - | - | - | 1 | - | - | - | 1 | 3 | 2 |
| CO4 | 2 | 1 | - | - | - | - | - | 1 | - | - | - | 1 | 3 | 2 |
| CO5 | 2 | 1 | _ | - | - | - | - | 1 | - | - | - | 1 | 3 | 2 |
| Average | 2 | 1 | - | - | - | - | - | 1 | - | - | - | 1 | 3 | 2 |

2023 - 2024

Semester-VI **3H-3C**

Instruction Hours/week: L:3 T:0 P:0

Marks: Internal:40 External: 60Total:100 End Semester Exam: 3 Hour

COURSE OBJECTIVE:

The goal of this course is for students to:

- To explain different food colors. .
- To interpret the properties and application of food colors. •
- To outline different food flavors and its application. •
- To explain the applications of food colors and its emerging techniques. •
- To describe the Quality control techniques and regulations involved in • colors and flavors.

COURSE OUTCOMES:

Upon completion of this course, students will be able to:

- Summarize the synthetic and natural food colors. •
- Explain the importance of food colors and their applications in different fields. •
- Interpret the various food flavors and their application. •
- Infer the applications of food coloring and its advancement.
- Explain the regulations involved in the safer use of colors and flavors in foods. . Infer the importance of food colorants and flavorants.

UNIT I - FOOD COLOURS

Introduction - Natural and Synthetic food Colors - Class and description of food colors-Physical form of food colors - Stability, storage and solubility of food colors -Regulations and safety assessment - Labeling requirements for food containing color additives - Adulteration and misbranding of color additives in foods.

UNIT II - PROPERTIES AND ANALYSIS OF FOOD COLOURS

Food color stability, Importance of food colors for food products - Methods of analysis for food colour - Quality and safety assessment - Applications of natural and synthetic food colours.

UNIT III - FOOD FLAVOURS

Introduction - Classification - flavor forms: water soluble liquid flavours - oil soluble liquid flavours, emulsion-based flavours, dispersed flavours, spray dried flavours – commercial considerations -Flavor characteristics - Flavor compounds - Natural and artificial flavoring materials - Flavoring constituent of various foods like meat, fish, milk, vegetables, fruits, fats & oils, spices & herbs, cereals and pulses. Changes in flavouring components and characteristics during cooking/processing of various foods. Effects of storage, processing, transportation and environmental conditions on flavor Components/constituents.

9

9

23BTFT6E09

FOOD COLORANTS AND FLAVORANTS

UNIT IV - FOOD FLAVOR: APPLICATIONS AND RECENT DEVELOPMENT

Culinary and Meat Products, bakery products, snack foods, sugar based confectionary products, dairy products and soft drinks - Changes in food flavor due to processing – flavor release from foods - Factors that affect the flavour and control of flavour in processed foods. Recent developments in flavor research, processing and technology.

UNIT V - FOOD FLAVOR: QUALITY CONTROL

Flavouring and coating technologies for preservation and processing of foods. Natural flavor enhancers for food and beverage, Quality Control – analytical, sensory and adulteration testing. Measurement of flavour, particularly for wine, tea, coffee, species and condiment.

TOTAL:45

9

TEXT BOOKS:

- 1. Spices and Flavor Technology. J.S. Pruthi, ICAR Publications, 2ndEdition, 1998.
- 2. Fenaroli, G, Handbook of flavour ingredients, CRC Press. Bota Rica, New York,2005.
- 3. Yamanishi, T, Recent advances in flavour researches, Dekker, New York, 2005.
- 4. Andrew J. Taylor and Robert S. T. Linforth, Food Flavour Technology, Blackwell Publishing Ltd, 2010.

REFERENCE BOOKS:

- 1. Suvendu Bhattacharya, Conventional and Advanced Food ProcessingTechnologies, Wiley Publishers, 2015.
- 2. Heath, HB, Flavour chemistry and technology, CBS Publ., New Delhi, 2005.

WEB LINKS:

- 1. https://onlinelibrary.wiley.com/doi/book/10.1002/9781119114796
- 2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8002548/

CO PO Mapping

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|------|-------------|------|------|
| CO1 | 2 | 1 | - | - | - | - | - | - | - | I | - | 1 | 3 | 2 |
| CO2 | 2 | 1 | - | - | - | - | - | - | - | I | - | 1 | 3 | 2 |
| CO3 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO4 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO5 | 2 | 1 | _ | _ | _ | _ | - | _ | _ | _ | _ | 1 | 3 | 2 |
| Average | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |

Semester-VI 23BTFT6E10 BIOLOGICALLY ACTIVE PHYTOCHEMICALS 3H-3C IN FOODS

Instruction Hours/week: L:3 T:0 P:0 Marks: Internal:40 External: 60Total:100 End Semester Exam:3 Hour

COURSE OBJECTIVES:

The goal of this course is for students to:

- To summarize Treatment methods and recycling of waste product from food industry
- To demonstrate the utilization or disposal of food waste
- To infer the characterization and chemical properties of food waste
- To interpret or minimize the impact of food waste on the environment
- To utilize value added products from food processing, industrial wastes

COURSE OUTCOMES:

Upon completion of this course, students will be able to:

- Summarize on the importance in treating waste product from food industry.
- Apply the knowledge of treatment methods and recycling of waste product from food industry.
- Illustrate on the industrial waste with necessary precautions to avoid infection and cross contamination.
- Interpret the sludge and effluents discharged from food industries meet the limitation by law.
- Explain on the control of environmental pollution by proper treatment of food waste.

UNIT I –BIOSYNTHESIS AND SIGNIFICANCE

Phytochemicals in food and their characteristics– the plants as chemical factories. synthesis of isotopically Labeled Phytoestrogens; Significance of phytochemicals in human nutrition.

UNIT II -ANALYSIS OF PHYTOCHEMICALS

Qualitative and quantitative methods, phytoestrogens in plants-isoflavones- flavonolspolyphenols-tannins-saponins-lignans, Multiresidue method for penicillins and cephalosporins in Bovine muscle.

UNIT III -ANTIOXIDANT ACTIVITY AND THEIR ASSESMENT

In vitro and In vivo methods for the assessment of antioxidant activity, Comparison of different methods to evaluate the antioxidant. Prediction of the antioxidant activity of natural phenolics from electrotopological state indices. Optimising phytochemical release by process technology; Variation of Antioxidant Activity during technological treatments, new food grade peptidases from plant sources.

9

9

UNIT IV – BIOAVAILABILITY

Factors affecting bioavailability, chemical and characterization of cell histochemical wall polysaccharides in almond seed in relation to lipid bioavailability

UNIT V- OPTIMISING PHYTOCHEMICAL

Optimizing phytochemical release by process technology, Variation of Antioxidant Activity during technological treatments, new food grade peptidases from plant sources.

TOTAL:45

9

TEXT BOOKS:

- 1. Gilbert, John and H. Z. Senyuva "Bioactive Compounds in Food". Blackwell
- 2. Meskin, Mark S., W.R. Bidlack and R.K. Randolph. "Phytochemicals : Nutrient-Gene Interactions". CRC / Taylor & Francis, 2006.

REFERENCE BOOKS:

- 1. Premier, Robert. "Phytochemicals in Food". Blackwell, 2010.
- 2. Johnson, Ian and Gary Williams. "Phytochemical Functional Foods". CRC Press, 2003.

WEB LINKS:

- 1. https://pubs.acs.org/doi/10.1021/np000779q
- 2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7247320/

CO -PO Mapping

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|------------|-----|-----|-----|-----|------------|------------|------------|------------|------|------|------|------|------|
| CO1 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO2 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO3 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO4 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO5 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| Average | 2.2 | 1.2 | 1 | - | - | - | - | - | - | - | - | 1 | 3 | 2 |

Semester-VI23BTFT6E11LIVESTOCK AND MARINE TECHNOLOGY3H-3C

Instruction Hours/week: L:3 T:0 P:0 Marks: Internal:40 External: 60Total:100 End Semester Exam:3 Hour

COURSE OBJECTIVES

The goal of this course is for students:

- To define meat composition, structure, chemistry and microbial safety of meat.
- To outline the various methods involved in the slaughtering and carcass processing of meat.
- To summarize the variety of meat products, equipment employed and safety of meat processing plant.
- To explain the overall processing of poultry meat and their products.
- To infer the processing of different marine based products.

COURSE OUTCOMES

Upon completion of the course, students will be able to:

- Explain the chemical composition, structure, color, flavor, and microbial safety of meat.
- Demonstrate the various technological ideas in preparation of various types of meat products and design of equipment used for processing meat.
- Infer the HACCP and GMP of meat processing.
- Outline the processing of poultry meat, meat products and egg products.
- Interpret the production, processing, spoilage, preservation and storage of marine products.

UNIT I - CHEMISTRY AND MICROBIOLOGY OF MEAT

Meat composition from different sources; Definitions and measurements, Explanation of muscle structure and compositions and its modifiers, White and Red Meat, Description of animal fat and its modifiers, description of bone and its modifiers; Post mortem muscle chemistry, Meat color, flavors of meat products, meat microbiology and safety. - Preslaughter operations and slaughtering operations for animals – Kosher/Halal - Evaluation of animal carcasses - properties and shelf life of meat-Mechanical deboning - grading and aging - Eating and cooking quality of meat - Meat tenderization

UNIT – II PRESERVATION OF MEAT

Preservation of meat by chilling - freezing, pickling, curing, cooking and smoking, dehydration, radiation, chemical and biological preservatives - Preparation, preservation and equipment for manufacture of smoked meat and its quality evaluation

9

- Preparation, packaging and equipment for manufacture of dehydrated meat products and their quality evaluation - Preparation, preservation and equipment for manufacture of meat sausages and their quality evaluation - Abattoir design and layout.

UNIT III - MEAT PRODUCTS

Canned meat, Frozen meat, Cooked and Refrigerated meat, Dried and preserved meat, cured meat, prepared meat products, Production methods for Intermediate moisture and dried meat products, Different kinds of sausages – Equipment used for all the process operations; Safety standards in meat, poultry and egg industry: Good manufacturing practice (GMP)/ HACCP /ISO/MFPO/FSSAI.

UNIT IV – PROCESSING AND PRESERVATION OF POULTRY PRODUCTS AND EGGS 9

Poultry industry in India, measuring the yields and quality characteristics of poultry products, microbiology of poultry meat, spoilage factors; Plant sanitation; Poultry meat processing operations in detail along with equipment used – De feathering, bleeding, Scalding etc.; Packaging of poultry products, refrigerated storage of poultry meat, – Egg-Structure of Egg - Chemical composition of egg- Nutritive value and Functional Properties of Egg - Preservation of Eggs - Shell Egg Preservation - Liquid Egg Preservation - Microbial Spoilage of Eggs - Evaluation of Egg Quality – Interior and Exterior quality - Grading of Eggs. by products – eggs, egg products, Whole egg powder, Egg yolk products, their manufacture, packaging and storage.

UNIT V - FISH AND OTHER MARINE PRODUCTS PROCESSING

Commercially important marine products from India, Basic biochemistry, spoilage factors of fish, field refrigeration and icing practice, merits and demerits, Use of dry ice and liquid nitrogen as preservation elements, use of Refrigerated Sea Water (RSW) for preservation, Changes during storage in RSW and CSW; Freeze preservation; freezing of prawn and shrimp, weighing, filling and glazing, Individual quick freezing -relative merits and demerits, canning operations, Salting and drying of fish, pickling and preparation of fish protein concentrate and fish oil. - HACCP - implementation of HACCP in fish and marine processing - Quality control and standards for fish, prawn and other sea foods - EU hygienic regulations in fish and marine industry.

TOTAL:45

159

9

TEXT BOOKS:

- Hui, Y.H., Nip, W.K., Rogers, R.W. Meat Science and Applications". Marcel Dekker Inc. New York, 1st Edition, 2001.
- 2. Sabel Guerrero and Hui YH. Handbook of Poultry Science Technology Volume-Wiley Publishing. 1st Edition, 2010.
- 3. Sabel Guerrero and Hui YH. Handbook of Poultry Science Technology Volume-Wiley Publishing. 1st Edition, 2010.

4. Mead, G. C.2004. Poultry meat processing and quality. CRC Press. Woodhead Publishing Limited, Abington Hall, Abington, Cambridge, England.

REFERENCE BOOKS:

- 1. Balachandran, K. K. Post-Harvest Technology of Fish and Fish Products. Daya Publishing House, New Delhi, 2002.
- 2. Hall, G.M. 1997. Fish Processing Technology, 2nd Ed. Chapman & Hall,
- 3. London, UK.
- 4. Chichester, C.O. and H.D. Graham. 1973. Microbial safety of Fishery products. Academic Press, New York.

WEBLINKS:

- 1. https://www.fao.org/3/CA1201EN/ca1201en.pdf
- 2. https://www.isaaa.org/resources/publications/pocketk/52/default.asp

CO PO Mapping

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|------------|------------|-----|------------|------------|------------|------------|------------|------------|------|------|------|------|------|
| CO1 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO2 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO3 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO4 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO5 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| Average | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |

PROFESSIONAL ELECTIVE V SEMESTER VII

| B. Tech. – Food Tech | nology | | 2023 - 2024 |
|----------------------|----------------|-------------------------|--------------------|
| | | | Semester-VII |
| 23BTFT7E01 | NOVEL F | OOD PROCESSING | 3H-3 C |
| | TEC | CHNOLOGIES | |
| Instruction Hours/we | ek: L:3T:0 P:0 | Marks: Internal:40 Exte | ernal:60 Total:100 |
| | | End Semeste | er Exam:3 Hours |
| | | | |

Course objectives

The goal of this course is for students to,

- To interpret the concepts of novel food processing techniques.
- To explain the principle and working behind the novel processing techniques.
- To summarize the application of such processes in food industry.
- To outline the concepts involved in food printing and meat analogues.
- To explain the major role of e-nose and e-tongue in sensory evaluation.

Course outcomes

Upon completion of this course, students will be able to,

- Infer the concepts and application of pulsed light and UV radiation technology.
- Outline the concepts and application of ultrasound and high-pressure processing.
- Interpret the concept, equipments involved and application of food irradiation and cold plasma.
- Illustrate the overall concepts involved in microwave and ohmic heating.
- Summarize the role of food printing in production of designer foods.

UNIT I - PULSE LIGHT AND UV TECHNIQUE

High-intensity pulse technique- Processing systems- design of static chambers- continuous chambers- other chamber designs- generation of different voltage waveforms-oscillation magnetic fields for food processing- generation of magnetic fields - mechanisms of inactivation of microorganisms in food preservation – UV treatment – principle involved – mechanism of inactivation – Pulsed electric field – principles of microbial inactivation – Generation of PEF – application in food processing.

UNIT II - ULTRASOUND & HIGH-PRESSURE PROCESSING

Ultra sound – introduction – types of pressure waves – generation of ultrasound – mechanism of microbial inactivation – application in food processing – High pressure processing – Principles –concepts – basic laws related to HPP - design of equipment - processing of food using HPP - effect on microorganisms – Application in industry.

UNIT III - FOOD IRRADIATION AND COLD PLASMA TECHNOLOGY

Food irradiation – principle of irradiation – radioactive substances – types of irradiations – construction and working of equipment – effect of irradiation on the nutritional and biochemical changes – application in food sectors – social and ethical issues – cold plasma technology – electron beam radiation - application in food processing.

UNIT IV - MICROWAVE AND OHMIC HEATING

Microwave properties – principle – design aspects of microwave equipment – interaction with food materials, material properties - application of microwave in food processing – merits and demerits – recent advancement in microwave processing - inactivation of microorganisms and

9

9

9

enzymes – electrical resistance heating of food - ohmic heating - treatment of products - Elsteril process -influence on microorganisms - food ingredients.

UNIT V - NOVEL FOODS AND BIOSENSORS

Definition-Designer foods-3D and 4D food printing-meat analogues-free from foods – Biosensors types- application of biosensors to food industry requirements- Development of Biosensors – e- nose and e- tongue and their applications in sensory evaluation of foods.

Text Books:

- 1. Nonthermal Preservation of Foods. Gustavo V. Barbosa-Canovas, Usha R. Pothakamury, Enrique Palou and Barry G. Swanson. Published by Marcel Dekker, Inc., 270, Madison Avenue, New Yorkm 10016, 1998.
- 2. Biosensors for food analysis, A O Scott, The Tetley Group Limited, UK, Woodhead Publishing Limited, Abington Hall, Abington, Cambridge, CB21 6AH, England, 2008.

REFERENCE BOOKS:

- 1. Trends in Food Engineering, Jorge E. Lozano, Cristina Anon, Efren Parada- Arias, Gustavo V. Barbosa Canovas, Contributor Jorge E. Lozano, Published byCRC Press, 2000.
- 2. Gould G.W., "New Methods of Food Preservation", Aspen Publishers, Great Britain, ISBN No. 0834213419, 1999.

WEB LINKS:

- 1. https://www.routledge.com/Novel-Food-Processing-Technologies/Barbosa-Canovas-Tapia-Cano/p/book/9780824753337
- 2. https://books.google.com/books/about/Novel_Food_Processing_Technologies.html?id =fpZ1Vpf17JkC

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|------------|-----|-----|------------|------------|------------|------------|------------|------------|-------------|------|------|------|------|
| CO1 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO2 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO3 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO4 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO5 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| Average | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |

CO-PO MAPPING

9

162

TOTAL: 45

23BTFT7E02

Course Objectives

The goal of this course is for students to,

Instruction Hours/week: L:3T:0 P:0

- To explain the basics principles, types and uses of extrusion cooking.
- To infer the importance of pre-conditioning and de-volatilization of raw materials.
- To interpret the constructional, operational and working of single and twin-screw extruders.

EXTRUSION TECHNOLOGY

• To summarize the nutritional, functional and sensory properties of extruded food products.

• To discuss the application of extrusion technology in the production and development of new product.

Course outcomes

Upon completion of this course, students will be able to,

- Identify the principles, types and uses of extrusion cooking.
- Illustrate the importance of pre-conditioning and de-volatilization of raw materials.
- Infer the constructional, operational and working of single and twin-screw extruders.
- Summarize the nutritional, functional and sensory properties of extruded food products.
- Outline the techniques of cold extrusion cooking.

UNIT I – INTRODUCTION

Extrusion: definition, introduction to extruders and their principles, types of extruders. Extruders in the food industry: History and uses of extruders in the food industry. Physical and chemical changes during extrusion cooking.

UNIT II – PRECONDITIONING

Pre-conditioning of raw materials used in extrusion process, Pre-conditioning operations and benefits of pre-conditioning and devolatilization. Interpreted-flight expanders - extruders, dry extruders- dry extruders in extrusion – pre-extrusion processes – practical considerations in extrusion processing – addition and subtraction of materials, shaping and forming at the die – post extrusion process.

UNIT III - SINGLE AND TWIN SCREW EXTRUDER

Single screw extruder: Constructional and operational characteristics, principle of working, net flow, factors affecting extrusion process, co-kneaders. Twin screw extruder: counter rotating and co-rotating twin screw extruder. Process characteristics of the twin-screw extruder: feeding, screw design, screw speed, screw configurations, die design. Barrel temperature and heat transfer, adiabatic operation, heat transfer operations and energy balances. Problems associated with twin screw extruder.

UNIT IV - CHARACTERISTICS OF VARIOUS EXTRUDED FOOD PRODUCTS

Physicochemical, rheological, textural and nutritional properties of extruded products- Sensory characteristics and nutritional value. Chemical and nutritional changes in food during extrusion

9

9

2023 - 2024 Semester-VII

Marks: Internal:40 External:60 Total:100

End Semester Exam: 3 Hours

3H-3C

9

-. Storage of extruded products- Practical considerations in extrusion processing: pre-extrusion processes, cooker extruder profiling. Addition and subtraction of materials, shaping and forming at the die, post extrusion processes

UNIT V – APPLICATION

Cold extrusion; extrusion cooking, new extrusion technology for confectionery product; Applications in different food commodities- Breakfast cereal products. Breakfast cereals: introduction, type of cooking - High shear cooking process, steam cookers, low shear, low pressure cookers and continuous steam pre-cooking, available brands. Traditional and extrusion methods, classification of breakfast cereals – flaked cereals, oven puffed cereals, gun puffed cereals, shredded products. Texturized vegetable protein: Definition, processing techniques, and foods. Snack food extrusion: Direct expanded (DX) and third generation (3G) Snacks: types, available brands, co- extruded snacks and indirect-expanded products

TOTAL: 45

9

TEXT BOOKS:

- 1. Richardson P., Thermal Technologies in Food Processing, Wood head Publishers, Cambridge, CRC Press, 2001.
- 2. Guy R. Extrusion Cooking, Technologies and Applications. Wood head Publishing Limited, Abington, Cambridge, 2001.
- 3. Fast R.B. and Caldwell E.F. Breakfast Cereals and How they are made. American Association of Cereal Chemists, St. Paul, Minnesota, 2000.

REFERENCE BOOKS:

- 1. Riaz M.N. Extruders in Food Application. CRC Press, 2000.
- 2. N.D. Frame. Technology of Extrusion Cooking. Springer, 2012.

WEBLINKS:

- 1. https://www.researchgate.net/publication/349399385_Recent_Development_Challenge s_and_Prospects_of_Extrusion_Technology
- 2. https://www.dynisco.com/userfiles/files/27429_Legacy_Txt.pdf

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|------------|------------|------------|------------|-----|------------|------------|------------|------------|-------------|------|-------------|------|------|
| CO1 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO2 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO3 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO4 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO5 | 2 | 1 | - | _ | - | _ | - | _ | _ | _ | _ | 1 | 3 | 2 |
| Average | 2.2 | 1.2 | 1 | - | - | - | - | - | - | - | - | 1 | 3 | 2 |

CO PO MAPPING

23BTFT7E03 FOOD ALLERGY AND TOXICOLOGY **3H-3C**

Instruction Hours/week: L:3T:0 P:0 Marks: Internal:40 External:60 Total:100 End Semester Exam: 3 Hours

Course Objectives

The goal of this course is for students to,

- To summarize hazards, and toxicity associated with food and their implications for health. Know the various kinds of allergens and basis of allergic reactions.
- To explain food related toxicological compounds in different foods. •
- To infer the protocols of sampling techniques in food toxicology measurements. •
- To explain the knowledge on level of processing of food to destroy allergens / toxins. •
- To outline an awareness to choose food with highly safe. •

Course Outcomes

Upon completion of this course, students will be able to,

- Summarize the different types of allergens and Natural toxins associated with food.
- Infer details about food toxicology and its hazards.
- Illustrate food sensitivity and allergy. •
- Summarize food toxin in food samples. •
- Interpret the toxins formed during processing and controlling. •

UNIT I – INTRODUCTION

Definition and need for understanding food toxicology; Hazards - Microbiological, nutritional and environmental. Basics of immune resources - humeraland cell media resources. Food Allergens and mechanism of allergic resources.

UNIT II - FOOD ALLERGY AND SENSITIVITY

Chemistry of food allergens, celiac disease, food disorders associated with metabolism, IgE and non-IgE based diseases, lactose intolerance, gluten intolerance, and asthma, primary, secondary and tertiary prevention of allergic disease and the evidence for food desensitization.

UNIT III - PRINCIPLES OF TOXICOLOGY

Natural food toxicants - toxicity of mushroom alkaloids, seafood, vegetables, fruits, pulses, and antinutritional compounds. Labelling on processed foods. Biological factors that influence toxicity, toxin absorption in the G.I.track, Industrial microflora, blood, brain barrier, storage and excretion of toxins.

UNIT IV - DETERMINATION OF TOXICANTS IN FOOD SAMPLING

Quantitative and qualitative analysis of toxicants in foods; Biological determination of toxicants Assessment of food safety – Pesticidal residues – Permitted limits, Toxicology on public health Risk assessment and risk benefit indices of human exposure, acute toxicity, mutagen city and carcinogenicity, reproductive and developmental toxicity, neurotoxicity and behavioral effect, immunotoxicity.

UNIT V - TOXICANTS FORMED DURING FOOD PROCESSING

Intentional direct additives, preservatives, nitrate, nitrite, and N- nitroso compound flavor enhancers, food colours, indirect additives, residues and contaminants, heavy metals, other organic residues and packaging materials. Toxicity of heated and processed foods, food

9

0

9

9

165

2023 - 2024

Semester-VII

carcinogens and mutagens – Polycyclic aromatic hydrocarbons, N - nitrosamines, Acrylamide and their mode of action.

TEXT BOOKS:

- 1. Helferich, William and Carl K.Winter, Food Toxicology, CRC Press, 2001.
- 2. Alluwalia and Vikas, Food Hygiene and Toxicology, Paragon International Publishers, 2007.
- 3. Shibamoto, Taka yuki and Leonard F.Bjeldanzes, Introduction to Food Toxicology, 2nd Edition, Academic Press, 2009.
- 4. Maleki, Soheila J. A.Wesley Burks, and Ricki M.Helm, Food Allergy, ASM Press, 2006.

REFERENCE BOOKS:

- 1. Cliver, Dean O. and Hans P.Riemann, Food Borne Diseases, 2nd Edition, Academic Press/Elsevier, 2002.
- 2. Riemann, Hans P. and Dean O. Cliver, Food Borne Infections and Intoxications, 3rd Edition, Academic Press/Elsevier, 2006.

WEBLINKS:

- 1. https://www.taylorfrancis.com/books/mono/10.1201/9781315371443/food-toxicology-debasis-bagchi-anand-swaroop
- 2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9777875/

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|------------|------------|-----|-----|-----|-----|------------|------------|------------|-----|------|------|------|------|------|
| CO1 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO2 | 2 | 1 | - | - | - | - | - | - | I | - | - | 1 | 3 | 2 |
| CO3 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO4 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO5 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| Average | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |

CO PO MAPPING

TOTAL: 45

B. Tech. – Food Technology

23BTFT7E04 TOTAL QUALITY MANAGEMENT **3H-3C**

Instruction Hours/week: L:3T:0 P:0 Marks: Internal:40 External:60 Total:100 End Semester Exam: 3 Hours

Course Objectives

The goal of this course is for students to,

• To infer the basic concepts of total quality management and appreciate its importance in today's business environment.

- To summarize required diagnostic skills and use various quality tools.
- To relate the concepts of Quality Management System in the industries.
- To interpret the various principles, practices of TQM to achieve quality.
- To utilize the TQM tools for continuous process improvement.

Course Outcomes

Upon completion of this course, students will be able to,

- Apply the TQM concepts for improving the quality of products and services. •
- Outline the tools and techniques of TQM for continuous improvement in quality.
- Summarize Quality Management System.
- Infer the principles, practices and statistical techniques.
- Demonstrate the quality, systems, tools and techniques. •

UNIT I – INTRODUCTION

Introduction - Need for quality - Vision, mission and policy statements of quality - Evolution of quality - Definition of quality - Dimensions of product and service quality - Basic concepts of TQM – TQM Framework - Contributions of Quality Gurus – Barriers to TQM – Cost of Quality.

UNIT II - TQM PRINCIPLES

Quality statements - Customer focus -Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Continuous process improvement - PDCA cycle, 5s, 8D methodology - Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating.

UNIT III - TQM TOOLS & TECHNIQUES I

The seven traditional tools of quality - New management tools - Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT – Bench marking – Reason to bench mark, Bench marking process - FMEA - Requirements of reliability, Failure rate, Stages, Types, Process and Documentation.

UNIT IV - TQM TOOLS & TECHNIQUES II

Quality circles - House of quality - Building of HOQ- Quality Function Deployment (QFD) -Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures - BPR.

UNIT V - OUALITY SYSTEMS

Need for ISO 9000- ISO 9000-2000 Quality System - Elements, Documentation, guideline for performance improvement - Quality auditing- QS 9000 - ISO 14000 - Concepts, Requirements and Benefits -Quality Council - Leadership, Employee involvement - Motivation, Empowerment, Team and Teamwork, Recognition and Reward.

9

9

9

9

9

167

2023 - 2024 Semester-VII

TEXT BOOKS:

- 1. Besterfiled, Dale H. et al., "Total Quality Management", 4thEdition, Pearson Education Asia, 2006.
- 2. Evans, James R. and William M. Lindsay, "The Management and Control of Quality". 6th Edition South-Western (Thomson Learning), 2005.
- 3. Suganthi, L and Anand Samuel, "Total Quality Management", PHI, 2006.

REFERENCE BOOKS:

- 1. Janakiraman, B and Gopal, R.K, "Total Quality Management Text and Cases". PHI, 2006.
- 2. Poornima M. Charantimath., Total quality management, Pearson Education, 2ND Edition, 2011.

WEBLINKS:

- 1. https://link.springer.com/chapter/10.1007/978-1-4615-2055-9_2
- 2. https://www.tandfonline.com/toc/ctqm20/current

| | | TATTT 1 | I II IO | | | | | | | | | | | |
|------------|------------|---------|---------|------------|-----|------------|------------|------------|------------|-------------|------|-------------|------|------|
| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO2 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO3 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO4 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO5 | 2 | 1 | - | _ | - | _ | - | _ | _ | - | _ | 1 | 3 | 2 |
| Average | 2.2 | 1.2 | 1 | - | - | - | - | - | - | - | - | 1 | 3 | 2 |

CO PO MAPPING

23BTFT7E05

Instruction Hours/week: L:3T:0 P:0 Marks: Internal:40 External:60 Total:100 End Semester Exam:3 Hours

CRYOGENIC ENGINEERING

Course Objectives

The goal of this course is for students to,

- To apply the concept of cryogenics and its applications.
- To interpret various cycles of cryogenics.
- To illustrate the applications of cryogenic refrigerators in different food sectors.
- To demonstrate the handling and instrumentation of cryogenic fluids.
- To explain the measuring devices involved in different cryogenic temperatures.

Course Outcomes

Upon completion of this course, students will be able to,

- Explain cryogenics, their applications and the production of low temperatures.
- Classify various cryogenic liquefaction processes and cryogenic gas purification processes.
- Illustrate thermophysical, transport properties of cryogenic fluids and medical application of cryogenic fluids.
- Infer the role of cold exchange in cryogenic fluids and design concepts of cryogenic propulsions.
- Utilize the measurement devices and material properties at cryogenic temperatures.

UNIT I- CRYOGENICS

Cryogenics – Introduction and history. Applications – space and aerospace industry, cryobiology and superconductivity. Thermodynamic analysis of low temperature processes refrigeration and production of low temperatures.

UNIT II- LIQUEFACTION PROCESSES

Cryogenic liquefaction processes – Liquefaction process of Nitrogen, Oxygen, Argon, Methane, Natural gas, Neon, Hydrogen and Helium. Separation processes for cryogens (Air, Hydrogen and Helium). Non- Cryogenic separation processes for Air and Helium. Cryogenic gas purification processes.

UNIT III- PROPERTIES OF CRYOGENIC FLUIDS

Thermophysical properties of cryogenic fluids – VLE data on mixtures of cryogenic liquids. Prediction of thermodynamic properties – Transport properties of cryogenic fluids- Unique properties of noble gases and Hydrogen isotopes – selection of proper cryogenic fluid for freezing of foods and medical application.

UNIT IV- COLD AND HEAT EXCHANGE IN CRYOGENIC FLUIDS 9

Cold exchange in cryogenic fluids – Introduction, heat exchanger configurations, Heat exchanger design analysis, cryogenic regeneration, thermal insulations for cryogenic systems. Cryogenic propellants for rocket propulsion – Introduction, challenge, performance analysis, selection of propellants and design concepts of cryogenic propulsions.

9

9

9

3H-3C

UNIT V- MEASUREMENT AND STORAGE DEVICES

Measurement devices at cryogenic temperatures – Temperature, sub-atmospheric pressure and vacuum, flow rates and liquid level. Storage and transportation of cryogenic fluids. Material properties at cryogenic temperatures.

TEXT BOOKS:

- 1. Harold Weinstock, 1970. "Cryogenic Technology", Boston Technical Publications.
- 2. Boris V.Kuznetsov, 1981. "Theory and design of Cryogenic system". MIR
- 3. Publishers, 1981.

REFERENCE BOOKS:

- 1. C.Rose Innes, 1964. "Low Temperature Techniques", English University Press.
- 2. Mamata Mukhopathay. "Fundamentals of Cryogenic Engineering".

WEB LINKS:

- 1. https://www.sciencedirect.com/journal/cryogenics
- 2. https://www2.brb.org.uk/display?textid=Q84v497&FilesData=Handbook_Of_Cryogen ic_Engineering.pdf

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|------------|------------|-----|------------|------------|------------|------------|------------|------------|-------------|------|------|------|------|
| CO1 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO2 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO3 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO4 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO5 | 3 | 2 | 1 | - | _ | _ | _ | _ | _ | - | _ | 1 | 3 | 2 |
| Average | 2.2 | 1.2 | 1 | - | - | - | - | - | - | - | - | 1 | 3 | 2 |

TOTAL: 45

Instruction Hours/week: L:3T:0 P:0

UNIT V- COMPUTER BASED MONITORING

Computer - Based Monitoring and Control - Introduction and Importance of monitoring and control - Hardware features of a data acquisition and control - Remote data acquisition - signal

UNIT II- MEASURING AND CONTROLLING DEVICES

Measuring and controlling devices in food processing- role. Classification and types of

UNIT III- MEASUREMENTS IN FOOD PROCESSING

Measurements in food processing- moisture, humidity, turbidity, colour, flow metering, viscosity, brix, pH, food enzymes, flavour measurement, texture, particle size and food constituents' analysis.

Course Objectives The goal of this course is for students to,

23BTFT7E06

- To interpret in detail the concepts of process instrumentation.
- To compare the knowledge of different process instruments.
- To explain several measurement techniques used in food processing. •
- To summarize the types of controllers and indicators used in food processing.

PROCESS INSTRUMENTATION AND

CONTROL IN FOOD PROCESSING

To interpret computer-based monitoring and control in food processing. •

Course Outcomes

Upon completion of this course, students will be able to,

- Explain the process instrumentation and control in food processing industries. •
- Compare various measuring and controlling devices in food processing.
- Illustrate several measurements in food processing.
- Interpret various controllers and indicators used in food processing.
- Summarize the computer-based monitoring and control in food processing.

UNIT I- INTRODUCTION

Introduction to food processing industries- canned and bottled fruits and vegetables, beer, ciders, soft drinks, sugar, jams, jellies and beverages. Introduction process instrumentation and control-Industrial processes, process parameters, batch and continuous processes, instrumentation and control and selection of controllers.

transducers. Selection of transducers- Actuating and controlling devices.

UNIT IV- CONTROLLERS AND INDICATORS

atmosphere control- timers and indicators- Food sorting and grading control- Discrete, Adaptive and Intelligent controllers.

Semester-VII **3H-3C**

2023 - 2024

Marks: Internal:40 External:60 Total:100

End Semester Exam: 3 Hours

9

9

9

9

9

Temperature control in food dehydration and drying- Electronic controllers- flow ratio control,

interfacing – Examples of computer-based measurement and control in food processing.

TOTAL: 45

TEXT BOOKS:

- 1. Manabendra Bhuyan. 2007. "Measurements and Control in Food Processing" CRC, Taylor and Francis.
- 2. E Kress-Rogers and C J B Brimelow. 2001. "Instrumentation and Sensors for the Food Industry" 2nd Edition Woodhead Publishing.
- 3. William C. Dunn. 2006. "Introduction to Instrumentation, Sensors and Process Control", Artech House Inc.

REFERENCE BOOKS:

- 1. Eckman.D.P, 1984. "Industrial Instrumentation", Wiley Eastern Ltd.
- 2. James E. Bailey and David F. Ollis, 1986. "Biochemical Engineering Fundamentals", McGraw-Hill Book Company, 2nd ed.

WEBLINKS:

- 1. http://ecoursesonline.iasri.res.in/course/view.php?id=82
- 2. http://www.eolss.net/sample-chapters/c10/e5-10-05-03.pdf

CO-PO MAPPING

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|------------|-----|-----|------------|-----|------------|------------|------------|------------|------|------|------|------|------|
| CO1 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO2 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO3 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO4 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO5 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| Average | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |

PROFESSIONAL ELECTIVE VI SEMESTER VII

| B. Tech. – Food Technolog | gy | | 2023 - 2024 |
|---------------------------|------------|-----------------------|---------------------|
| | | | Semester-VII |
| 23BTFT7E07 | FOOD B | IOTECHNOLOGY | 3H-3 C |
| | | | |
| Instruction Hours/week: I | 2:3T:0 P:0 | Marks: Internal:40 Ex | ternal:60 Total:100 |

End Semester Exam: 3 Hours

Course Objectives

The goal of this course is for students to,

- To illustrate the role of biotechnology in various food processing applications.
- To explain the production of metabolites, flavors, colors, protein rich foods and preservatives using biotechnological methodologies.
- To describe the various downstream processing techniques.
- To Outline the molecular diagnostic tools and methods applied to detect pathogens, pesticides and toxins in the raw materials and food.
- To summarize the application and classification of biosensors and discuss the social, ethical and safety aspects of GM foods.

Course Outcomes

Upon completion of this course, students will be able to,

- Identify the biotechnological applications in the various food processing sectors.
- Illustrate the production of various biotechnologically derived food products.
- Demonstrate the importance of downstream processing techniques in biotechnology and food processing.
- Infer the different types of molecular diagnostic tools, assays and methods in the detection of pathogens, pesticides and toxins in the raw materials and food.
- Summarize the classification and applications of biosensors and discuss the ethical, social, and safety aspects of production and consumption of GM foods.

UNIT I - INTRODUCTION TO BIOTECHNOLOGY

Introduction -Biotechnology relating to the food industry – application ofgenetics to food production – Genetic Engineering Techniques- Recombinant DNA Techniques and Cloning Strategies - Genetically modified organisms- Classical and modern biotechnology - Role of bio process engineering in biotechnology industry. Regulatory and Social aspects of biotechnology of foods. Biotechnological approachesto improve nutritional qualities and shelf life of fruits and vegetables, livestock, poultryand fish products.

UNIT II - PRODUCTION OF PRIMARY AND SECONDARY METABOLITES 9 Production of commercially important metabolites – citric acid, lactic acid, acidic acid, gluconic acid, amino acids, Flavoring agents, colouring agents and vitamins. Stages in industrial production of microbial metabolites - New protein foods - SCP; mushroom; algal proteins. Natural bio-preservatives – Nisin, Lacticin.

Karpagam Academy of Higher Education (Deemed to be University), Coimbatore

UNIT III – FOOD BIOTECHNOLOGY

Principle of Downstream Processing – stages in downstream processing – solid liquid separation – flotation – flocculation – filtration – types – centrifugation- cell disruption – concentration – evaporation liquid – liquid extraction – membrane filtration precipitation – adsorption – purification by chromatography.

UNIT IV - MOLECULAR DIAGNOSTIC TOOLS

Rapid detection techniques for food borne pathogens and their toxins; In-vitro evaluation of bacterial toxins by immunological techniques like slide agglutination, tube agglutination, gel diffusion assay; Genetic based diagnostic systems - Polymerase Chain Reaction (PCR). The development of novel molecular diagnostic methods for different diseases, including nanotechnology-based diagnostics, and their application in medical clinics. Micro array diagnostic methods to detect pathogens, pesticides, and toxins in the raw materials and food.

UNIT V - BIOSENSORS AND GM FOODS – SOCIAL AND ETHICAL ISSUES 9 Biosensors: Introduction, classification and application in food industries Potential Impact of Biotechnology on Food Industries. GM foods and food security- modern approaches to the detection of raw materials or food from genetically modified food biotechnology – legal frame work for the production of raw matrials or food from genetically modified organisms - Safety aspects and social acceptance - Ethical issues. GMOs- current guidelines for the production, release and movement of GMOs; labeling and traceability; trade related aspects

TEXT BOOKS:

- 1. Bielecki S., Ed., Polak J., J. and Bielecki, Tramper S., Food Biotechnology, Elsevier Science Publishing Company, New Delhi, 2000.
- 2. Gutierre, Gustavo F., Food Science and Food Biotechnology, CRC Press, New York, 2003.
- 3. Rita Singh, Food Biotechnology, Global vision publication house, Delhi, 2004.

REFERENCE BOOKS:

- 1. B.D. Singh. 2014. Biotechnology Expanding Horizons. Kalyani Publishers, New Delhi.
- 2. Meenakshi Paul. 2007. Biotechnology and Food Processing Mechanics. Gene- Tech Books, New Delhi.

WEB LINKS:

- 1. https://www.tandfonline.com/journals/lfbt20.
- 2. https://www.mdpi.com/journal/foods/sections/food_biotechnology

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|------------|------------|------------|-----|------------|-----|------------|------------|------------|------------|-------------|------|------|------|------|
| CO1 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO2 | 2 | 1 | - | - | - | - | _ | - | - | - | - | 1 | 3 | 2 |
| CO3 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO4 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO5 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| Average | 2.2 | 1.2 | 1 | - | - | - | - | - | - | - | - | 1 | 3 | 2 |

CO-PO MAPPING

9

TOTAL: 45

| B. Tech. – Food Tech | hnology | 2023 - 2024 |
|----------------------|-------------------------|--------------|
| | | Semester-VII |
| 23BTFT7E08 | SUPPLY CHAIN MANAGEMENT | 3H-3C |

Instruction Hours/week: L:3 T:0 P:0 Marks: Internal:40 External:60 Total:100 End Semester Exam:3 Hours

Course objectives

The goal of this course is for students to,

- To outline the various concepts of food marketing system.
- To explain the different constraints involved in the marketing research.
- To demonstrate the innovations in food chains, quality and safety standards in the retail management.
- To summarize the important key areas relating to supply chain management in food processing industries.
- To make use of the overall concepts of globalization and logistics.

Course outcomes

Upon completion of this course, students will be able to,

- Outline the important concepts and approaches of food marketing system.
- Interpret the multivariate techniques involved in market research.
- Illustrate the innovations in food chains, quality and safety standards in the retail management.
- Explain the multiple strategies of supply chain management system in food industries.
- Infer the important concepts of globalization and logistics.

UNIT I - INTRODUCTION

9

9

9

Supply chain, logistics, Evolution of logistics concept, Logistical mission and strategic Issues, Logistics in India, Importance of logistics management, Strategic logistics planning process, Operational objectives, Components of logistics management, Functions of logistics management, Integrated logistics system, Agribusiness Environment & Policy – Agricultural Production Management - Business Ethics & Global Business Environment Sources of cereals and legumes, fruits and vegetables, milk and milk products, meat and meat products, marine products in India, its importance in national economy. Supply chain business opportunities, Market, Assessment, Technical Analysis, and Financial Analysis, Forecasting, Facilities and Aggregate Planning.

UNIT II - LOGISTICS, SUPPLY AND DISTRIBUTION

Principles of Logistics Production and sale of food products at global level, and the life cycle of the product is short. The right and wrong of logistics are influencing the success or failure of corporate management. Learning CSF (critical success factor) of Logistics through the study of successful food industry. Quantitative Management Analysis Business logistics - The supply chain Importance of Logistics/Supply Chain (SC) Costs analysis Logistics customer service Supply and distribution lines lengthening with greater complexity Quick customized response Logistics, Food supply chain management from farm to fork, Elements of the supply chain, Transport and storage, Social and environmental concerns associated with the food supply chain.

UNIT III - MANAGEMENT CHALLENGES IN COLD CHAIN

Post-Harvest Food Management - Supply Chain Management, The major cold chain technologies Dry ice, Gel packs, Eutectic plates, Liquid nitrogen, Quilts, Reefers Refrigerated Containers, Managerial Economics - Fresh Food and Supply Chain Management Challenges, Life Cycle Assessment Studies of Food Product, Retail logistics changes and challenges Retail

TEXT BOOKS:

- 1. Supply Chain Management Theories & Practices, R. P. Mohanty, S. G. Deshmukh, Dream tech Press, 2005.
- 2. Total Supply Chain Management by Ron Basu, J. Nevan Wright, 1st edition 2008, Elsevier.

REFERENCE BOOKS:

- 1. Supply Chain Management, Chopra and peter, Pearson, 5th edition, 2013.
- 2. Logistics Engineering and Management, Blanchard, pearson, 6th edition 2004.

WEBLINKS:

- 1. https://guides.emich.edu/c.php?g=187846&p=1269509
- 2. https://gtl.csa.iisc.ac.in/scm/scm_references.html

CO PO Mapping

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|------------|-----|-----|-----|-----|------------|------------|------------|------------|-------------|------|-------------|------|------|
| CO1 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | 1 |
| CO2 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | 1 |
| CO3 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | 1 |
| CO4 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | 1 |
| CO5 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | 1 |
| Average | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | 1 |

UNIT IV - FOOD SAFETY MANAGEMENT

Food safety - The risk management, internationally agreed definition, framework and process of risk management. Risk analysis, risk assessment, risk management and risk communication. Food Safety and Standards - Agricultural Marketing - Production and Operations Management Commodity Markets and Futures Trading - Retail Management - Management Concepts -Business Communication, Traceability system in order to nurture a diverse viewpoint capable of understanding and analyzing traceability, Recalls.

UNIT V - QUALITY CONTROL AND MANAGEMENT REGULATION 9

Organizational Behavior - Human Resource Management - Financial Management of Agribusiness Managerial Accounting and Control, Quality Management in Agribusiness -Agribusiness and Society International food Legislation & Standards Concepts and trends in food legislation. International and federal standards Codex Alimentarius, ISO series, food safety in USA. Legislation in Europe EU, Enforcers of Food Laws Approval Process for Food Additives Nutritional Labeling. Distribution - Purpose of Quality Control Raw Material Safety, Product Value, Accident Prevention QC Issues in Food System Raw Material Sourcing, Manufacturer, Distributer, Retailer. Safety/Quality/Price required by consumers, Consumer Needs The practices of QC in wholesalers the practices of QC in retailers.

TOTAL: 45

Instruction Hours/week: L:3 T:0 P:0 Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

Course objectives

The goal of this course is for students to,

- To classify the basic theory of drying and its significance in food systems.
- To summarize the importance of drying as a method of food processing.
- To compare drying mechanism of food products.
- To interpret moisture content measurement and thermal properties related to drying judge quality of dried product.
- To infer the relative advantages / disadvantages of each method of drying.

Course outcomes

Upon completion of this course, students will be able to,

- Outline the novel and hybrid drying technology.
- Illustrate the suitable dryer meeting requirements.
- Demonstrate functional design of dryers.
- Summarize the importance of drying as a method of food processing.
- Infer the principle and working of various types of dryers.

UNIT I – PRINCIPLES OF DRYING

9

9

Principles of drying – Fundamentals of air-water mixtures – Theories of drying - Psychometric chart – Problems based on psychometry – Drying curves – constant and falling rate period - Heat and mass transfer in dryers – with and without recirculation– Dryers in food processing industry – Issues in food drying technology - Water content in foods and its determination

UNIT II - DRUM DRYING, FOAM MAT DRYING AND OSMOTIC DEHYDRATION OF FOODS 9

Drum driers - Types of Drum Dryers - Principles of Operation of the Drum Dryer – Steam Consumption – Types of Feeding – Final product form. Foam Mat Drying- Principles-Equipments- Factors affecting Foam mat drying. Rotary Dryer. Osmotic dehydration – Principles – Osmotic agents - Factors affecting osmosis- Equipment used.

UNIT III - SPRAY DRYING OF FOODS

Fundamentals –Nozzles, Rotary atomizers and two fluid feeds- Interaction of droplets with air-Drying of droplets with soluble and insoluble solids – factors affecting spray drying- glass transition temperature - Microstructure of spray dried products – properties of spray dried powders – Packing and storage of spray dried powder - Reconstitution – Foam spray drying – Applications in the Food industry.

UNIT IV – FLUIDIZED BED, PNEUMATIC AND FREEZE DRYING

Fluidized bed drying – Introduction – Effect of operating parameters – conventional and modified fluidized bed dryer – Effects of processing parameters in fluidized bed dryer - Fundamentals of freeze drying – Freezing – Primary drying stage – secondary drying stage - Changes during freeze drying – Condensation, defrosting – Industrial freeze driers. Pneumatic / Flash dryers - Basic Operation Principle and Applications of Flash Dryers - Design of Flash Dryers - Materials Dried in Flash Dryers.

UNIT V - NOVEL DRYING METHODS

Special drying techniques - contact-sorption drying - drying on inert particles –pulse combustion drying - drying with induction heating - novel dryers - Airless drying, drying in mobilized beds, vacuum jet drying, Refractance window drying. Dryer performance indices. Pulsed fluid bed drying: Principle and layout - dehydration of foods using cyclic pressure.

TEXT BOOKS:

- 1. Paul Singh, R and Dennis R. Heldman. Introduction to Food Engineering Academic Press, 2001
- 2. Loasecke H.W.V., Drying and dehydration of Foods, Agrobios, Jodhpur, 2001
- 3. Kudra, T and Majumdar, A.S., Advanced Drying Technologies, Marcel Dekker Inc., New York, 2002.
- 4. Loeseck ,H. W. V, "Drying & Dehydration of Foods", Published by Agrobios, 2005.

REFERENCE BOOKS:

- 1. Arun S. Mujumdar, "Handbook of Industrial Drying", CHIPS, 3rd Edition, 2006.
- 2. Hui Y. H,:"Food Drying Science and Technology, Microbiology, Chemistry, Application", CHIPS, 2008.

WEBLINKS:

CO PO Mapping

- 1. https://www.intechopen.com/chapters/85628
- 2. https://www.sciencedirect.com/science/article/abs/pii/S0023643821004680

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|------------|-----|-----|------------|-----|------------|------------|------------|------------|-------------|------|------|------|------|
| CO1 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO2 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO3 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO4 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| CO5 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |
| Average | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 | 2 |

178

TOTAL: 45

23BTFT7E10

FOOD FERMENTATION TECHNOLOGY 3H-3C

Instruction Hours/week: L:3 T:0 P:0

Marks: Internal:40 External:60 Total:100 End Semester Exam:3 Hours

Course objectives

The goal of this course is for students to,

- To relate the benefits, nutritive value, and microorganisms associated with the fermentation processes.
- To demonstrate the preparation and culture maintenance of bacteria, yeast and mold.
- To explain the production of different types of fermented products.
- To summarize the production processes of fermented drinks and fermented vegetables.
- To infer the production of yeast, enzymes, proteins, fats and HFCS.

Course outcomes

Upon completion of this course, students will be able to,

- Explain the overall benefits, nutritive value, and microorganisms involved in the fermentation processes.
- Experiment with the cultures of bacteria, yeast and mold for fermentationprocesses.
- Infer the processes involved in the production of fermented drinks.
- Illustrate the overall steps employed in the production of fermented vegetables.
- Outline the different set of processes followed in the production of yeast, enzymes, proteins, fats and HFCS.

UNIT I - INTRODUCTION TO FERMENTATION

Definition - benefit of fermentation - design of fermenters - nutritive value of fermented foods - microbial changes in fermented foods - selection and importance of microorganism - proteolytic, liploytic and fermentative bacteria.

UNIT II - CULTURE MAINTENANCE

Preparation and Maintenance of Bacterial, Yeast and Mold cultures for food fermentations. Probiotics - Lactic acid bacteria-activities and health-promoting effects. Mushrooms: Cultivation and preservation.

UNIT III - FERMENTED PRODUCTS

Fermented Vegetables (Pickles) Fermented meat and fish products, Oriental fermented foods - Fermented Dairy Products: Cheeses, Curd and Yoghurt. Spoilages and defects of fermented products and their control.

UNIT IV - FERMENTED DRINKS

Fermentative Production of Beer, Wines, Cider and Vinegar, distilled spirits (eg. Rum, gin, whisky), Fermented Dairy drinks: Butter milk and the fermented milks.

UNIT V - MICROBIAL PROTEINS

Microbial proteins, Production of Baker's Yeast, Microbial Proteins and fats, Food enzymes (eg. Amylases, protease, lipases, pectinases, rennin) - production and their

9

9

9

9

applications in food fermentation. HFCS (High Fructose Corn Syrup). Health benefits of microbial protein.

TEXT BOOKS:

- 1. K.H. Steinkrus, Handbook of Indigenous Fermented Foods, Marcel Dekker publisher,1983.
- 2. Sukumar De, Outlines of Dairy Technology, Oxford University Press N Delhi, 1991.
- 3. Prescott and Dunn, Industrial Microbiology, Agrobios (India) publisher, 2009 **REFERENCE BOOKS:**
- 1. L.E.Casida, Industrial Microbiology, New Age International(p) Ltd N Delhi, 2007
- 2. W.C.frazier and D.C.Westhoff, Food Microbiology, Tata McGraw Hill publisher, 3rd edition, 2008

WEB REFERENCES:

- 1. https://link.springer.com/book/10.1007/978-3-319-42457-6
- 2. https://www.taylorfrancis.com/books/edit/10.1201/9780203913550/handbook-foodbeverage-fermentation-technology-hui-lisbeth-meunier-goddik-jytte-josephsen-waikit-nip-peggy-stanfield

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|------------|------------|-----|------------|------------|------------|------------|------------|------------|-------------|------|-------------|------|------|
| CO1 | 2 | 1 | - | - | - | - | - | - | 1 | - | 1 | 1 | 3 | 2 |
| CO2 | 3 | 2 | 1 | - | - | - | - | - | 1 | - | 1 | 1 | 3 | 2 |
| CO3 | 2 | 1 | - | - | - | - | - | - | 1 | - | 1 | 1 | 3 | 2 |
| CO4 | 2 | 1 | - | - | - | - | - | - | 1 | - | 1 | 1 | 3 | 2 |
| CO5 | 2 | 1 | - | - | - | - | - | - | 1 | - | 1 | 1 | 3 | 2 |
| Average | 2.2 | 1.2 | - | - | - | - | - | - | 1 | - | 1 | 1 | 3 | 2 |

CO PO Mapping

TOTAL: 45

23BTFT7E11 RHEOLOGY & TEXTURE ANALYSIS OF FOODS 3H-3C

Instruction Hours/week: L:3 T:0 P:0 Marks: Internal:40 External:60 Total:100 End Semester Exam:3 Hours

Course objectives

The goal of this course is for students to,

- To illustrate the importance of rheology in the food industry.
- To explain the mechanical and sensory characteristics of foods.
- To interpret the significance of food texture.
- To summarize the instrumental measurement of rheology.
- To outline the significance of emulsifiers in foods.

Course outcomes

Upon completion of this course, students will be able to,

- Illustrate the importance of rheology in the food industry.
- Explain the mechanical and sensory characteristics of foods.
- Interpret the significance of food texture.
- Summarize the instrumental measurement on rheology.
- Infer the significance of emulsifiers in foods.

UNIT I – PROPERTIES OF FOOD

Properties of foods. Models to visualize behavior of foods. Basic and applied rheological considerations and their application to foods.

UNIT II- STRUCTURE AND SENSORY ANALYSIS

Food Microstructure. Scanning and Transmission Electron microscopy. Determining mechanical and sensory characteristics of foods.

UNIT III – FOOD TEXTURE

Requirement of test systems for measuring food texture. Types of texture Instrument and their operating mechanisms, Calibration, Performance of test and measurements of test Parameters. Interpretation of test results.

UNIT IV – INSTRUMENTAL ANALYSIS

Dough, Pasta, Baked products and fat products; and their instrumental Measurements.

UNIT V – FOOD EMULSIONS

Textural characteristics of food emulsions, Functions of emulsifiers in relation to food texture, Sensory measurement of food texture.

TEXT BOOKS:

- 1. J.M. de Man Rheology and Texture in Food quality
- 2. Berk, Zeki. "Food Process Engineering and Technology". Elsevier, 2009.

9

TOTAL: 45

181

9 .1

9

WEBLINKS:

- 1. https://onlinelibrary.wiley.com/doi/abs/10.1002/9781119780045.ch10
- 2. https://link.springer.com/chapter/10.1007/978-3-319-45776-5_29
- 3. https://www.researchgate.net/publication/362545490_Rheological_analysis_of_food_materials

CO PO Mapping

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|------------|------------|-----|-----|------------|-----|------------|------------|------------|------------|-------------|------|------|------|------|
| CO1 | 2 | 1 | - | - | - | - | - | - | 1 | - | - | 1 | 1 | 2 |
| CO2 | 2 | 1 | - | - | - | - | - | - | 1 | - | - | 1 | 1 | 2 |
| CO3 | 2 | 1 | - | - | - | - | - | - | 1 | - | - | 1 | 1 | 2 |
| CO4 | 2 | 1 | - | - | - | - | - | - | 1 | - | - | 1 | 1 | 2 |
| CO5 | 2 | 1 | - | - | - | - | - | - | 1 | - | - | 1 | 1 | 2 |
| Average | 2 | 1 | - | - | - | - | - | - | 1 | - | - | 1 | 1 | 2 |

23BTFT7E12 SEA FOOD PROCESSING TECHNOLOGY 3H-3C

Instruction Hours/week: L:3 T:0 P:0 Marks: Internal:40 External:60 Total:100 End Semester Exam:3 Hours

Course objectives

The goal of this course is for students to,

- To classify the benefits, nutritive value, and microorganisms associated with sea food processing.
- To demonstrate the drying and irradiation of sea foods.
- To explain the freezing and cold storage of sea foods.
- To interpret the various packaging techniques in sea food processing.
- To outline the utilization of fishery by products.

Course outcomes

Upon completion of this course, students will be able to,

- Explain the overall benefits, nutritive value, and microorganisms involved in thefermentation processes.
- Infer the details in preparation and maintenance of the cultures of bacteria, yeast and mold for fermentationprocesses.
- Demonstrate the processes involved in the production of fermented drinks.
- Illustrate the overall steps employed in the production of fermented vegetables.
- Outline the different set of processes followed in the production of yeast, enzymes, proteins, fats and HFCS.

UNIT I – PRESERVATION AND PROCESSING

Importance of preservation and processing of sea foods criteria for assessing freshness handling of fresh materials – on board handling, chilling methods, phenomena of rigor mortis, spoilage changes – causative factors (other than microbial).

UNIT II – DRYING AND IRRADIATION

Drying and dehydration – conventional and modern methods, relative merits and demerits. Quality changes during drying and storage – functional properties, sensory quality, nutritional value, quality indices, storage life. Salt curing, picking and smoking – methods, merits and demerits – quality changes during processing and storage life – quality standards. Irradiation – source of radiation, methods, merits and demerits, quality changes during processing and storage - quality standards, minimal processing technologies.

UNIT III – FREEZING

Freezing and cold storage – process of freezing, types, quality changes during processing and storage. Canning – procedures, quality changes during processing and storage – quality standards. Role of preservatives in processing.

9

9
UNIT IV – PACKING

Packing – a function of packaging, special needs in food packaging, packaging materials, types -1 handling fresh fish, retail packing, wholesale packaging, block frozen packs, IQF, layered and shatter packs, modified atmospheric packaging, vacuum packaging, boil and bag type, cans and containers, air freight packaging, packaging standards for wet shipment and irradiated foods. Food contact substances – limits. Labeling – information to be included, labeling regulation.

UNIT V – FISHERY BY – PRODUCTS

Fishery by – products of commerce – surimi, fish protein concentrate, meal and oil production, hydrolysis of fish protein. Cannery waste processing of fish stick water. Animal feeds, fish silage, fish liver preservation, fish gelatin, fish glue, leather from fish skin, chitin and chitosan, pearl essence, use of shells, fertilizer from fishery by products.

TEXT BOOKS:

- 1. Kreuzer R., 1974. Fishery Products, FAO Fishing News (Books) Ltd., England.
- 2. Anon, 1979. Handling, Processing and Marketing of Tropical fish, Tropical Products Institute, London.

REFERENCE BOOKS:

- 1. Miller, M.D., 1990. Ciguatera Seafood Toxins, CRC Press.
- Sikorski, Z.E., 1990. Seafood: Resource, Nutritional Composition, Preservation, CRC Press.

WEBLINKS:

- 1. https://onlinelibrary.wiley.com/doi/book/10.1002/9781118346174
- 2. https://link.springer.com/book/10.1007/978-1-4615-2181-5

| | | FF 0 | | | | | | | | | | | | |
|---------|------------|------|-----|------------|-----|------------|------------|------------|------------|-------------|------|-------------|------|------|
| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 1 | 1 | 2 |
| CO2 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 1 | 1 | 2 |
| CO3 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 1 | 1 | 2 |
| CO4 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 1 | 1 | 2 |
| CO5 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 1 | 1 | 2 |
| Average | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 1 | 1 | 2 |

CO PO Mapping

OPEN ELECTIVES (offered by Food Technology)

B. Tech. – Food Technology

23BTFTOE01PROCESSING OF FOOD MATERIALS3H-3C

Instruction Hours/week: L:3 T:0 P:0 Marks: Internal:40 External:60 Total:100 End Semester Exam:3 Hours

Course Objectives

The goal of this course is for students to,

- To explain the milling, extraction and manufacture of tremendous products fromcereals, pulses and oil seeds.
- To summarize the production and processing methods of fruits and vegetables.
- To infer the chemical composition, processing, production, spoilage and quality of milk and milk products.
- To outline the overall processes involved in the production of meat, poultry and fishproducts.
- To review the production and processing methods of plantation and spice products.

Course Outcomes

Upon completion of this course, students will be able to,

- Infer the basics of food processing.
- Demonstrate the various processing technologies involved in fruits and vegetables, dairy, cereals, meat, fish, egg and plantation products.
- Infer the basics on microbiology of food products.
- Summarize the process of manufacture of various food products.
- Outline the various methods of food preservation.

UNIT I - CEREAL, PULSES AND OIL SEEDS TECHNOLOGY

Rice milling, Pulse milling, Wheat milling – Recent trends in milling process- Oil extraction – different methods in oil extraction - Methods of manufacture of Bread - different processes of manufacture - types of breads - buns, biscuits, cakes and cookies - Pasta products - Tortilla - Method of manufacture.

UNIT II - FRUITS AND VEGETABLE PROCESSING

Production of Fruits and vegetables in India, Maturity standards, Cause for heavy losses, preservation treatments - Basics of Canning, Minimal processing and Hurdle technologyas applied to Vegetable and Fruit processing, Processing of fruit juices, Dehydration, Aseptic processing- Indian Food Regulation and Quality assuranceFruit Juice / pulp/ Nectar/Drinks, concentrates.

UNIT III – DAIRY PROCESSING

Basic dairy terminology, composition, General tests at reception, Dairy Processing -

185

9

9

Processing, Meat Products, Processing of Poultry Products, Common pathogens, Sanitation management, Sanitizers for meat & poultry plants, Fish and other Marine Products Processing, Sources of sea food contamination.

Meat composition from different sources, Definitions and measurements, Carcass

Method of manufacture of Standardized, toned and double toned milk, milkpowder - Equipments - Pasteurizers, homogenizers and pumps - Method of manufactureof dairy products - Ice-cream, Cheese, Paneer, Yoghurt - Pasteurization and microorganisms involved in spoilage of milk – Major pathogens, Plant construction, Sanitation

UNIT V - PLANTATION PRODUCT TECHNOLOGY

UNIT IV - MEAT, POULTRY AND FISH PROCESSING

management, Cleaning equipment.

Processing of Tea, Coffee and Cocoa - Outline of the methods of manufacture of - green tea, black tea, instant tea, Instant coffee, Cocoa and Chocolate. Outline of the methods of processing of Pepper, cardamom, ginger, vanilla and turmeric. By products from plantation crops and spices.

TEXT BOOKS:

- 1. Srivastava R.P. and Kumar S. Fruit and Vegetable Preservation: Principles and Practices. International Book Distributing Co. Lucknow. 3rd Edition. 2010.
- 2. Chakraverty A., Mujumdar A.S., Raghavan G.S.V and Ramaswamy H.S. Handbook of Post- harvest Technology: Marcel Dekker Press. USA. 1st Edition. 2003.

REFERENCE BOOKS:

- 1. Sukumar De. Outlines of Dairy Technology. Oxford University Press. New Delhi.23rd impression. 2016.
- 2. James G. Brennan. 2006. Food Processing Handbook. Wiley-VCH Verlag GmbH& Co. KGaA, Weinheim, Germany.

WEB REFERNCES

- 1. https://www.intechopen.com/chapters/86251
- 2. https://ifst.onlinelibrary.wiley.com/journal/17454549

CO PO Mapping

| CO No | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|------------|------------|------------|-----|------------|------------|------------|------------|------------|-------------|------|-------------|------|------|
| CO1 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | 1 |
| CO2 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | 1 |
| CO3 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | 1 |
| CO4 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | 1 |
| CO5 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | 1 |
| Average | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | 1 |

9

9

TOTAL: 45

B. Tech. – Food Technology

Instruction Hours/week: L:3 T:0 P:0 Marks: Internal:40 External:60 Total:100 End Semester Exam:3 Hour

Course objectives

23BTFTOE02

The goal of this course is for students,

- To explain the basic concepts of food and nutrition.
- To define the overall classification, function, and source of carbohydrates, lipids and proteins.
- To summarize the availability, source, deficiency and physiological role of fat andwater-soluble vitamins.
- To outline the role of health and nutritional importance of micro and macro minerals.
- To interpret the recent trends and developments in nutrition.

Course outcomes

Upon successful completion of this, students will be able to

- Explain the basics in the area of nutritional assessment in health and disease.
- Outline the biological functions of various macromolecules in terms of food andhealth.
- Summarize the balanced diet for healthy life to avoid or prevent the deficiency disorders.
- Infer an appropriate diet, products that prevent vitamin deficiency disorders.
- Identify the proper foods rich in minerals to live a healthy life.

UNIT I - HUMAN NUTRITION

Six classes of nutrients - Historical perspective of nutrient requirements – Assessment of nutritional status - recommended dietary allowances of macronutrients for all age groups - Assessment of protein quality - Malnutrition and related disorders –Balanced Diet. Factors influencing dietary intake: Food habits, food fads and fallacies, their influence on health and wellbeing.

UNIT II - BIOMOLECULES

Carbohydrates- Definition, classification, Functions, Sources of Carbohydrates, Deficiency. Lipids – Definition, classification, function, sources, Properties of fats and oils, Refined & Hydrogenated fats process. Proteins - Definitions, Classification, Function, Amino Acids, Sources of Proteins, Texturized proteins.

UNIT III - VITAMINS

Physiological role, bio-availability, requirements, sources and deficiency of Fat-Soluble Vitamins: Vitamin A, Vitamin D, E & K. *f* Water soluble vitamins: Vitamin C, Thiamine, Riboflavin, Niacin, Pantothenic acid, Biotin, Folic acid, Vitamin B12, VitaminB6. Stability under different food processing conditions.

9

9

9

NUTRITION AND DIETETICS

UNIT IV – MINERALS AND WATER

Physiological role, bio-availability, requirements, sources and deficiency of Macro minerals: Calcium, Phosphorus Magnesium, Sodium, Potassium chloride. Micro minerals: Iron, Zinc, copper, selenium, chromium, iodine, manganese, Molybdenum and fluoride - Chemistry and physical properties of free, bounded and entrapped water, water activity, quality parameters of drinking and mineral water.

UNIT V - RECENT TRENDS IN NUTRITION

Principles of dietary management in gout, rheumatism, AIDS/HIV - Cancer-risk factors, symptoms, dietary management, role of food in prevention of Cancer. Role of functional foods Health foods and novel foods, organically grown foods, personalized nutrition, recent concepts in human nutrition like nutrigenomics, nutraceuticals etc.

TOTAL: 45

TEXT BOOKS:

- Sunetra Roday. Food Science and Nutrition. Oxford Higher Education/Oxford University Press. 3rd edition 2018. (ISBN-13: 9780199489084).
- 2. Charis Galanakis. Nutraceutical and Functional Food Components. Academic Press, 1st Edition, 2017. (ISBN: 9780128052570).
- Ashley Martin. Nutrition and Dietetics. Syrawood Publishing House. 1st Edition, 2016. (ISBN:9781682860588).

REFERENCE BOOKS:

- Robert E. C. Wildman. Handbook of Nutraceuticals and Functional Foods. CRC Press, 2nd Edition, 2016. (ISBN-10: 9781498770637).
- Srilakshmi. B. Nutrition Science. New Age International Pvt. Ltd, Publishers. 6th Edition. 2017. (ISBN-13: 9789386418883).

WEB REFERENCES

- 1. https://onlinelibrary.wiley.com/journal/17470080
- 2. https://aub.edu.lb.libguides.com/c.php?g=276518&p=1842999

| | | | 0 | | | | | | | | | | | |
|------------|------------|------------|-----|------------|-----|------------|------------|------------|------------|-------------|------|------|------|------|
| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | 1 |
| CO2 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | 1 |
| CO3 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | 1 |
| CO4 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | 1 |
| CO5 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 2 | 1 |
| Average | 2.2 | 1.2 | 1 | - | - | - | - | - | - | - | _ | 1 | 2 | 1 |

CO PO Mapping

9

READY TO EAT FOODS

Instruction Hours/week: L:3 T:0 P:0 Marks: Internal:40 External:60 Total:100 End Semester Exam:3 Hour

Course Objectives

The goal of this course is for students to,

- To outline the current status of snack food Industry.
- To describe the production, processing and marketing trends of potato and tortillachips.
- To outline the overall processing of popcorn.
- To explain the production and processing of fruits involved in snack food preparation.
- To summarize the sensory analysis methods and packaging techniques of snack foods.

Course Outcomes

Upon completion of this course, students will be able to,

- Outline the various manufacturing process in snack food industries.
- Summarize the current production and marketing status of Snack foods.
- Explain the advantages of Sensory Evaluation.
- Infer packaging technologies in Snack Food Industries.
- Demonstrate the equipment's involved in the snack production processes.

UNIT I - INTRODUCTION TO SNACK FOODS

Introduction- Types – processing methods - Nutrition- Quality and standards for snack foods - GHP and GMP for snack food industries - Outline of snack food industry - Domestic Snack Food Market-Global Market.

UNIT II - POTATO AND TORTILLA CHIPS PROCESSING

Potato Production- selection and grading of potato - Potato snack Ingredients- Potato Analysis and Composition-Potato chip manufacturing process-Unit Operations-Other value added products from Potato. Tortilla chips - Raw Materials- Processing steps-Equipment involved-Reconstitution of Dry Maize Flour-Unit operations - Nutritional properties of potato and tortilla chips.

UNIT III - POPCORN PROCESSING

Introduction- Raw popcorn selection and preparation-Popping Methods-Home preparation of Popcorn-Equipment's-Industrial manufacturing process- Flavorings and Applicators-Popcorn Packaging- Relative Nutrition- Marketing.

UNIT IV - FRUIT BASED SNACKS

Introduction-production and processing of fruit crops – fruit purees – fruit powders – canned fruit snacks – alcoholic preservation of fruit snacks – fruit candies – fruit bars –

2023 - 2024

9

9

9

exotic fruits – Nutrition's and health benefits of fruit snacks.

UNIT V - SENSORY EVALUATION AND PACKAGING

Introduction- importance of sensory evaluation – Analytical methods - Sensory methods-Sensory Aspect of Processing- Limitations of sensory evaluation- Quality properties of Snack Foods and Packaging Materials-Automated Bag- Pouch Packaging- Cartoning Case Packing- Labelling requirements - Current Issues in Snack Foods Packaging.

TOTAL: 45

9

TEXT BOOKS:

- Lusas, E. W and Rooney, L. W. Snack Foods Processing. CRC Press,1st Edition 2001.
- 2. Panda, H. The Complete Technology Book on Snack Foods, National Institute of Industrial Research, Delhi. 2nd Edition 2013.
- *3.* Sergio O Serna-Saldivar, Industrial Manufacture of Snack Foods, Kennedys Books Ltd. 2008.

REFERENCE BOOKS:

- Lusas, E. W and Rooney, L. W. Snack Foods Processing. CRC Press,1st Edition 2001.
- 2. Panda, H. The Complete Technology Book on Snack Foods, National Institute of Industrial Research, Delhi. 2nd Edition 2013.
- *3.* Sergio O Serna-Saldivar, Industrial Manufacture of Snack Foods, Kennedys Books Ltd. 2008.

WEBLINKS:

- 1. https://www.sciencedirect.com/book/9780128019160/food-hygiene-and-toxicology-in-ready-to-eat-foods
- 2. https://www.eurofins.in/blog/food-testing/ready-to-eat-food-testing/

CO PO Mapping

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|------------|-----|------------|------------|------------|------------|------------|------------|------------|-------------|------|-------------|------|------|
| CO1 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 1 | 2 | 1 |
| CO2 | 2 | 1 | - | - | - | - | - | - | I | - | 1 | 1 | 2 | 1 |
| CO3 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 1 | 2 | 1 |
| CO4 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 1 | 2 | 1 |
| CO5 | 2 | 1 | _ | _ | _ | _ | _ | _ | _ | _ | 1 | 1 | 2 | 1 |
| Average | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 1 | 2 | 1 |

23BTFTOE04 AGRICULTURAL WASTE AND BYPRODUCTS 3H-3C UTILIZATION

Instruction Hours/week: L:3 T:0 P:0

Marks: Internal:40 External:60 Total:100 End Semester Exam:3 Hour

Course Objectives

The goal of this course is for students,

- To classify the types of agricultural wastes.
- To outline the production and utilization of biomass.
- To explain the various parameters considered to be important in the designing of biogas units.
- To outline the methods employed in the production of alcohol from agricultural wastes/byproducts.
- To summarize the overall aspects involved in the production of paperboards and particleboards from agricultural wastes.

Course Outcomes

Upon successful completion of this, students will be able to,

- Outline the types of agricultural wastes.
- Illustrate the collection and generation of value-added products from agricultural wastes
- Demonstrate the techniques involved in the production and utilization of biomass.
- Infer the various parameters considered to be important in the designing of biogas units.
- Illustrate the various methods employed in the production of alcohol from thebyproducts of agricultural wastes.

UNIT I - TYPES OF AGRICULTURAL WASTES

Introduction and Background Agricultural Waste, Crop Waste, Agricultural Residues (annual crops), Technical terms, properties of agricultural waste- storage and handling - rice by-products utilization-rice bran and germ, rice bran oil, economic products from agriculture waste/by-products.

UNIT II - BIOMASS PRODUCTION AND UTILIZATION

Biomass – types – production and utilization Technology used for the utilization of agricultural wastes: Biomass Gasifier, Nimbkar Agricultural Research Institute (NARI) Gasifier, Rice-Husk Based Gasifier, Heat and Steam from Sugarcane Leaf and Bagasse.

UNIT III - BIOGAS DESIGN AND PRODUCTION

Biogas: Definition, composition, history of biogas, Production of biogas – factors affecting the efficiency; types of biogas plant (floating drum type and fixed dome type) and their components (inlet, outlet, stirrer, slanting pipe, digester, gas holder and gas outer pipe), Selection and Design of biogas plant.

9

9

Karpagam Academy of Higher Education (Deemed to be University), Coimbatore

UNIT IV - PRODUCTION OF ALCOHOL FROM WASTE MATERIALS 9

Production of Alcohol from waste materials: Introduction, Production methods, Cellulolysis (biological approach): Pretreatment, Cellulolytic processes (Chemical and Enzymatic hydrolysis), Microbial fermentation, Gasification process (thermochemical approach).

UNIT V - PRODUCTION OF PAPERBOARD AND PARTICLEBOARDS FROM AGRICULTURAL WASTE 9

Biodegradable packing materials: merits and demerits, Production and testing of Paperboards and Particleboards from Agricultural Waste: Introduction, History, Terminology and classification, Raw materials, Production steps- Pulping, Classifications of pulp, Bleaching, Plies, Coating, Grades.

TEXT BOOKS:

- Efthymia Alexopoulou. Bioenergy and Biomass from Industrial Crops on 1. Marginal Lands. Elsevier, 1st Edition, 2020. (ISBN: 9780128188644).
- 2 Navanietha Krishnaraj Rathinam, Rajesh Sani. Biovalorisation of Wastes to Renewable Chemicals and Biofuels. Elsevier, 1st Edition, 2019. (ISBN: 9780128179529).
- Simona Ciuta, Demetra Tsiamis, Marco J. Castaldi. Gasification of Waste 3 Materials. Academic Press, 1st Edition, 2017. (ISBN: 9780128127162).

REFERENCE BOOKS:

- 1. Nicholas E. Korres, Padraig O'Kiely, John A.H. Benzie, Jonathan S. West. Bioenergy Production by Anaerobic Digestion: Using Agricultural Biomass and Organic Wastes. Routledge, 1st Edition, 2013. (ISBN-13: 9780415698405).
- 2 Albert Howard, Yashwant Wad. The Waste Products of Agriculture. Benediction Classics, 1st Edition, 2011. (ISBN-13: 9781849025).

WEB REFERENCES:

- 1. https://www.researchgate.net/publication/308880744_AGRICULTURAL_WAST E_CONCEPT_GENERATION_UTILIZATION_AND_MANAGEMENT
- 2. https://bioresourcesbioprocessing.springeropen.com/articles/10.1186/s40643-017-0187-z

CO PO Mapping

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|------------|------------|-----|-----|-----|-----|------------|------------|------------|------------|-------------|------|-------------|------|------|
| CO1 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | 1 |
| CO2 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | 1 |
| CO3 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | 1 |
| CO4 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | 1 |
| CO5 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | 1 |
| Average | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | 1 |

TOTAL: 45

23BTFTOE05 DESIGN OF FOOD PROCESS EQUIPMENT 3H-3C

Instruction Hours/week: L:3 T:0 P:0 Marks: Internal:40 External:60 Total:100 End Semester Exam:3 Hour

Course Objective

The goal of this course is for students to,

- To illustrate the types of materials used in the food processing equipment's.
- To outline the materials and designing of different storage vessel.
- To explain the importance of reaction vessel and their deskinning techniques.
- To interpret the materials and designing of heat exchanger and evaporators.
- To summarize the importance of dryers in food processing industries.

Course Outcome

Upon completion of this course, students will be able to,

- Outline the materials suitable for the construction of equipment's.
- Summarize the vessels used for food storage in the industries.
- Classify types of reaction vessel used for different purposes. •
- Infer the importance of heat exchanger in the designing of food processing equipment's. •
- Infer the significance of dryers in food processing.

UNIT I - MATERIALS

Metals and non-metals, design of pressure vessels – cylindrical shell –internal and external pressure - under continued loadings. Materials for fabrication, mechanical properties, ductility, hardness, corrosion, protective coatings, corrosion preventionlinings equipment, choice of materials, material codes Numerical problem and design of pressure vessel.

UNIT II - STORAGE VESSELS

Design of storage vessels - Rectangular Tank without stiffeners - with stiffeners - shelldesign -Numerical problem and design. Design of agitators and baffles. Design considerations: Stresses created due to static and dynamic loads, combined stresses, design stresses and theories of failure, safety factor, temperature effects, radiation effects, effects of fabrication method, economic considerations;

UNIT III - REACTION VESSELS

Design of Reaction vessels - materials -classification - jackets-Design of vessel shell with half coil - Design of vessel shell with jacket - Numerical problem and design.

Hazards in process industries, analysis of hazards, safety measures, safety measures in equipment design, pressure relief devices.

193

9

9

0

2023-2024

Karpagam Academy of Higher Education (Deemed to be University), Coimbatore

UNIT IV - HEAT EXCHANGERS

Design of Heat exchangers – types – materials – Design pressure and temperature- shelldesign – tubes - Numerical problem. -Design of Equipment. Evaporator: Materials of concentration – types – design- consideration – Design of agitators – power requirements – Design based on Torque – critical speed.

UNIT V – DRYERS

Types - General considerations – Design of Tray dryer, Rotary Dryer, fluidized bed dryer, spray dryer, vacuum dryer, microwave dryer – Material Balance, Thermal energyRequirements, electrical energy Requirements, Performance Indices

TEXT BOOKS:

- 1. Maroulis Z.B. and Saravacos G.D. Food Process Design, Marcel Dekker Inc.ISBN-0824743113, 2003.
- 2. Joshi M.V, "Process Equipment Design", Macmillan India Ltd., 1985.

REFERENCE BOOKS:

1. Coulson, J.M. and Richardson, J. F, "Chemical Engineering "Butterworth-HeinemnnElsevier, ISBN-0750644451, 2002.

WEBLINKS:

- 1. https://onlinelibrary.wiley.com/toc/17454530/2022/45/6
- 2. https://link.springer.com/chapter/10.1007/978-1-4615-2193-8_7

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|------------|-----|-----|------------|-----|------------|------------|------------|------------|------|------|-------------|------|------|
| CO1 | 2 | 1 | - | - | - | - | I | - | - | - | - | 1 | 2 | 1 |
| CO2 | 2 | 1 | - | - | - | - | I | - | - | - | - | 1 | 2 | 1 |
| CO3 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | 1 |
| CO4 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | 1 |
| CO5 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | 1 |
| Average | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | 1 |

2. https://him

CO PO Mapping

9

9

TOTAL: 45

23BEBMEOE01 HUMAN ANATOMY AND PHYSIOLOGY **3H-3C**

Instruction Hours/week: L:3 T:0 P:0

Marks: Internal: 40 External:60 Total:100

End Semester Exam: 3Hours

COURSE OBJECTIVES:

The goal of this course is for students

- To discuss all the organelles of an animal cell and their function.
- To perceive structure and functions of the various types of systems of human body. ٠
- To outline about eye, ear and Endocrine glands of human
- To learn organs and structures involving in system formation and functions.
- To infer basic understanding of the inter connection of various organ systems in human body

COURSE OUTCOMES:

Upon completion of this course, students will be able to:

- Explain basic structure and functions of cells and its organelles
- Elucidate the Nervous Control system of Heart
- Classify respiration types and its function
- Illustrate the functions of Digestion and absorption system
- Differentiate the functions of sensory organs and Endocrine glands of human

UNIT I CELL

Structure of Cell- Organelles and description-Function of each component of the cell- Membrane potential-Action Potential-Generation and Conduction -Electrical Stimulation. Blood Cell-Composition -Origin of RBC-Blood Groups-Estimation of RBC, WBC and Platelet- Tissues and its functions-.Homeostasis - Tissue: Types - Specialized tissues - functions.

UNIT II CARDIAC AND NERVOUS SYSTEM

Heart, Major blood vessels- Cardiac Cycle - ECG-Conducting system of heart--importance of blood groups - identification of blood groups- Nervous Control of Heart-Cardiac output- Coronary and Peripheral Circulation-Structure and function of Nervous tissue-Neuron-Synapse- Reflexes-Receptors-Brain-Brainstem-Spinalcord-Reflexaction.

UNIT III RESPIRATORY SYSTEM AND MUSCULO SKELETAL SYSTEM

Physiological aspects of respiration-Trachea and lungs -Exchange of gases-Regulation of Respiration Disturbance of respiration function -Pulmonary function test-Types of respiration - Oxygen and carbon dioxide transport and acid base regulation-Muscles-tissue-types-structure of skeletal muscle-types of muscle and joints.

UNIT IV DIGESTIVE.EXCRETORY AND LYMPHATIC SYSTEM

Organisation of GI System, Digestion and absorption -Movements of GI tract-Intestine-Liver-Pancreas-Structure of Nephron-Mechanism of Urine formation-Urine Reflex-Skin and Sweat

9

9

9

Gland–Temperature regulation, Lymphatic: Parts and Functions of Lymphatic systems– Types of Lymphatic organs and vessels.

UNIT V EYE, EAR & ENDOCRINE GLANDS

Optics of Eye–Retina–Photochemistry of Vision–Accommodation-Neurophysiology of vision–EOG, Physiology of internal ear–Mechanism of Hearing–Auditory Pathway, Hearing Tests–Endocrine-Pituitary and thyroid glands.

TOTAL: 45

TEXT BOOKS:

1. Textbook Equity Edition, Anatomy and Physiology : Volume 2 of 3, Lulu.com, 2014

REFERENCES:

- William F. Ganong, Review of Medical Physiology, Mc Graw Hill, New Delhi, 26th Edition, 2019
- 2. Arthur C. Guyton, Text book of Medical Physiology Elsevier Saunders, 12th Edition, 2011

WEB SITES:

- 1. https://dth.ac.in/medical/course.php
- 2. https://onlinecourses.swayam2.ac.in/cec20_bt19/preview

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 2 | 2 | 2 | 2 | - | - | - | - | 1 | 1 | - | 1 | - | - |
| CO2 | 2 | 2 | 2 | 2 | - | - | - | - | 1 | 1 | - | 1 | - | - |
| CO3 | 2 | 2 | 2 | 2 | - | - | - | - | 1 | 1 | - | 1 | - | - |
| CO4 | 2 | 2 | 2 | 2 | - | - | - | - | 1 | 1 | - | 1 | - | - |
| CO5 | 2 | 2 | 2 | 2 | - | - | - | - | 1 | 1 | - | 1 | - | - |
| Average | 2 | 2 | 2 | 2 | - | - | - | - | 1 | 1 | - | 1 | - | - |

CO PO MAPPING

23BEBMEOE02 ARTIFICIAL ORGANS AND IMPLANTS Marks: Internal:40 External:60 Total:100

Instruction Hours /week: L:3 T:0 P:0

COURSE OBJECTIVES:

The goal of this course is for students

- To have an overview of artificial organs & transplants
- To describe the principles of implant design with a case study •
- To explain the implant design parameters and solution •
- To study about various blood interfacing implant
- To study about soft tissue replacement and hard tissue replacement •

COURSE OUTCOMES:

Upon completion of this course, students will be able to:

- Compare the fundamentals of Artificial organs and Transplants
- Explain the implant design parameters and solution in use
- Interpret the response of biomaterials in living system
- Choose blood interfacing implants
- Differentiate soft and hard tissue replacements

UNIT I ARTIFICIAL ORGANS & TRANSPLANTS

ARTIFICIAL ORGANS:-Introduction, Outlook for organ replacements, Design consideration -Evaluation process.

TRANSPLANTS:-Overview, Immunological considerations, Blood transfusions, Individualorgans kidney, liver, heart and lung, bone marrow, cornea.

UNIT II PRINCIPLES OF IMPLANT DESIGN

Principles of implant design - body response to implants, Clinical problems requiring implants for solution, The missing organ and its replacement, Tissue engineering, scaffolds, Biomaterials, Regenerative medicine & Stem cells.

UNIT III IMPLANT DESIGN PARAMETERS AND ITS SOLUTION

Biocompatibility, Local and systemic effects of implants, Design specifications for tissue bonding and modulus matching, Degradation of devices, natural and synthetic polymers, corrosion, wear and tear, Implants for Bone, Devices for nerve regeneration. Limb prosthesis, Externally Powered limb Prosthesis.

UNIT IV BLOOD INTERFACING IMPLANTS

Neural and neuromuscular implants, Heart valve implants, heart and lung assist devices, artificial heart, cardiac pacemakers, Prosthetic cardiac valves, Artificial kidney-dialysismembrane and artificial blood.

IMPLANTABLE MEDICAL DEVICES AND ORGANS UNIT V

Gastrointestinal system, Dentistry, Soft tissue replacement & Hard tissue replacement – sutures, surgical tapes, adhesive, percutaneous implants, internal fracture fixation devices, joint replacements.

End Semester Exam: 3Hours

2023-2024

9

9

9

9

Maxillofacial and craniofacial replacement, Recent advancement and future directions.

TOTAL: 45

TEXT BOOKS:

1. Kopff W.J, Artificial Organs, John Wiley and sons, New York, 1st edition, 1976

2. Park J.B, Biomaterials Science and Engineering, Plenum Press, 2011

REFERENCES:

1. J D Bronzino, Biomedical Engineering handbook Volume II, (CRC Press / IEEE Press), 2000.

- 2. R S Khandpur, Handbook of Biomedical Instrumentation, Tata Mc Graw Hill, 2003
- 3. Joon B Park, Biomaterials An Introduction, Plenum press, New York, 1992.

4. Yannas, I. V, —Tissue and Organ Regeneration in Adults^{II}, New York, NY: Springer, 2001.

5. Yadin David, Wolf W. von Maltzahn, Michael R. Neuman, Joseph D, Bronzino, Clinical Engineering^{II}, CRC Press, 1st edition, 2010.

6. Standard Handbook of Biomedical Engineering & Design , Myer Kutz, McGraw-Hill, 2003

WEB SITES:

1.https://ocw.mit.edu/courses/mechanical-engineering/2-782j-design-of-medical-devices-and-implants-spring-2006/

| CO PO |) MAP | PING | | | | | | | | | | | |
|---------|-------|------|-----|-----|-----|-----|------------|-----|-----|------|------|------|------|
| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 |
| CO1 | 2 | 2 | 2 | 2 | - | - | - | - | 1 | 1 | - | 1 | - |
| CO2 | 2 | 2 | 2 | 2 | - | - | - | - | 1 | 1 | - | 1 | - |
| CO3 | 2 | 2 | 2 | 2 | - | - | - | - | 1 | 1 | - | 1 | - |
| CO4 | 3 | 3 | 3 | 3 | - | - | - | - | 1 | 1 | - | 1 | - |
| CO5 | 2 | 2 | 2 | 2 | - | - | - | - | 1 | 1 | - | 1 | - |
| Average | 2 | 2 | 2 | 2 | - | - | - | - | 1 | 1 | - | 1 | - |

PSO₂

-

_

HOUSING PLAN AND MANAGEMENT

3H-3C

Instruction Hours/week: L: 3 T: 0 P: 0

Marks:Internal:40External:60 Total:100 End Semester Exam:3 Hours

COURSE OBJECTIVES:

23BECEOE01

- To examine the role and tasks of basic housing policies and building bye laws
- Understand the process of integrated service delivery in the context of economic, social, environmental, and institutional factors.
- Analyze the Innovative construction methods and Materials.
- Analyze city management strategies and strengthen the urban governance through a problem-solving approach.
- To know the Importance of basic housing policies and building bye laws
- To use Housing Programmes and Schemes

COURSE OUTCOME:

After completing the course, the students will be able to

- Know the Importance of basic housing policies and building bye laws.
- Use Housing Programmes and Schemes
- Plan and Design of Housing projects
- Examine Innovative construction methods and Materials.
- Know Housing finance and loan approval procedures.
- Understand Construction as well as managing techniques.

UNIT I INTRODUCTION TO HOUSING

Definition of Basic Terms – House, Home, Household, Apartments, Multi storeyed Buildings, Special Buildings, Objectives and Strategies of National Housing Policies, Principle of Sustainable Housing, Housing Laws at State level, Byelaws at Urban and Rural Local Bodies – levels – Development Control Regulations, Institutions for Housing at National, State and Local levels

UNIT II HOUSING PROGRAMMES

Basic Concepts, Contents and Standards for Housing Programmes - Sites and Services, Neighborhoods, Open Development Plots, Apartments, Rental Housing, Co-operative Housing, Slum Housing Programmes, Role of Public, Private and Non-Government Organizations.

UNIT III PLANNING AND DESIGN OF HOUSING PROJECTS

Formulation of Housing Projects – Site Analysis, Layout Design, Design of Housing Units (Design Problems)

UNIT IV CONSTRUCTION TECHNIQUES AND COST-EFFECTIVE MATERIALS 9

 $New\ Constructions\ Techniques-Cost\ Effective\ Modern\ Construction\ Materials,\ Building\ Centers$

Concept, Functions and Performance Evaluation.

9

9

UNIT V HOUSING FINANCE AND PROJECT APPRAISAL

Appraisal of Housing Projects – Housing Finance, Cost Recovery – Cash Flow Analysis, Subsidy and Cross Subsidy, Pricing of Housing Units, Rents, Recovery Pattern (Problems).

TEXTBOOKS

- 1. Meera Mehta and Dinesh Mehta, Metropolitan Housing Markets, Sage Publications Pvt. Ltd.,New Delhi, 2002.
- 2. Francis Cherunilam and Odeyar D Heggade, Housing in India, Himalaya Publishing House, Mumbai (Bombay), 2001.

REFERENCES

- 1. Development Control Rules for Chennai Metropolitan Area, CMA, Chennai, 2002.
- 2. UNCHS, National Experiences with Shelter Delivery for the Poorest Groups, UNCHS

CO PO MAPPING

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|------------|-----|-----|-----|-----|-----|-----|------------|------------|-----|------|------|------|------|------|
| | | | | | | | | | | | | | | |
| CO1 | 3 | 3 | 3 | 2 | 2 | 2 | - | - | 2 | - | 2 | 2 | - | - |
| CO2 | 3 | 3 | 3 | 3 | 3 | 2 | - | - | 2 | - | 2 | 2 | - | - |
| CO3 | 3 | 3 | 2 | 2 | 2 | 2 | - | - | 2 | - | 2 | 2 | - | - |
| CO4 | 3 | 3 | 3 | 3 | 2 | 2 | I | - | 2 | - | 2 | 2 | - | - |
| CO5 | 3 | 3 | 2 | 2 | 2 | 2 | - | - | 2 | - | 2 | 2 | - | - |
| Average | 3 | 3 | 2.6 | 2.4 | 2.2 | 2 | - | - | 2 | - | 2 | 2 | - | - |

23BECEOE02 BUILDING SERVICES

3H-3C

Instruction Hours/week: L: 3 T: 0 P: 0

Marks:Internal:40External:60 Total:100 End Semester Exam:3 Hours

COURSE OBJECTIVES

- Defining and identifying of engineering services systems in buildings.
- The role of engineering services systems in providing comfort and facilitating life of users of the building.
- The basic principles of asset management in a building & facilities maintenance environment
- Importance of Fire safety and its installation techniques.
- To understand Electrical system and its selection criteria
- To use the principles of illumination & design

COURSE OUTCOME

After completing the course, the students will be able to

- Machineries involved in building construction.
- Understand Electrical system and its selection criteria.
- Use the Principles of illumination & design.
- Know the principle of Refrigeration and application.
- Importance of Fire safety and its installation techniques
- Know the principle behind the installation of building services and to ensure safety in buildings.

UNIT I MACHINERIES

Hot Water Boilers – Lifts and Escalators – Special features required for physically handicapped and elderly – Conveyors – Vibrators – Concrete mixers – DC/AC motors – Generators – Laboratory services – Gas, water, air, and electricity.

UNIT II ELECTRICAL SYSTEMS IN BUILDINGS

Basics of electricity – Single / Three phase supply – Protective devices in electrical installations – Earthing for safety – Types of earthing – ISI specifications – Types of wires, wiringsystems and their choice – Planning electrical wiring for building – Main and distribution boards – Transformers and switch gears – Layout of substations.

UNIT IV REFRIGERATION PRINCIPLES & APPLICATIONS

Thermodynamics – Heat – Temperature, measurement transfer – Change of state – Sensible heat – Latent heat of fusion, evaporation, sublimation – saturation temperature – Super heated vapor– Sub cooled liquid – Pressure temperature relationship for liquids – Refrigerants – Vapor compression cycle – Compressors – Evaporators –Refrigerant control devices – Electric motors – Starters – Air handling units – Cooling towers – Window type and packaged air-conditioners –

9

9

Chilledwater plant – Fan coil systems – Water piping – Cooling load – Air conditioning systems for different types of buildings – Protection against fire to be caused by A.C. Systems.

UNIT III PRINCIPLES OF ILLUMINATION & DESIGN

Visual tasks – Factors affecting visual tasks – Modern theory of light and colour – Synthesis oflight – Additive and subtractive synthesis of colour – Luminous flux – Candela – Solid angle illumination – Utilization factor – Depreciation factor – MSCP – MHCP –Classification of lighting – Artificial light sources – Spectral energy distribution – Luminous efficiency – Colour temperature – Colour rendering. Design of modern lighting – Lighting for stores, offices, schools, hospitals, and house lighting. Elementary idea of specific features required, and minimum level of illumination required for physically handicapped and elderly in building types.

UNIT V FIRE SAFETY INSTALLATION

Causes of fire in buildings – Safety regulations – NBC – Planning considerations in buildings like noncombustible materials, construction, staircases and lift lobbies, fire escapes and A.C. systems.Specific features required for physically handicapped and elderly in building types – Heat and smoke detectors – Fire alarm system, snorkel ladder – Fire lighting pump and water storage – Dry and wet risers – Automatic sprinklers.

TEXTBOOKS

- 1. E.R.Ambrose, "Heat Pumps and Electric Heating", John and Wiley and Sons, Inc., New York, 2002.
- 2. Handbook for Building Engineers in Metric systems, NBC, New Delhi, 2005.

REFERENCES

- 1. Philips Lighting in Architectural Design, McGraw-Hill, New York, 2000.
- 2. A.F.C. Sherratt, "Air-conditioning and Energy Conservation", The Architectural Press, London, 2005.
- 3. National Building Code.

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|-----|-----|-----|-----|-----|-----|------------|-----|-----|------|------|------|------|------|
| | | | | | | | | | | | | | | |
| CO1 | 3 | - | 2 | 2 | 1 | 2 | - | - | - | - | - | 2 | - | - |
| CO2 | 3 | - | 2 | 2 | 1 | 2 | - | - | - | - | - | 2 | - | - |
| CO3 | 3 | - | 2 | 2 | 1 | 2 | - | - | - | - | - | 2 | - | - |
| CO4 | 3 | - | 2 | 2 | 1 | 2 | - | - | - | - | - | 2 | - | - |
| CO5 | 3 | - | 2 | 2 | 1 | 2 | - | - | - | - | - | 2 | - | - |
| Average | 3 | - | 2 | 2 | 1 | 2 | - | - | - | - | - | 2 | _ | - |

CO PO MAPPING

Karpagam Academy of Higher Education (Deemed to be University) - Coimbatore

9

23BECEOE03 REPAIR AND REHABILITATION OF STRUCTURES 3H- 3C

Instruction Hours/week: L: 3 T: 0 P: 0

Marks: Internal:40External:60 Total:100 End Semester Exam:3 Hours

COURSE OBJECTIVES

- To learn various distress and damages to concrete and masonry structures
- To know the influence of corrosion in durability of structures
- To understand the importance of maintenance of structures
- To study the various types and properties of repair materials
- To learn various techniques involved in demolition of structures.
- To Assessing damage of structures and various repair techniques.

COURSE OUTCOME

After completing the course, the students will be able to

- Various distress and damages to concrete and masonry structures.
- Durability of structures and corrosion mechanism
- The importance of maintenance of structures, types, and properties of repair materials etc.
- Assessing damage of structures and various repair techniques
- the several types and properties of repair materials
- Modern technique and equipment being adopted for the demolition of structures

UNIT I INTRODUCTION

Quality assurance for concrete construction as built concrete properties strength, permeability, thermalproperties, and cracking. Effects due to climate, temperature, chemicals, wear and erosion, Design, and construction errors.

UNIT II DURABILITY OF STRUCTURES

Corrosion mechanism – diagnosis- causes and effects - cover thickness and cracking, measurements for corrosion - methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, cathodic protection.

UNIT III MAINTENANCE AND REPAIR STRATEGIES

Definitions: Maintenance, repair and rehabilitation, Facets of Maintenance importance of Maintenance Preventive measures on various aspects Inspection, Assessment procedure for evaluating a damaged structure causes of deterioration - testing techniques.

UNIT IV MATERIALS FOR REPAIR

Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, Ferro cement, Fibre reinforced concrete. eliminators and polymers coating for rebars during repair foamed concrete, mortar and dry pack, vacuum concrete.

9

9

9

UNIT V TECHNIQUES FOR REPAIR AND REPAIR OF STRUCTURES

Non-destructive Testing Techniques, Corrosion protection techniques ,Gunite and Shotcrete Epoxy injection, Mortar repair for cracks, shoring and underpinning. Repairs to overcome low member strength, Deflection, Cracking, Chemical disruption, weathering wear, fire, leakage, marine exposure Engineered demolition techniques for dilapidated structures - case studies.

TEXT BOOKS:

- 1. Denison Campbell, Allen, and Harold Roper, "Concrete Structures, Materials, Maintenance and Repair," Longman Scientific and Technical UK, 1991.
- 2. Allen R.T. & Edwards S.C, Repair of Concrete Structures, Blakie and Sons, UK, 1987
- 3. Shetty M.S., "Concrete Technology Theory and Practice," S. Chand and Company, 2008.

REFERENCE BOOKS:

- 1. Ravishankar.K., Krishnamoorthy.T.S, "Structural Health Monitoring, Repair and
- 2. Rehabilitation of Concrete Structures," Allied Publishers, 2004.
- 3. Gambhir.M.L., "Concrete Technology," McGraw Hill, 2013
- 4. R. K. Rajput, Engineering Materials, S. Chand & Company Ltd., 2000.
- 5. M. S. Shetty, Concrete Technology (Theory and Practice), S. Chand & Company Ltd., 2003.
- 6. Sustainable Construction: Green Building Design and Delivery. Third Edition, Charles J.Kibert, New York: John Wiley & Sons, 2012.
- 7. Working Toward Sustainability: Ethical Decision Making in a Technological World, CJ Kibertet al, New York: John Wiley & Sons, 2011.

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|-----|-----|-----|-----|-----|-----|------------|-----|-----|------|------|------|------|------|
| CO1 | 3 | 2 | 2 | 2 | 1 | 2 | - | - | 2 | | 1 | 2 | - | - |
| CO2 | 3 | 2 | 2 | 2 | 1 | 2 | - | - | 2 | - | 1 | 2 | - | - |
| CO3 | 3 | 2 | 2 | 2 | 1 | 2 | - | - | 2 | - | 1 | 2 | - | - |
| CO4 | 3 | 2 | 2 | 2 | 1 | 2 | - | - | 2 | - | 1 | 2 | - | - |
| CO5 | 3 | 2 | 2 | 2 | 1 | 2 | - | - | 2 | - | 1 | 2 | - | - |
| Average | 3 | 2 | 2 | 2 | 1 | 2 | - | - | 2 | - | 1 | 2 | - | - |

CO PO MAPPING

23BECEOE04 COMPUTER-AIDED CIVIL ENGINEERING DRAWING 3H-3C

Instruction Hours/week: L: 3 T: 0 P: 0

Marks: Internal:40External:60 Total:100 End Semester Exam:3 Hours

COURSE OBJECTIVES:

- Develop Parametric design and the conventions of formal engineering drawing
- Produce and interpret 2D & 3D drawings •
- Communicate a design idea/concept graphically/ visually •
- Examine a design critically and with understanding of CAD The student learns to • interpret drawings, and to produce designs using a combination of 2D and 3D software.
- Get a Detailed study of an engineering artifact.
- To Communicate a design idea/concept graphically/ visually ٠

COURSE OUTCOMES:

After completing the course, the students will be able to

- Develop Parametric design and the conventions of formal engineering drawing
- Produce and interpret 2D & 3D drawings
- Communicate a design idea/concept graphically/ visually
- Examine a design critically and with understanding of CAD The student learn to interpret drawings, and to produce designs using a combination of 2D and 3D software.
- Get a Detailed study of an engineering artifact •
- Planning and designing of structures •

UNIT I INTRODUCTION

Introduction to concept of drawings, Interpretation of typical drawings, Planning drawings to show information concisely and comprehensively; optimal layout of drawings and Scales; Introductionto computer aided drawing, co- ordinate systems, reference planes. Commands: Initial settings, Drawing aids, Drawing basic entities, Modify commands, Layers, Text and Dimensioning, Blocks. Drawing presentation norms and standards.

UNIT II SYMBOLS AND SIGN CONVENTIONS

Materials, Architectural, Structural, Electrical and Plumbing symbols. Rebar drawings and structural steel fabrication and connections drawing symbols, welding symbols; dimensioning standards. Q

UNIT III MASONRY BONDS

English Bond and Flemish Bond - Corner wall and Cross walls - One brick wall and one and half brick wall

UNIT IV BUILDING DRAWING

Terms, Elements of planning building drawing, Methods of making line drawing and detailed drawing. Site plan, floor plan, elevation and section drawing of small residential buildings. Foundationplan. Roof drainage plans. Depicting joinery, standard fittings & fixtures, finishes. Use of Notes to improve clarity.

Karpagam Academy of Higher Education (Deemed to be University) - Coimbatore

0

205

Q

UNIT V: PICTORIAL VIEW

Principles of isometrics and perspective drawing. Perspective view of building, Software's

TEXT BOOKS:

- 1. Venugopal (2007), "Engineering Drawing and Graphics + AUTOCAD", New Age International Pvt.Ltd.,
- 2. Subhash C Sharma & Gurucharan Singh (2005), "CivilEngineering Drawing", StandardPublishers

REFERENCE BOOKS:

- 1. (Corresponding set of) CAD Software Theory and User Manuals.
- 2. Malik R.S., Meo, G.S. (2009) Civil Engineering Drawing, Computech Publication LtdNewAsian.
- 3. Sikka, V.B. (2013), A Course in Civil Engineering Drawing, S.K.Kataria&Sons.
- 4. Ajeet Singh (2002), "Workingwith AUTOCAD 2000 with updates on AUTOCAD 2001", Tata- Mc Graw-Hill Company Limited, NewDelhi

CO PO MAPPING

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|-----|-----|-----|-----|-----|-----|------------|------------|-----|------|------|------|------|------|
| CO1 | 3 | 2 | - | 2 | 1 | 2 | 1 | - | 2 | - | 1 | 2 | - | - |
| CO2 | 3 | 2 | - | 2 | 1 | 2 | 1 | - | 2 | - | 1 | 2 | - | - |
| CO3 | 3 | 2 | - | 2 | 1 | 2 | 1 | - | 2 | - | 1 | 2 | - | - |
| CO4 | 3 | 2 | - | 2 | 1 | 2 | 1 | - | 2 | - | 1 | 2 | - | - |
| CO5 | 3 | 2 | - | 2 | 1 | 2 | 1 | - | 2 | - | 1 | 2 | - | - |
| Average | 3 | 2 | - | 2 | 1 | 2 | 1 | - | 2 | - | 1 | 2 | - | - |

23BECEOE05

CONTRACTS MANAGEMENT

Instruction Hours/week: L: 3 T: 0 P: 0

Marks: Internal:40External:60 Total:100 End Semester Exam:3 Hours

COURSE OBJECTIVES:

- To have developed a more detailed appreciation for construction planning and scheduling
- To apply their learned knowledge as it pertains to upper-level construction management skills and procedures.
- To evaluate the best practices associated with the development of contract parameters.
- To understand the legal aspects of acts governing the contracts
- To discuss techniques for appropriate risks and changes, monitoring and measuring the contract closure
- To understand the basics of the bid process, important points in a tender document, and unbalanced contracts.

COURSE OUTCOMES:

After completing the course, the students will be able to

- Apply project Procurement management concepts in a project environment.
- Describe techniques used to procure resources within a project's scope and techniques to reduce procurement risks.
- Evaluate the best practices associated with the development of contract parameters.
- Understand the legal aspects of acts governing the contracts
- Discuss techniques for appropriate risks and changes, monitoring and measuring the contract closure
- Understand the basics of the bid process, important points in a tender document, and unbalanced contracts.

UNIT I CONTRACT MANAGEMENT

Introduction, Importance of Contracts, Overview of Contract Management, Overview of Activities in Contract Management; Planning and People- Resource Management; Types of Contracts, Parties to a Contract; Contract Formation, Formulation of Contract, Contract Start-Up, Managing Relationships; Common contract clauses (Notice to proceed, rights and duties of various parties, notices to be given, Contract Duration and Price.

UNIT II CONTRACT PARAMETERS

Performance parameters; Delays, penalties, and liquidated damages; Force Majeure, Suspension and Termination. Changes & variations, Notices under contracts; Conventional and Alternative Dispute Resolution methods.

UNIT III VARIOUS ACTS GOVERNING CONTRACTS

Contract Administration and Payments- Contract Administration, Payments; Contract Management in Various Situations- Contract Management in NCB Works, Contract Management in ICB Works Contracts, Contract of Supply of Goods- Design, Supply and Installation Contracts, Contract Management in Consultancy,

UNIT IV BID PROCESS AND BID EVALUATION

Bid process, important points in a tender document, and unbalanced contracts. Material covered includes: Request For Proposal and problems Different types of proposals Design Conditions and

3H-3C

9

9

9

9

Standard Component List-Tender document - Unbalanced proposals. Exercises: Evaluating Unit Prices Premium Portion Of The Overtime Rate Handling Bid Questions.

UNIT V MANAGING RISKS AND CHANGE

Managing Risks, Managing Change; Contract Closure and Review- Ending a Contract, Post-Implementation Review; Legal Aspects in Contract Management- Contract Management Legal View, Dispute Resolution, Integrity in Contract Management; Managing Performance-Introduction, Monitoring and Measurement.

TEXT BOOKS:

- 1. R. K. Rajput, Engineering Materials, S. Chand & Company Ltd., 2000.
- 2. M. S. Shetty, Concrete Technology (Theory and Practice), S. Chand & Company Ltd., 2003.
- 3. Sustainable Construction: Green Building Design and Delivery. Third Edition, Charles J.Kibert, New York: John Wiley & Sons, 2012.

REFERENCE BOOKS:

- 1. Working Toward Sustainability: Ethical Decision Making in a Technological World, CJ Kibertet al, New York: John Wiley & Sons, 2011.
- 2. Varghese, P.C., "Building Construction," Prentice Hall India, 2007.
- 3. National Building Code, Bureau of Indian Standards, New Delhi, 2017.
- 4. Chudley, R., Construction Technology, ELBS Publishers, 2007.
- 5. Peurifoy, R.L. Construction Planning, Methods and Equipment, McGraw Hill, 2011
- 6. Nunnally, S.W. Construction Methods and Management, Prentice Hall,2006
- 7. Jha, Kumar Neeraj., Construction Project management, Theory & Practice, Pearson EducationIndia, 2015
- 8. Punmia, B.C., Khandelwal, K.K., Project Planning with PERT and CPM, Laxmi Publications, 2016.

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|------|-----|-----|-----|-----|-----|-----|------------|------------|-----|------|------|------|------|------|
| CO1 | 3 | 2 | - | 2 | 1 | 2 | 1 | - | 2 | - | - | 2 | - | - |
| CO2 | 3 | 2 | - | 2 | 1 | 2 | 1 | - | 2 | - | - | 2 | - | - |
| CO3 | 3 | 2 | - | 2 | 1 | 2 | 1 | - | 2 | - | - | 2 | - | - |
| CO4 | 3 | 2 | - | 2 | 1 | 2 | 1 | - | 2 | - | - | 2 | - | - |
| CO5 | 3 | 2 | - | 2 | 1 | 2 | 1 | - | 2 | - | - | 2 | - | - |
| Aver | 3 | 2 | - | 2 | 1 | 2 | 1 | - | 2 | - | - | 2 | - | - |
| age. | | | | | | | | | | | | | | |

CO PO MAPPING

23BECEOE06 AIR AND NOISE POLLUTION AND CONTROL **3H-3C** Marks: Internal:40External:60 Total:100

Instruction Hours/week: L: 3 T: 0 P: 0

End Semester Exam: 3 Hours

COURSE OBJECTIVES:

- To impart knowledge on the principles and design of control of indoor/ particulate / • gaseous air pollutant and its emerging trends
- To induce operational considerations under the processing and control monitoring. •
- To apply sampling techniques of gaseous contaminants. •
- To control noise pollution by specific measurements, standard and preventive • measures.
- To enable to evaluate the behavior of air pollutants. •
- To have knowledge about appropriate control measures of air pollution •

COURSE OUTCOMES:

After completion of this course, the student will be able to

- Have knowledge about appropriate control measures of air pollution. •
- To apply sampling techniques and suggest suitable air pollution prevention • equipment's and techniques for various gaseous and particulate pollutants.
- Have knowledge about the air pollution monitoring and modeling. •
- Understand causes of air pollution and analyze different types of air pollutants. •
- Evaluate air pollutant behavior in the atmosphere. •
- Enable to evaluate the behavior of air pollutants. •

UNIT I INTRODUCTION

Structure and composition of Atmosphere - Sources and classification of air pollutants - Effects of air pollutants on human health, vegetation & animals, Materials & Structures - Effects of air Pollutants on the atmosphere, Soil & Water bodies - Long- term effects on the planet - Global Climate Change, Ozone Holes - Ambient Air Quality and Emission Standards - Air Pollution Indices-Emission Inventories.

UNIT II AIR POLLUTION MONITORING AND MODELLING

Ambient and Stack Sampling and Analysis of Particulate and Gaseous Pollutants -Effects of meteorology on Air Pollution - Fundamentals, Atmospheric stability, Inversion, Wind profiles and stack plume patterns- Transport & Dispersion of Air Pollutants - Modeling Techniques - Air PollutionClimatology.

UNIT III CONTROL OF PARTICULATE CONTAMINANTS

Factors affecting Selection of Control Equipment – Gas Particle Interaction, – Working principle, Design and performance equations of Gravity Separators, cyclones, Fabric filters, Particulate Scrubbers, Electrostatic Precipitators - Operational Considerations - Process Control and Monitoring -Costing of APC equipment - Case studies for stationary and mobile sources.

9

9

UNIT IV CONTROL OF GASEOUS CONTAMINANTS

Factors affecting Selection of Control Equipment – Working principle, Design and performance equations of absorption, Adsorption, condensation, Incineration, Bio scrubbers, Bio filters - Process control and Monitoring - Operational Considerations - Costing of APC Equipment - Case studies for stationary and mobile sources.

UNIT V AUTOMOBILE AND NOISE POLLUTION

Vehicular Pollution: Automobile emission- Types of emissions- Exhaust emissions, evaporative emissions, crank-case emissions- Prevention and control of vehicular pollution. Noise Pollution: Sources and Effects of Noise Pollution – Measurement – Standards – Control and Preventivemeasures. Source types and control of indoor air pollutants, sick building syndrome types – Radon Pollution and its control.

TEXTBOOKS:

- 1. Anjaneyulu D, "Air pollution and control technologies," Allied Publishers, Mumbai, 2002.
- 2. Khitoliya R K, "Environmental Pollution," 2/e, S. Chand Publishing, 2012.

REFERENCE BOOKS:

- 1. Rao C.S, "Environmental pollution control engineering," Wiley Eastern Ltd., New Delhi,1996.
- 2. Rao M.N, and Rao H.V.N, "Air Pollution Control" Tata-McGraw-Hill, New Delhi, 1996.
- 3. David H. F Liu, Bela G.Liptak, "Air Pollution," Lewis Publishers, 2000.
- 4. Mudakavi, J R, "Principles and Practices of Air Pollution Control and Analysis" IK International, 2010.
- 5. Air Pollution act, India, 1998.

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|-----|-----|-----|-----|-----|-----|------------|-----|-----|------|------|------|------|------|
| CO1 | 3 | 2 | - | 2 | 1 | 2 | 1 | - | 2 | - | 2 | 2 | - | - |
| CO2 | 3 | 2 | - | 2 | 1 | 2 | 1 | - | 2 | - | 2 | 2 | - | - |
| CO3 | 3 | 2 | - | 2 | 1 | 2 | 1 | - | 2 | - | 2 | 2 | - | - |
| CO4 | 3 | 2 | - | 2 | 1 | 2 | 1 | - | 2 | - | 2 | 2 | - | - |
| CO5 | 3 | 2 | - | 2 | 1 | 2 | 1 | - | 2 | - | 2 | 2 | - | - |
| Average | 3 | 2 | - | 2 | 1 | 2 | 1 | - | 2 | - | 2 | 2 | - | - |

CO PO MAPPING

210

B.E. COMPUTER SCIENCE ENGINEERING

23BECSOE01

INTERNET OF THINGS

3H-3C

Instruction Hours/week: L:3 T:0 P:0

Marks: Internal:40 External:60 Total:100 End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course is for the students to

- Understand the basics of Internet of Things.
- Identify an idea of some of the application areas where Internet of Things can be applied.
- Infer the middleware for Internet of Things.
- Express the concepts of Web of Things .
- Examine the concepts of Cloud of Things with emphasis on Mobile cloud computing.
- Inspect the IOT security protocols.

COURSE OUTCOMES:

Upon completion of this course the students will be able to

- Model IoT architecture for a given application.
- Identify the feasibility and potential impact of IoT solutions in different industries.
- Apply a systematic and structured approach to designing IoT solutions.
- Make use of techniques to secure the elements of an IoT device.
- Utilize security protocols in IOT domains of industrial applications.

UNIT I INTRODUCTION TO IoT

Introduction to IoT – IoT Architectures – Core IoT Functional Stack, Sensors and Actuators Layer, Communications Network Layer, Applications and Analytics Layer – IoT Data Management and Compute Stack, Fog Computing, Edge Computing, Cloud Computing – Sensors, Actuators, Smart Objects, Sensor networks. Middleware for IoT: Overview – Communication middleware for IoT –IoT Information Security, WSN and Sensing Model.

UNIT II IoT COMMUNICATION

Communications Criteria – Access Technologies – IP as IoT Network Layer – Business case – Optimization – Profiles and compliances – Application Protocols – Transport Layer – Application Transport Methods.

UNIT III DESIGN METHODOLOGY

Design Methodology – Case study – Basic blocks of IoT device – Raspberry Pi – Board, Interfaces, Linux, Setting up, Programming – Arduino – Other IoT Devices.

UNIT IV DATA ANALYTICS FOR IoT

Data Analytics for IoT – Big Data Analytics Tools and Technology – Edge Streaming Analytics – Network Analytics Applications. Security history, challenges, variations – Risk Analysis Structures – Application in Operational Environment.

9

9

9

UNIT V IoT IN INDUSTRY

Manufacturing, Architecture, Security Protocols – Utilities, Grid Blocks - Smart Cities, Architecture, use cases – Transportation, Architecture, Use cases.

TOTAL: 45

TEXT BOOKS:

- 1. Honbo Zhou "The Internet of Things in the Cloud: A Middleware Perspective", CRC Press, 2013
- 2. Dieter Uckelmann, Mark Harrison, Florian Michahelles, "Architecting the Internet of Things", Springer Berlin, 2011
- 3. David Easley, Jon Kleinberg, "Networks, Crowds, and Markets: Reasoning About a Highly Connected World", Cambridge University Press, 2010

REFERENCE BOOKS:

- 1. Olivier Hersent, Omar Elloumi and David Boswarthick,"The Internet of Things: Applications to the Smart Grid and Building Automation", Wiley, 2018
- 2. Olivier Hersent, David Boswarthick, Omar Elloumi,"The Internet of Things Key applications and Protocols", Wiley, 2019

WEBLINKS:

- 1. https://www.javatpoint.com/iot-internet-of-things
- 2. https://www.geeksforgeeks.org/introduction-to-internet-of-things-iot-set-1/
- 3. https://www.tutorialspoint.com/internet_of_things/index.htm
- 4. <u>https://www.startertutorials.com/blog/physical-design-of-iot.html</u>
- 5. <u>https://www.guru99.com/iot-tutorial.html</u>

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|-----|-----|-----|-----|-----|-----|------------|-----|-----|------|------|------|------|------|
| CO1 | 3 | 2 | 2 | - | - | - | - | - | 2 | - | 2 | 2 | - | - |
| CO2 | 3 | 3 | 2 | 2 | 2 | - | - | - | 2 | - | 2 | 2 | - | - |
| CO3 | 3 | 3 | 2 | 2 | 2 | - | - | - | 2 | - | 2 | 2 | - | - |
| CO4 | 3 | 2 | 2 | 2 | - | - | - | - | 2 | - | 2 | 2 | - | - |
| CO5 | 3 | 2 | 2 | 2 | 2 | - | - | - | 2 | - | 2 | 2 | - | - |
| Average | 3 | 2 | 2 | 2 | 2 | - | - | - | 2 | - | 2 | 2 | - | - |

CO PO MAPPING

B.E. COMPUTER SCIENCE ENGINEERING

Instruction Hours/week: L:3 T:0 P:0

COURSE OBJECTIVES

23BECSOE02

The goal of this course is for the students to

- Introduce the basic concepts and techniques of Machine Learning.
- Understand Supervised and Unsupervised learning techniques.
- Study the various probability-based learning techniques.
- Learn Dimensionality Reduction Techniques.
- Infer Evolutionary Models and Graphical models of machine learning algorithms.

COURSE OUTCOMES

Upon completion of this course, the students will be able to

- Apply machine learning concepts to dimensionality reduction. •
- Construct machine learning techniques for a given problem.
- Experiment with open-source machine learning libraries and its uses.
- Choose similarity based learning for predictive data analytics.
- Identify online fraud detection to diagonise sensitive information. •

UNIT I: MACHINE LEARNING BASICS

Introduction to Machine Learning (ML) - Essential concepts of ML - Types of learning - Machine learning methods based on Time - Dimensionality - Linearity and Non linearity - Early trends in Machine learning – Data Understanding Representation and visualization.

UNIT II: MACHINE LEARNING METHODS

Linear methods - Regression -Classification -Perceptron and Neural networks - Decision trees -Support vector machines - Probabilistic models --- Unsupervised learning - Featurization

UNIT III: MACHINE LEARNING IN PRACTICE

Ranking - Recommendation System - Designing and Tuning model pipelines- Performance measurement - Azure Machine Learning - Open-source Machine Learning libraries - Amazon's Machine Learning Tool Kit: Sagemaker

UNIT IV: MACHINE LEARNING AND DATA ANALYTICS

Machine Learning for Predictive Data Analytics – Data to Insights to Decisions – Data Exploration – Information based Learning - Similarity based learning - Probability based learning - Error based learning – Evaluation – The art of Machine learning to Predictive Data Analytics.

9

9

9

9

MACHINE LEARNING

3H-3C Marks: Internal:40 External:60 Total:100

2023-2024

End Semester Exam:3 Hours

UNIT V: APPLICATIONS OF MACHINE LEARNING

9

Image Recognition – Speech Recognition – Email spam and Malware Filtering – Online fraud detection – Medical Diagnosis.

TOTAL: 45

TEXT BOOKS:

- 1. Ameet V Joshi, Machine Learning and Artificial Intelligence, Springer Publications, 2020
- 2. John D. Kelleher, Brain Mac Namee, Aoife D' Arcy, Fundamentals of Machine learning for Predictive Data Analytics, Algorithms, Worked Examples and case studies, MIT press,2015

REFERENCES:

- 1. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer Publications, 2011
- 2. Stuart Jonathan Russell, Peter Norvig, John Canny, Artificial Intelligence: A Modern Approach, Prentice Hall, 2020 3. Machine Learning Dummies, John Paul Muller, Luca Massaron, Wiley Publications, 2021

WEBLINKS:

- 1. https://www.tutorialspoint.com/machine_learning/index.htm
- 2. <u>https://www.hackerearth.com/practice/machine-learning/challenges-winning-approach/machine-learning-challenge-one/tutorial/</u>
- 3. https://www.javatpoint.com/machine-learning
- 4. <u>https://www.geeksforgeeks.org/machine-learning/</u>

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 2 | 1 | - | - | - | - | - | 1 | 1 | - | 1 | - | - |
| CO2 | 3 | 2 | 1 | - | - | - | - | - | 1 | 1 | - | 1 | - | - |
| CO3 | 3 | 2 | 1 | - | - | - | - | - | 1 | 1 | - | 1 | - | - |
| CO4 | 3 | 2 | 1 | - | - | - | - | - | 1 | 1 | - | 1 | - | - |
| CO5 | 3 | 2 | 1 | - | - | - | - | - | 1 | 1 | - | 1 | - | - |
| Average | 3 | 2 | 1 | - | - | - | - | - | 1 | 1 | - | 1 | - | - |

CO PO MAPPING

B.E COMPUTER SCIENCE ENGINEERING

23BECSOE03

BLOCKCHAIN TECHNOLOGIES

NOLOGIES3H-3CMarks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course is for the students to

Instruction Hours/week: L:3 T:0 P:0

- Comprehend the importance of the Blockchain framework and its practical uses.
- Scrutinize the verification of Bitcoin transactions through the utilization of the Blockchain.
- Recognize the constituent elements of smart contracts required for achieving consensus in a Permissioned Blockchain.
- Furnish the essential infrastructure and boost the effectiveness, efficacy, and transactions of diverse business procedures by utilizing Hyperledger.
- Examine the scope of utilization of Blockchain in diverse governmental and non-governmental entities.

COURSE OUTCOMES:

Upon completion of this course the students will be able to:

- Model blockchain architecture for an application.
- Apply proof of work consensus algorithm in securing the network.
- Build permissioned blockchain to assest transfer.
- Identify the transaction flow in Hyperledger Fabric and validation processes.
- Analyze message digest hashing algorithms in blockchain technology.

UNIT I INTRODUCTION

Introduction – Block Structure – Architecture – Block Header – Genesis Block – Merkle Trees – Hashing - Signature & Encryption Schemes – Business Applications

UNIT II BITCOIN BASICS

Bitcoin Basics – Wallet - Decentralized Consensus – Aggregate transactions - Proof of Work – Miners – Consensus Algorithms – Double Spending - Verifying Transactions – Fork – Reward

UNIT III PERMISSIONED BLOCK CHAIN

Permissioned Block Chain – Smart Contracts - Consensus – Raft – Byzantine – Paxos – Degree of Decentralization – Asset Transfer - Enterprise Application

9

9

9

2023-2024

UNIT IV FABRIC ARCHITECTURE

Fabric Architecture – Transaction Flow – Channel – Ordering Service –Membership & Identity Management – Network Setup – Hyperledger Composer – Roles – Network Administration

UNIT V BLOCKCHAIN USE CASES & SECURITY

Financial Services – Supply Chain – Government – Digital Identities – Land Record Registry – Security Overview – Membership & Access Control – Privacy

TEXT BOOKS:

- 1. Andreas M. Antonopoulos, "Mastering Bitcoin", 2nd Edition, O'Reilly Media, 2017
- 2. Melanie Swan, "Blockchain: Blueprint for a New Economy", 1st Edition, O'Reilly Media, 2017

REFERENCE BOOKS:

- Nitin Gaur, Luc Desrosiers, Et al, "Hands-On Blockchain with Hyperledger", Packt Publisher, June 2018
- 2. Imran Bashir, "Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks", Packt Publisher, March 2017

WEBLINKS:

- 1. https://nptel.ac.in/courses/106105184
- 2. https://www.hyperledger.org/projects/fabric
- 3. https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html
- 4. https://www.javatpoint.com/blockchain-tutorial

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|-----|-----|-----|-----|-----|-----|------------|-----|-----|-------------|------|------|------|------|
| CO1 | 3 | 2 | 2 | - | - | 2 | - | - | - | - | - | 2 | - | - |
| CO2 | 3 | 2 | 2 | - | - | 2 | - | - | - | - | - | 2 | - | - |
| CO3 | 3 | 2 | 2 | - | - | 2 | - | - | - | - | - | 2 | - | - |
| CO4 | 3 | 3 | 2 | - | - | 2 | - | - | - | - | - | 2 | - | - |
| CO5 | 3 | 3 | 3 | - | 2 | 2 | - | - | - | - | - | 2 | - | - |
| Average | 3 | 2 | 2 | - | 2 | 2 | - | - | - | - | - | 2 | - | - |

CO PO MAPPING

TOTAL: 45

Karpagam Academy of Higher Education (Deemed to be University) - Coimbatore

B.E COMPUTER SCIENCE ENGINEERING

Instruction Hours/week: L:3 T:0 P:0

COURSE OBJECTIVES:

23BECSOE04

The goal of this course is for the students to:

- Learn the basic concepts of cloud computing.
- Learn types of cloud services and its applications.
- Understand the key components of Amazon Web Services.
- Collaborate with real time cloud services.
- Understand the security risk and application of cloud computing.

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

- Identify the basic concepts of cloud computing and its usage.
- Choose cloud computing services based on infrastructure providers.
- Utilize the ways of collaborating cloud with web based communication tools..
- Build load balancing techniques using virtualization techniques.
- Develop proficiency in Google web services for cloud management.

UNIT I CLOUD INTRODUCTION

Cloud Computing Fundamentals: Cloud Computing definition, Types of cloud, Cloud services: Benefits and challenges of cloud computing, Evolution of Cloud Computing, usage scenarios and Applications, Business models around Cloud – Major Players in Cloud Computing - Issues in Cloud -Eucalyptus - Nimbus – Open Nebula, Cloud Sim.

CLOUD COMPUTING

UNIT II CLOUD SERVICES AND FILE SYSTEM

Types of Cloud services: Software as a Service - Platform as a Service – Infrastructure as a Service - Database as a Service - Monitoring as a Service – Communication as services. Service providers - Google App Engine, Amazon EC2, Microsoft Azure, Sales force. Introduction to MapReduce, GFS, HDFS, Hadoop Framework.

UNIT III COLLABORATING WITH CLOUD

Collaborating on Calendars, Schedules and Task Management – Collaborating on Event Management, Contact Management, Project Management – Collaborating on Word Processing, Databases – Storing and Sharing Files- Collaborating via Web-Based Communication Tools – Evaluating Web Mail Services – Collaborating via Social Networks – Collaborating via Blogs and Wikis.

3H-3C

Marks: Internal:40 External:60 Total:100 End Semester Exam:3 Hours

....

9

9

217

2023-2024

UNIT IV ABSTRACTION AND VIRTUALIZATION

Introduction to Virtualization Technologies, Load Balancing and Virtualization, Understanding Hyper visors, Understanding Machine Imaging, Porting Applications, Virtual Machines Provisioning and Manageability Virtual Machine Migration Services, Virtual Machine Provisioning and Migration in Action, Provisioning in the Cloud Context.

UNIT V MANAGING AND SECURING CLOUD

Managing & Securing the Cloud: Administrating the Clouds, Cloud Management Products, Emerging Cloud Management Standards, Securing the Cloud, Securing Data, Establishing Identity and Presence. Case-Studies: Using Google Web Services, Using Amazon Web Services, Using Microsoft Cloud Services

TEXT BOOKS:

- 1. John Ritting house & James Ransome, "Cloud Computing Implementation Management and Strategy", CRC Press, 2018.
- 2. Rao M.N., Cloud Computing, PHI Learning Private Limited, 2018.

REFERENCES:

- 1. Bloor R., Kanfman M., Halper F. Judith Hurwitz "Cloud Computing for Dummies" (Wiley India Edition), 2015.
- 2. Antohy T Velte, Cloud Computing : "A Practical Approach", McGraw Hill, 2018.

WEBLINKS:

- 1. https://nptel.ac.in/courses/106105167/
- 2. <u>https://www.javatpoint.com/cloud-computing</u>

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|-----|-----|-----|-----|-----|-----|------------|-----|-----|------|------|------|------|------|
| CO1 | 3 | 2 | 1 | - | - | - | - | - | 1 | 1 | - | 1 | - | - |
| CO2 | 3 | 2 | 1 | - | - | - | - | - | 1 | 1 | - | 1 | - | - |
| CO3 | 3 | 2 | 1 | - | - | - | - | - | 1 | 1 | - | 1 | - | - |
| CO4 | 3 | 2 | 1 | - | - | - | - | - | 1 | 1 | - | 1 | - | - |
| CO5 | 3 | 2 | 1 | 1 | - | - | - | - | 1 | 1 | - | 1 | - | - |
| Average | 3 | 2 | 1 | - | - | - | - | - | 1 | 1 | - | 1 | - | - |

CO PO MAPPING

9

TOTAL: 45

Karpagam Academy of Higher Education (Deemed to be University) - Coimbatore

B.E COMPUTER SCIENCE ENGINEERING (CYBER SECURITY)

23BECYOE01 BASICS OF CYBER CRIME AND CYBER SECURITY Instruction Hours/week: L:3 T:0 P:0 Marks: Internal:40 External:60 Total:100

COURSE OBJECTIVES:

The goal of this course is for the students to

- Uunderstand the fundamental concepts of cybercrime.
- Explore knowledge on cybercrimes in wireless devices. ٠
- Infer tools used in the cyber security.
- Familiar with various Indian IT Act in cybercrime and cyber security.
- Enhance the knowledge in handheld devices and digital forensics. •

COURSE OUTCOMES:

Upon completion of this course the students will be able to

- Identify the basics of cyber-crime and information security in safeguarding digital assets. •
- Apply the fundamentals concepts for identifying cyber-attacks.
- Make use of tools and methods used in cyber security.
- Analyze theoretical and cross-disciplinary approaches in Indian IT Act and in digital devices.
- Discover the effect of cybercrime on digital devices on the public sector, private sector, individual, and societal levels.

UNIT I INTRODUCTION

Introduction to Cyber Crime: Cyber Crime and Information Security - Classifications of Cyber Criminals - Cyber Cri\me Legal Perspective and Indian Perspective - Cyber Crime and Indian ITA -A Global perspective on Cybercrimes – Categories of Cybercrimes – Criminal plans for attack – Social Engineering – Cyber talking – Cyber cafe and cyber criminals – Botnet – Attack vector – Cloud Computing.

UNIT II CYBER CRIME MOBILE AND WIRELESS DEVICES

Cyber Crime Mobile and Wireless Devices: Proliferation - Trends in Mobility - Credit card frauds -Security challenges – Registry setting – Authentication service – Attacks – Security Implication for Organization - Organizational measures - Organizational Security Policies - Physical security counter measures.

UNIT III TOOLS AND METHODS USED IN CYBER SECURITY

Tools and methods used in cyber security: Proxy servers and anonymizers - Phishing - Password cracking - Keyloggers and spywares - Virus and worms - Trojan horse - Stegnography - DoS and DDoS attack – SQL Injection – Buffer overflow – Attacks on wireless networks – Phishing and Identity theft.

9

9

9

3H-3C

End Semester Exam:3 Hours

2023-2024
UNIT IV CYBER CRIME AND LEGAL LANDSCAPE

Cyber Crime and Legal landscape – Indian IT Act – Digital Signature and Indian IT Act – Amendments to the Indian IT Act – Cybercrime and punishment. Understanding Computer Forensics: Need for computer forensics – Cyber forensics and digital evidence – Digital forensics life cycle – Network forensics – Computer forensics and steganography - Computer forensics from compliance perspective – Challenges

UNIT V SPECIAL TOOLS AND TECHNIQUES

Special tools and techniques –Hand held devices and digital forensics. Cyber security organizational implications: Cost of cybercrimes and IPR – Web threads for organizations – Security and privacy implications – Social media marketing – Incident handling – Forensics best practices for organization.

TEXT BOOKS:

1. Nina Godbole and Sunit Belapure, Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley Publisher, First Edition, 2011

REFERENCE BOOKS:

- 1. Harish Chander, Cyber Laws and IT Protection, PHI Learning, First Edition, 2012
- 2. James Graham, Ryan Olson and Rick Howard, Cyber Security Essentials, CRC Press, First Edition, CRC Press, First Edition

WEBLINKS:

- 1. www.lexology.com/library/
- 2. www.swayam.gov.in/nd2_ugc19_hs25/preview
- 3. www.educba.com/cyber-security-tools/
- 4. www.intaforensics.com
- 5. www.itu.int/en/ITU-D/Cybersecurity

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|------------|-----|-----|-----|-----|------------|------------|------------|-----|------|------|------|------|------|
| | | | | | | | | | | | | | | |
| CO1 | 3 | 2 | 1 | - | - | - | - | - | 1 | 1 | - | 1 | - | - |
| CO2 | 3 | 2 | 1 | - | - | - | - | - | 1 | 1 | - | 1 | - | - |
| CO3 | 3 | 2 | 1 | - | - | - | - | - | 1 | 1 | - | 1 | - | - |
| CO4 | 3 | 3 | 2 | 1 | - | - | - | - | 1 | 1 | - | 1 | - | - |
| CO5 | 3 | 3 | 2 | 1 | - | - | - | - | 1 | 1 | - | 1 | - | - |
| Average | 3 | 2.4 | 1.4 | 1 | - | - | - | - | 1 | 1 | - | 1 | - | - |

CO PO MAPPING

TOTAL: 45

9

B.E COMPUTER SCIENCE ENGINEERING (CYBER SECURITY)

2023-2024

23BECYOE02BASICS OF CYBER FORENSICS3H-3CInstruction Hours/week: L:3 T:0 P:0Marks: Internal:40 External:60 Total:100
End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course is for the students

- Make aware of fundamentals on cyber forensics and usage of cyber forensics tools.
- Be familiar with the file systems and challenges in the Linux and mac operating system.
- Explore knowledge on the network and different operating systems on mobile devices.
- Learn various services like FaaS and MaaS.
- Enhance the knowledge on database, email and threats in crypto currency.

COURSE OUTCOMES:

Upon completion of the course, the students will be able to:

- Identify the basic of Forensics investigation process.
- Utilize popular Linux distributions used for forensic analysis, file systems, processes, and artifacts associated with Linux systems.
- Make use of iOS forensics and relevant data extraction procedure from iOS devices
- Analyze the challenges in cloud forensics.
- Discover Bitcoin forensics and Blockchain artifacts.

UNIT INTRODUCTION

Introduction to Cyber forensics: Forensics investigation process – Forensics protocol – Digital forensics standards –Digital evidence – Types of cybercrime – Notable data breaches – Case study - Challenges in Cyber security – Cyber forensics tools. Windows forensics: Digital Evidence – File systems – Time analysis – Challenges- Case Study.

UNIT II LINUX FORENSICS AND MAC OS FORENSICS

Linux forensics: Popular linux – File systems – Process – Artifacts – Linux distribution used for forensics analysis – Challenges – Case study. Mac OS forensics: File systems – Process – Artifacts – Information to collect Mac book forensics investigation – Case study. Anti-forensics: Data wiping and shredding – Trial obfuscation – Encryption – Data hiding – Anti-forensics detection technique

9

UNIT III NETWORK FORENSICS AND MOBILE FORENSICS

Network forensics: OSI Model – Artifacts – ICPM Attack – Analysis tools. Mobile forensics: Android operating system – Mutual Extraction – Physical acquisition – Chip-off – Micro-read – Challenges – iOS operating system.

UNIT IV CLOUD FORENSICS AND WEB ATTACK FORENSICS

Cloud forensics: Cloud computing model – Server-side forensics – Client-side forensics – Challenges –Artifacts – use – Forensics as a Service. Malware forensics: Types – Analysis – Tools – Challenges – Malware as a Service. Web attack forensics: Web attack test – Intrusion forensics – Database forensics– Log forensics – Content analysis – File metadata forensics

UNIT V EMAILS AND EMAIL CRIMINALS

Emails and email criminals: Protocols – Email criminals – Email forensics. Solid State device forensics: Components –Data wiping – Analysis. Bit coin forensics: Crypto currency – Block chain – Artifacts – Challenges.

TOTAL: 45

TEXT BOOKS:

1. Niranjan Reddy, Practical Cyber Forensics: An Incident-Based Approach to Forensic Investigations, Apress, First Edition, 2019

REFERENCE BOOKS:

- 1. Marjie Britz T, Computer Forensics and Cyber Crime: An Introduction, Prentice Hall, ThirdEdition, 2013
- 2. Albert Marcella J and Frederic Guillossou, Cyber Forensics: From Data to Digital Evidence, Wiley Publisher, .First Edition, 2012

WEBLINKS:

- 1. www.swayam.gov.in/nd2_ugc19_hs25/preview
- 2. www.educba.com/cyber-security-tools/
- 3. www.intaforensics.com
- 4. <u>www.cs.nmt.edu/~df/lectures.html</u>

CO PO MAPPING

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|-----|-----|-----|-----|-----|-----|------------|-----|-----|------|------|------|------|------|
| | | | | | | | | | | | | | | |
| CO1 | 3 | 2 | 1 | - | - | - | - | - | 1 | 1 | - | 1 | - | - |
| CO2 | 3 | 2 | 1 | - | - | - | - | - | 1 | 1 | - | 1 | - | - |
| CO3 | 3 | 2 | 1 | - | - | - | - | - | 1 | 1 | - | 1 | - | - |
| CO4 | 3 | 3 | 2 | 1 | - | - | - | - | 1 | 1 | - | 1 | - | - |
| CO5 | 3 | 3 | 2 | 1 | - | - | - | - | 1 | 1 | - | 1 | - | - |
| Average | 3 | 2.4 | 1.4 | 1 | - | - | - | - | 1 | 1 | - | 1 | - | - |

Karpagam Academy of Higher Education (Deemed to be University) - Coimbatore

9

9

23BECYOE03CYBER LAWS AND INTELLECTUAL PROPERTY RIGHTS3H-3CInstruction Hours/week: L:3 T:0 P:0Marks: Internal:40 External:60 Total:100End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course is for the students to

- Understand the need for cyber laws and intellectual property rights.
- Acquire knowledge about the protective measures of Intellectual property such ascopyright, patent, Trademark.
- Examine the criminal remedies and defensive measures.
- Provide an insight about the role of certifying authority and cryptography.
- Be aware of Indian IT Act 2000 and 2008 cyber laws.

COURSE OUTCOMES:

Upon completion of the course, the students will be able to:

- Identify the fundamental concepts of cyber laws and the various intellectual property rights for criminal activities.
- Utilize the concept of work of employment and its implications in copyright infringement cases.
- Select civil remedies available for design infringement and their application in different infringement scenarios.
- Identify the scope and significance of cyber laws that arises from the use of technology.
- Make use of information technology act and its subsequent amendments in cyberspace.

UNIT I INTRODUCTION

Intellectual Property: Introduction – Protection of Intellectual Property – Copyright related rights – Patents – Industrial designs – Trademark – Unfair competition – Information technology related intellectual property rights – Computer software and intellectual property – Copyright protection – Reproducing – Defences – Patent protection.

UNIT II INFRINGEMENT

Ownership and enforcement of intellectual property – Defences in case of infringement copyright – Work of employment infringement – Defences for infringement – Trademarks – Rights – Protection of good will – Infringement – Passing off defences

2023-2024

9

Karpagam Academy of Higher Education (Deemed to be University) - Coimbatore

system of digital signatures – The role and function of certifying authorities

The science of cryptography – IT Act 2000 and 2008 – Amendments in IT Act – IPC and Privacy threats in cyber law. Intellectual Property issues in cyber space: Domain names and related issues – Copyright in the digital media – Patents in the cyber world. rights of netizens and e-Governance.

TEXT BOOKS:

- 1. David I Bainbridge, Intellectual Property, Pearson Education, Eighth Edition, 2010
- 2. Talat Fatima, Cyber Law in India, Wolters Kluwer, First Edition, 2017

REFERENCE BOOKS:

- 1. Yatindra Singh, Guide to Cyber Laws, Universal Law, Fourth Edition, 2010
- 2. Information Technology Law and Practice- Cyber Laws and Laws Relating to E-Commerce, Universal Law, Third Edition, 2011

WEBLINKS:

1. www.core.ac.uk/download/pdf/144527187.pdf

UNIT V INTELLECTUAL PROPERTY ISSUES

- 2 <u>www.nptel.ac.in/courses/110/105/110105</u>139/
- 3 <u>www.icsi.edu/media/webmodules/FINAL_IPR&LP_BOOK_10022020.pdf</u>
- 4 www.lawshelf.com/videocoursesmoduleview/
- 5 <u>www.lawfaculty.du.ac.in/files/course_material/Old_Course_Material/</u>

CO PO MAPPING

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|------------|-----|-----|-----|------------|-----|------------|------------|------------|-----|------|------|------|------|------|
| | | | | | | | | | | | | | | |
| CO1 | 3 | 2 | 1 | - | - | - | - | - | 1 | 1 | - | 1 | - | - |
| CO2 | 3 | 2 | 1 | - | - | - | - | I | 1 | 1 | I | 1 | - | - |
| CO3 | 3 | 2 | 1 | - | - | - | - | - | 1 | 1 | I | 1 | - | - |
| CO4 | 3 | 2 | 1 | - | I | - | I | I | 1 | 1 | I | 1 | - | - |
| CO5 | 3 | 2 | 1 | - | I | - | I | I | 1 | 1 | I | 1 | - | - |
| Average | 3 | 2 | 1 | - | - | - | - | - | 1 | 1 | - | 1 | - | - |

UNIT III IP IINTELLECTUAL PROPERTY RIGHTS AND ENFORCEMENT

Designs – Defences of design infringement. Enforcement of intellectual property rights – Civil remedies – Criminal remedies – Border – Security measures. Practical aspects of licensing – Benefits – Determinative factors – Important clauses – Licensing clauses.

Cyber law: Basic concepts of technology and law – Understanding the technology of internet – Scope of cyber laws. Cyber jurisprudence law of digital contracts: The essence of digital contracts – The

UNIT IV CYBER LAW

mindatore

TOTAL: 45

9

BLOCKCHAIN AND CYBER SECURITY 23BECYOE04

Instruction Hours/week: L:3 T:0 P:0

Marks: Internal:40 External:60 Total:100 **End Semester Exam:3 Hours**

COURSE OBJECTIVES:

The goal of this course is for the students to

- Decompose a block chain system's fundamental components, how they fit together and examine a decentralization using block chain.
- Illustrate how Crypto currency works, from when a transaction is created to when it is considered part of the blockchain.
- Explain the components of Ethereum, programming languages for Ethereum and study the basics Hyperledger and Web3.
- Understand the nature of threats and cyber security management goals and technology
- Infer the landscape of hacking and perimeter defense mechanisms

COURSE OUTCOMES:

Upon completion of the course the student will be able to:

- Identify the technology components of Block chain and its working principles.
- Utlize Ethereum model and its architectural components.
- Make use of Hyperledger components along with its development framework.
- Categorize the nature of threats and cyber security management goals.
- Discover malicious software attack and wireless network attack.

UNIT I INTRODUCTION OF BLOCKCHAIN TECHNOLOGY

History of Blockchain - Types of Blockchain - Consensus - Decentralization using Blockchain -Blockchain and Full Ecosystem Decentralization - Platforms for Decentralization. Bitcoin - Digital Keys and Addresses - Transactions - Mining - Bitcoin Networks and Payments - Wallets - Alternative Coins - Theoretical Limitations - Bitcoin Limitations - Name Coin - Prime Coin - Zcash. - Smart Contracts - Ricardian Contracts.

UNIT II ETHEREUM NETWORK

The Ethereum Network – Components of Ethereum Ecosystem – Ethereum Programming Languages: Runtime Byte Code, Blocks and Blockchain, Fee Schedule - Supporting Protocols - Solidity Language. 9

UNIT III FRAMEWORK FOR HYPERLEDGER FABRIC

Introduction to Web3 - Contract Deployment - POST Requests - Development frameworks -Hyperledger as a protocol – The Reference Architecture – Hyperledger Fabric – Distributed Ledger – Corda-Alternative Blockchains.

9

Karpagam Academy of Higher Education (Deemed to be University) - Coimbatore

UNIT IV CYBER SECURITY

Introduction – Cyberspace – Cyber Crime – Nature of Threat – Cyber security – Policy, Mission and Vision of Cyber security Program. Cyber security management system – goals, technology categories –perimeter defense and encryption.

UNIT V WEB APPLICATION ATTACKS

Malicious Attacks, Threats, and Vulnerabilities- Malware –malicious software attack – social engineering attack – wireless network attack – web application attack –Countermeasures. Creating Mechanisms for IT Security.

TEXT BOOKS:

- 1. Imran Bashir "Mastering Blockchain: Distributed Ledger Technology, Decentralization, and Smart Contracts Explained" Packt Publishing, Second Edition 2018.
- 2. Arshdeep Bahga, Vijay Madisetti "Blockchain Applications: A Hands-On Approach" VPT Publications, First Edition 2017.
- 3. David Kim and Michael G. Solomon "Fundamentals of Information Systems Security" Jones &Bartl Learning, Third Edition 2018.
- 4. Peter Trim and Yang –Im Lee "Cyber Security Management- A Governance, Risk and Compliance Framework" Gower Publishing, First Edition 2014.

REFERENCE BOOKS:

- 1. Andreas Antonopoulos, Satoshi Nakamoto "Mastering Bitcoin", O'Reilly Publishing, Second Edition 2017.
- 2. Alex Leverington "Ethereum Programming", Packt Publishing, First Edition 2017.
- 3. John G. Voeller "Cyber Security" John Wiley & Sons, First Edition 2014.

WEB SITES:

- 1. www.nptel.ac.in/courses/106/104/106104220/
- 2. www.icaew.com/technical/technology/blockchain/blockchain-articles/whatisblockchain/history
- 3. www.ibm.com/topics/blockchain-security
- 4. https://blockgeeks.com/guides/ethereum/
- 5. <u>https://world101.cfr.org/global-era-issues/cyberspace-and-cybersecurity/what-are-cyberspaceand-cybersecurity</u>

9

9

TOTAL: 45

CO PO MAPPING

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|-----|-----|-----|-----|-----|-----|------------|-----|-----|------|------|------|------|------|
| CO1 | 3 | 2 | 1 | - | - | - | - | - | 1 | 1 | - | 1 | - | - |
| CO2 | 3 | 2 | 1 | - | - | - | - | - | 1 | 1 | - | 1 | - | - |
| CO3 | 3 | 2 | 1 | - | - | - | - | - | 1 | 1 | - | 1 | - | - |
| CO4 | 3 | 3 | 2 | 1 | - | - | - | - | 1 | 1 | - | 1 | - | - |
| CO5 | 3 | 3 | 2 | 1 | - | - | - | - | 1 | 1 | _ | 1 | - | - |
| Average | 2 | 1 | 1.4 | 1 | - | - | - | - | 1 | 1 | - | 1 | _ | - |

23BEEEOE01

RENEWABLE ENERGY SYSTEMS3H-3C

Instruction Hours/week: L:3 T:0 P:0

Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

Course Objectives The goal of this course is for students:

- To gain the knowledge about environmental aspects of energy utilization.
- To understand the basic principles of solar cells, photovoltaic conversion.
- To understand the basic principles of wind energy conversion.
- To gain the knowledge about hydro and ocean energy.
- To understand the basic principles of Biomass, fuel cell, Geo-thermal power plants and MHD.

Course Outcomes

Upon completion of this course, students will be able:

- Outline the environmental issues associated with fossil fuels and other energy resources.
- Make use of Solar PV systems for practical applications.
- Choose the Wind Turbine systems for application based on their working.
- Explain the operation of Hydroelectric Plant and Ocean Energy
- Compare the working of Biomass Power Generation, Fuel Cell, Geo thermal plants and MHD.

UNIT I INTRODUCTION

Energy scenario - Different types of Renewable Energy Sources – Environmental aspects of energy utilization - Energy Conservation and Energy Efficiency - Needs and Advantages, Energy Conservation Act 2003.

UNIT II SOLAR ENERGY

Introduction to solar energy: solar radiation, availability, measurement and estimation–Solar thermal conversion devices and storage – solar cells and photovoltaic conversion –PV systems – MPPT. Applications of PV Systems – solar energy collectors and storage.

UNIT III WIND ENERGY

Introduction – Basic principles of wind energy conversion- components of wind energy conversion system - site selection consideration – basic–Types of wind machines. Schemes for electric generation – generator control, load control, energy storage – applications of wind energy – Inter connected systems.

Karpagam Academy of Higher Education (Deemed to be University) - Coimbatore

9

9

UNIT IV HYDRO ENERGY

Hydropower, classification of hydro power, Turbine selection, Ocean energy resources, ocean energy routes. Principles of ocean thermal energy conversion systems, ocean thermal power plants. Principles of ocean wave energy conversion and tidal energy conversion.

UNIT V OTHER SOURCES

Bio energy and types –Fuel cell, Geo-thermal power plants; Magneto-hydro-dynamic(MHD) energy conversion.

TEXT BOOKS:

- 1. Rai.G.D, Non-conventional sources of energy Khanna publishers, 2011.
- 2. Khan.B.H, Non-Conventional Energy Resources ,The McGraw Hills, Second edition, 2012.
- 3. John W Twidell and Anthony D Weir , Renewable Energy Resources, Taylor and Francis 3rd edition, 2015

CO PO MAPPING

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|------------|-----|-----|-----|-----|-----|-----|------------|------------|-----|------|------|------|------|------|
| | | | | | | | | | | | | | | |
| CO1 | 2 | 1 | 1 | 1 | - | 2 | 1 | - | - | - | - | 1 | - | - |
| CO2 | 3 | 2 | 2 | 2 | - | - | 1 | - | - | - | - | 1 | - | - |
| CO3 | 3 | 2 | 2 | 2 | - | - | 1 | - | - | - | - | 1 | - | - |
| CO4 | 2 | 1 | 1 | 1 | - | I | 1 | - | - | - | - | 1 | - | - |
| CO5 | 2 | 1 | 1 | 1 | - | I | 1 | - | - | - | - | 1 | - | - |
| Average | 2.4 | 1.4 | 1.4 | 1.4 | - | 0.4 | 1 | - | - | - | _ | 1 | - | _ |

Karpagam Academy of Higher Education (Deemed to be University) - Coimbatore

TOTAL: 45

23BEEEOE02

HYBRID ELECTRIC VEHICLES

3H-3C

Instruction Hours/week: L:3 T:0 P:0

Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

Course Objectives The goal of this course is for students:

- To understand the basics of electric and hybrid electric vehicles, their architecture, technologies and fundamentals.
- To familiarize the plug in hybrid electric drive- Train Topologies.
- To analyze electric drives suitable for hybrid electric vehicles.
- To discuss different energy storage technologies used for hybrid electric vehicles and their control.
- To demonstrate energy management strategies in hybrid electric vehicles.

Course Outcomes

Upon completion of this course, students will be able:

- Explain the basics of electric and hybrid electric vehicles, their architecture, technologies and fundamentals
- Analyze the use of train topologies in hybrid electric drive.
- Interpret electric drives suitable for hybrid electric vehicles.
- Explain the use of energy storage devices used for hybrid electric vehicles.
- Analysis the performance of Energy Management strategies in HEVs.

UNIT I INTRODUCTION

History of hybrid and electric vehicles, social and environ2ental i2portance of hybrid andelectric vehicles, i2pact of 20dern drive-trains on energy supplies.

UNIT II HYBRID E1ECTRIC DRIVE-TRAINS

History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies.

UNIT III E1ECTRIC PROPU1SION UNIT

Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.

9

Q

UNIT IV ENERGY STORAGE

Introduction to Energy Storage Require2ents in Hybrid and Electric Vehic1es, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices.

UNIT V ENERGY 2ANAGE2ENT STRATEGIES

Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies.

TEXT BOOKS:

- 1. C.Mi, M.A. Masrur and D.W.Gao, "Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives", John Wiley & Sons, 2011.
- 2. S.Onori, L.Serrao and G.Rizzoni, "Hybrid Electric Vehicles: Energy Management Strategies", Springer, 2015.
- 3. M.Ehsani, Y.Gao, S.E.Gay and A.Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design", CRC Press, 2004.
- 4. T.Denton, "Electric and Hybrid Vehicles", Routledge, 2016.

WEBLINKS:

- 1. https://www.energy.gov/eere/electricvehicles/electric-vehicle-basics
- 2. https://swayam.gov.in/nd1_noc20_ee18/preview3.https://nptel.ac.in/courses/108103009/
- 3. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/106105166/lecpdf
- 4. https://nptel.ac.in/courses/106105166/
- 5. https://nptel.ac.in/courses/108108098/

COs **PO1 PO2** PO3 **PO4 PO5 PO6 PO7 PO8 PO9 PO10 PO11 PO12 PSO1** PSO₂ **CO1** 2 2 1 2 1 1 1 1 --**CO2** 3 3 2 2 2 1 1 --_ _ _ -_ **CO3** 2 2 1 1 1 1 1 --_ _ _ _ _ 3 3 2 2 2 **CO4** 1 1 --_ 3 3 2 2 2 **CO5** 1 -1 -_ -_ -2.6 2.6 1.6 1.6 1.6 0.4 1 1 _ Average _

CO PO MAPPING

B.E Electronics and Communication Engineering

23BEECOE01

Instruction Hours/week: L:3 T:0 P:0

Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for students is:

• To introduce students to the embedded systems, its hardware and software.

REAL TIME EMBEDDED SYSTEMS

- To introduce devices and buses used for embedded networking.
- To study about task management.
- To learn about semaphore management and message passing.
- To study about memory management.

COURSE OUTCOMES

At the end of the course the students will be able to

- Explain the Embedded system's hardware and software.
- Outline the operating system for embedded applications.
- Analyse the tasks performed by Embedded system.
- Examine the activities of multiple processes in an embedded system.
- Interpret the memory management system.

UNIT I INTRODUCTION TO EMBEDDED SYSTEM

Introduction- Embedded systems description, definition, design considerations & requirements-Overview of Embedded System Architecture (CISC and RISC)-Categories of Embedded Systemsembedded processor selection & tradeoffs- Embedded design life cycle -Product specificationshardware / software partitioning- iterations and implementation- hardware software integration – product testing techniques–ARM7.

UNIT II OPERATING SYSTEM OVERVIEW

Introduction–Advantage and Disadvantage of Using RTOS–Multitasking–Tasks-Real Time Kernels – Scheduler- Non-Preemptive Kernels – Preemptive Kernels – Reentrancy- Reentrant Functions– Round Robin Scheduling- Task Priorities- Static Priorities– Mutual Exclusion– Deadlock– Inter task Communication–Message Mailboxes–Message Queues- Interrupts- Task Management–Memory Management-Time Management–Clock Ticks.

UNIT III TASK MANAGEMENT

Introduction- μ C/OS-II Features-Goals of μ C/OS-II-Hardware and Software Architecture–Kernel Structures: Tasks–Task States–Task Scheduling–Idle Task–Statistics Task–Interrupts Under μ C/OS-II–Clock Tick- μ C/OS- II Initialization. Task Management: Creating Tasks–Task Stacks–Stack Checking–Task's Priority–Suspending Task, ResumingTask.TimeManagement: Delaying a Task–Resuming a Delayed Task–System Time. Event Control Blocks-Placing a Task in the ECB Wait List–Removing a Task from an ECB wait List.

232

9

Q

9

2023-2024 3H-3C

- In Publication, 2015.

Web links

- 1. https://nptel.ac.in/courses/10810505.
- 2. https://onlinecourses.nptel.ac.in/noc21_cs98/preview.
- 3. https://nptel.ac.in/courses/108102045.
- 4. https://archive.nptel.ac.in/courses/106/105/106105193/

CO PO MAPPING

| COs | PO | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|----|-----|-----|-----|-----|------------|------------|------------|-----|-------------|------|------|------|------|
| | 1 | | | | | | | | | | | | | |
| CO1 | 2 | 1 | 1 | - | 2 | - | - | - | - | - | - | - | - | - |
| CO2 | 2 | 1 | 1 | - | - | - | - | 1 | - | - | - | - | - | - |
| CO3 | 2 | 3 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - |
| CO4 | 2 | 3 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - |
| CO5 | 1 | 2 | 2 | - | 3 | - | - | - | - | - | - | - | - | - |
| Average | 3 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | - | - | - |

UNIT IV SEMAPHORE MANAGEMENT AND MESSAGE PASSING

Semaphore Management: Semaphore Management Overview- Signaling a Semaphore. Message Mailbox Management: Creating a Mailbox – Deleting Mailbox–Waiting for a Message box–Sending Message to a Mailbox- Status of Mailbox. Message Queue Management: Creating Message Queue-Deleting a Message Queue–Waiting for a Message Queue–Sending Message to a Queue–Flushing a Queue.

UNIT V MEMORY MANAGEMENT

Memory Management: Memory Control Blocks-Creating Partition-Obtaining a Memory Block-Returning a Memory Block. Getting Started with C/OS-II–Installing C/OS-II–Porting C/OS-II: Development Tools-Directories and Files-Testing a Port -IAR Workbench with C/OS-II-µ C/OS-II Porting on a 8051CPU- Implementation of Multitasking- Implementation of Scheduling and Rescheduling –Analyze the Multichannel ADC with help of µC/OS-II.

TEXT BOOKS:

1. JeanJ. Labrosse, Micro C/OS–II The Real Time Kernel, CMPBOOKS, 2009. 2. David Seal, ARM Architecture, Reference Manual, Addison-Wesley, 2008.

- 3. Steve Furbe, ARM System-on-Chip, Architecture, Addison-Wesley Professional, California, 2000.
- 4. K.C. Wang, Embedded and Real-Time Operating Systems, Springer, 2017.
- 5. Janez Puhan, Operating systems, Embedded systems and Real-time systems, CIP Cataloging

9

TOTAL: 45

B.E Electronics and Communication Engineering

23BEECOE02

CONSUMER ELECTRONICS

Instruction Hours/week: L:3 T:0 P:0

Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

OURSE OBJECTIVES

The goal of this course for students is:

- To study about various speakers and microphone.
- To learn the fundamental of television systems and standards.
- To learn the process of audio recording and reproduction.
- To study various telephone networks.
- To discuss about the working of home appliances

COURSE OUTCOMES

At the end of the course the students will be able to

- Explain working of loud speakers and Microphones
- Interpret the fundamentals of Television systems.
- Record the Audio Signal and reproduce it.
- Classify telecommunication networks.
- Examine the working of home appliances.

UNIT I LOUDSPEAKERS AND MICROPHONES

Introduction Loudspeaker, types of loud speakers, Loudspeaker characteristics, Dynamic Loudspeaker, Electrostatic loudspeaker, Permanent Magnet Loudspeaker, Woofers and Tweeters – Introduction Microphone, Types of Microphones, Microphone Characteristics, Carbon Microphones, Dynamic Microphones and Wireless Microphones.

UNIT II TELEVISION STANDARDS AND SYSTEMS

Introduction to TV system - Components of a TV system–Scanning – types of scanning-interlacing– Color TV Fundamentals - Additive Mixing- Subtractive Mixing- Need for Synchronization- Aspect Ratio- Video Bandwidth - Positive and Negative Transmission- Advantages of Negative Transmission- composite video signal - Color TV system– Luminance and Chrominance signal-Monochrome and Color Picture Tubes- Color TV systems– NTSC, PAL, SECAM.

UNIT III OPTICAL RECORDING AND REPRODUCTION

Introduction to Audio disc - Audio Disc– Processing of the Audio signal–Readout from the Disc – Reconstruction of the audio signal–Introduction to Video Disc recording –video disc mastering and replication - Video disc formats- Recording Systems–Playback Systems.

UNIT IV TELECOMMUNICATION SYSTEMS

Introduction to telecommunication Systems – Modes of telecommunication system-line system characteristics – Radio system characteristics –Signaling- Station Interconnection - Telephone services-telephone networks–switching system principles–PAPX or PBX switching–Data Services - Circuit, Packet and Message Switching, Telephone Networks - LAN, MAN and WAN, Integrated

2023-2024

3H-3C

9

9

9 41

Services Digital Network. Introduction to Mobile radio systems- Wireless Local Loop – the role of WLL – types of WLL - VHF/UHF radio systems- Limited range Cordless Phones –Introduction to cellular communication - cellular modems.

UNIT V HOME APPLIANCES

Introduction to home appliances – types of home appliances- Microwaves - Basic principle and block diagram of microwave oven -Washing Machine- electronic controller for washing machines - washing machine hardware and software –Introduction to air conditioners and refrigerators - Components of air conditioning systems – types of air conditioning systems- Refrigeration –Refrigeration systems – types of Refrigeration systems.

TOTAL: 45

TEXT BOOKS:

- 1. S.P. Bali Consumer Electronics Pearson Education 2007
- 2. J.S.Chitode Consumer Electronics Technical Publications 2007
- 3. Philip Hoff, Philip Herbert Hoff Consumer Electronics for Engineers Cambridge University Press 1998
- 4. R.G.Gupta Audio & Video Systems Tata Mc Graw hill Publishing Company Ltd 2004

WEB LINKS

- 1. https://nptel.ac.in/courses/117105133
- 2. https://archive.nptel.ac.in/courses/117/104/117104127/
- 3. https://nptel.ac.in/courses/117102059
- 4. https://nptel.ac.in/courses/108101091

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|-----|-----|-----|-----|-----|-----|------------|-----|-----|------|------|------|------|------|
| CO1 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | 2 | 1 | 1 | - | - | - | - | - | - | - | - | - | - | - |
| CO3 | 3 | 2 | 1 | 1 | 2 | - | - | - | - | - | - | 2 | - | - |
| CO4 | 3 | 3 | 2 | 2 | 2 | - | - | - | - | - | - | 1 | - | - |
| CO5 | 3 | 2 | 2 | 1 | 2 | - | - | - | - | - | - | 2 | - | - |
| Average | 2.6 | 2 | 1.7 | 1.7 | 2 | - | - | - | - | - | - | 1.7 | - | - |

CO PO MAPPING

23BEMEOE01BATTERY MANAGEMENT SYSTEMInstruction Hours/week: L:3 T:0 P:0Marks: Internal:40 External

Marks: Internal:40 External:60 Total:100

2023-2024

3H-3C

End Semester Exam:3 Hours

COURSE OBJECTIVE

The goal of the course is:

- To learn various energy storage systems used for Hybrid Electric Vehicle (HEV) and Electric Vehicle (EV).
- To learn about design and operation of solid-state Li-ion battery.
- To gain knowledge on the high temperature application of battery.
- To learn various technology for recycling used batteries.
- To understand the battery electrical and thermal management systems using active and passive cooling system.

COURSE OUTCOMES

At the end of the course the student would be able:

- To understand the performance and driving cycles of EVs.
- To apply their knowledge to manufacture various types of Li-ion batteries.
- To apply knowledge on use of Li-ion battery in large scale grid and space crafts.
- To understand Techno-economic aspects of battery recycling and environmental safety.
- To understand battery cooling system and safety precautions for high voltage battery.

UNIT I ENERGY STORAGE SYSTEMS

General background on alternative energy sources and sustainability, Introduction to electric-based transportation, Overview of on-road vehicle electrification, EVs configuration, Energy and power requirements for various HEVs and EVs Vehicle performance and driving cycles.

UNIT II LITHIUM BATTERIES

Li-ion batteries - Principle of operation, Battery components and design Electrode, cell and battery fabrications, Building block cells, battery modules and packs and applications. All solid-state batteries and future developments, Li-Sulphur battery, Li-Air battery, Sodium-battery, Magnesium battery, Aluminium battery, Silicon battery.

UNIT III HIGH TEMPERATURE BATTERIES FOR BACK-UP APPLICATIONS 9

Advance Ni-MH batteries for transportation, Future prospects of Ni-MH batteries vs. lithium ion batteries, Zebra cell, Li-iron sulphide cells, Vanadium and iron-based batteries, Semi-fluid flow batteries for large scale grid application, Ni-H₂ cells for space applications.

UNIT IV FUEL CELLS AND BATTERY RECYCLING TECHNOLOGY

Introduction to fuel cells, Proton-exchange membrane and alkaline fuel cells for transportation, Solid oxide fuel cells, Technology and economic aspects of battery recycling, Environmental effect and controlling of poisonous chemicals contamination.

9

9

UNIT V BATTERY MANAGEMENT

Fundamentals of battery management systems and controls, Battery Thermal Management - Passive cooling, Active cooling -Liquids & air systems.Regulations and Safety Aspects of High Voltage Batteries, Code and Standards, Safe handling of Lithium Batteries, Safety of high voltage battery.

TOTAL: 45

TEXT BOOKS:

- 1. Gerardus Blokdyk, Battery Management System A Complete Guide, Springer, 2019 Edition.
- 2. Reiner Korthauer, Lithium-Ion Batteries: Basics and Applications, 1st Edition. Springer, 2018
- 3. Alfred Rufer, Energy Storage: Systems and Components, 1st Edition, CRC Press, 2017.
- 4. Arno Kwade and Jan Diekmann, Recycling of Lithium-Ion Batteries: The LithoRec Way (Sustainable Production, Life Cycle Engineering and Management), 1st Edition. Springer, 2018.

WEB REFERENCES

1. https://nptel.ac.in/courses/108/103/108103009/

CO PO MAPPING

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO2 | PSO2 |
|---------|-----|-----|-----|-----|-----|-----|------------|------------|-----|------|------|------|------|------|
| CO1 | 3 | 2 | 1 | - | - | - | - | - | - | 1 | - | 1 | - | - |
| CO2 | 3 | 3 | 2 | 1 | - | - | - | - | - | 1 | - | 1 | - | - |
| CO3 | 3 | 2 | 1 | - | - | - | - | - | - | 1 | - | 1 | - | - |
| CO4 | 3 | 2 | 1 | - | - | - | - | - | - | 1 | - | 1 | - | - |
| CO5 | 3 | 2 | 1 | - | - | - | - | - | - | 1 | - | 1 | - | - |
| Average | 3 | 2.4 | 1 | 0.2 | - | - | - | - | - | 1 | - | 1 | - | - |

B.E. MECHANICAL ENGINEERING

Instruction Hours/week: L:3 T:0 P:0

23BEMEOE02 INDUSTRIAL SAFETY AND ENVIRONMENT 3H-3C

Marks: Internal:40 External:60 Total:100 End Semester Exam:3 Hours

COURSE OBJECTIVES:

- To recognize and evaluate occupational safety and health hazards in the workplace.
- To determine appropriate hazard controls following the hierarchy of controls.
- To analyses the effects of workplace exposures, injuries and illnesses, fatalities.
- To prevent incidents using the hierarchy of controls, effective safety and health management systems and task-oriented training.
- To teach student the concept of Industrial Safety & provide useful practical knowledge for workplace safety.

COURSE OUTCOMES:

At the end of the course, student will be able to

- Recognize and evaluate occupational safety and health hazards in the workplace.
- Determine appropriate hazard controls following the hierarchy of controls.
- Analyze the effects of workplace exposures, injuries and illnesses, fatalities.
- Prevent incidents using the hierarchy of controls, effective safety and health management systems and task- oriented training.
- Understand the concept of Industrial Safety & provide useful practical knowledge for workplace safety.

UNIT I CONCEPTS

Evolution of modern safety concept- Safety policy - Safety Organization - line and staff functions for safety- Safety Committee- budgeting for safety.

UNIT II TECHNIQUES

Incident Recall Technique (IRT), disaster control, Job Safety Analysis (JSA), safety survey, safety inspection, safety sampling, Safety Audit.

UNIT III ACCIDENT INVESTIGATION AND REPORTING

Concept of an accident, reportable and non-reportable accidents, unsafe act and condition – principles of accidentprevention, Supervisory role- Role of safety committee – Accident causation models - Cost of accident. Overall accident investigation process - Response to accidents, India reporting requirement, Planning document, Planningmatrix, Investigators Kit, functions of investigator, four types of evidences, Records of accidents, accident reports

UNIT IV SAFETY PERFORMANCE MONITORING

Reactive and proactive monitoring techniques - Permanent total disabilities, permanent partial disabilities, temporary total disabilities -Calculation of accident indices, frequency rate, severity rate, frequency severity incidence, incident rate, accident rate, safety "t" score, safety activity rate – problems.

238

2023-2024

9

9

UNIT V SAFETY EDUCATION AND TRAINING

Importance of training-identification of training needs-training methods – programme, seminars, conferences, competitions – method of promoting safe practice - motivation – communication - role of government agencies and private consulting agencies in safety training – creating awareness, awards, celebrations, safety posters, safety displays, safety pledge, safety incentive scheme, safety campaign – Domestic Safety and Training.

TOTAL: 45

TEXT BOOKS:

- 1. Accident Prevention Manual for Industrial Operations, 3rd edition, N.S.C. Chicago, 2010(digital).
- 2. Heinrich H.W. "Industrial Accident Prevention", 2ndedition, Tata McGraw-Hill Company, New York, 1941.
- 3. Krishnan N.V, Safety Management in Industry, 1st edition, Jaico Publishing House, Bombay, 1997.
- 4. John R Ridley, Safety at Work,3rd edition, Elsevier,2014
- 5. Roland P. Blake, Industrial Safety, 2ndedition, Prentice Hall, Inc., New Jersey, 1973
- 6. L M Deshmukh, Industrial safety management, 1stedition, TATA McGraw Hill, 2005.

CO PO MAPPING

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|-----|-----|-----|-----|-----|-----|------------|-----|-----|------|------|------|------|------|
| CO1 | 2 | 1 | - | - | - | - | - | - | - | 1 | - | 1 | - | - |
| CO2 | 2 | 1 | - | - | - | - | - | - | - | 1 | - | 1 | - | - |
| CO3 | 3 | 2 | 1 | - | - | - | - | - | - | 1 | - | 1 | - | - |
| CO4 | 3 | 3 | 2 | 1 | - | - | - | - | - | 1 | - | 1 | - | - |
| CO5 | 2 | 1 | - | - | - | - | - | - | - | 1 | - | 1 | - | - |
| Average | 3 | 1 | 2 | 1 | - | - | - | - | - | 1 | - | 1 | - | - |

23BEMEOE03NON-DESTRUCTIVE TESTING3H-3C

Instruction Hours/week: L:3 T:0 P:0

Marks: Internal:40 External:60 Total:100

+0 External:00 10tal:100 End Semester Exam:3 Hours

COURSE OBJECTIVE:

- The main objectives of this course are to introduce the concept of non-destructive testing among the students and make them understand various types of non-traditional practices available for manufacturing industry.
- To provide in-depth knowledge on various techniques of non-destructive testing.
- To provide an overview of destructive and non-destructive tests and state their applications
- To study the features of NDT techniques for various products and to understand the established NDE techniques and basic familiarity of emerging NDE techniques.
- To expose students to skills needed for selection of appropriate NDT technique(s) for new inspection jobs.
- To facilitate the understanding of standard application area of NDET

COURSE OUTCOME:

Student will be able to

- Understand the codes, standards and specifications related to NDT.
- Classify the destructive and non-destructive tests and state their applications.
- Develop NDT techniques for various products.
- Acquire skills needed for selection of appropriate NDT technique(s) for new inspection jobs
- Acquire sound knowledge of established NDE techniques and basic familiarity of emerging NDE techniques.
- Make use of standards application area of NDET

UNIT I INTRODUCTION

Properties of Engineering Materials – Types of Defects – Surface and Sub-Surface of a component – Characteristics of Ferrous, Non-ferrous and Alloys. Classification of Destructive testing and Non-Destructive testing – Uses and applications. Codes, Standards and Specifications of NDT (ASME, ASTM, AWS etc.). Importance and Scope of NDT, Non-destructive testing methods

UNIT II PENETRANT TESTING AND MAGNETIC PARTICLE INSPECTION

Introduction to Penetrant Testing – Liquid Penetrants and Dye Penetrants - Apparatus required for LPT - An Illustration of Penetrant Testing, Application, Advantages and Disadvantages of Penetrants Testing. Introduction to Magnetic Particle Inspection – MPT equipments and devices - An Illustration of Magnetic Particle Inspection, Advantages and Disadvantages of Magnetic Particle Crack Detection.

UNIT III ULTRASONIC FLAW DETECTION AND RADIOGRAPHY INSPECTION 9 Introduction to Ultrasonic Flaw Detection, UT equipments and devices, An Illustration of Ultrasonic Flaw Detection, Application, Advantages and Disadvantages of Ultrasonic Flaw Detection.Principle of Radiography Inspection, RT equipments and devices Radiation sources, uses of x-rays and gamma rays Attenuation in the specimen, Radiographic imaging, Inspection Techniques, Application and limitations, Safety from Radiation.

9

Karpagam Academy of Higher Education (Deemed to be University) - Coimbatore

UNIT IV EDDY CURRENT TESTING AND VISUAL TESTING METHODS 9

Introduction to Eddy Current Testing. ECT equipments and devices, An Illustration of Eddy Current Testing Equipment, Application, Advantages and Disadvantages of Eddy Current Testing.

Introduction to visual testing method, Equipments required for VT - An Illustration of visual testing method, Application, Advantages and Disadvantages of visual testing method.

UNIT V NON-DESTRUCTIVE INSPECTION(NDI) AND ITS APPLICATIONS 9

Inspection of Raw Products, Inspection for In-Service Damage, Power Plant Inspection, Storage Tank Inspection, Automobile component Inspection, Jet Engine Inspection, Pressure Vessel Inspection, Bridge Inspection, Pipeline Inspection.

TEXT BOOKS:

- 1. Sadashiva.M Non Destructive Testing Paperback 15 July 2021.
- 2. Ramachandran.S and Anderson.A Non-Destructive Testing Kindle Edition 2018
- 3. J. Prasad and C. G. Krishnadas Nair Non-Destructive Test and Evaluation of Materials Hardcover 1 July 2017.
- 4. Lari and Kumar Basics of Non Destructive Testing Paperback 1 January 2013.
- 5. Ravi Prakash Non Destructive Testing Techniques Hardcover 1 January 2010.
- 6. Louis Cartz Non destructive Testing 1st Edition, ASM International, Almere, Netherland, 2007(digital).

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 2 | 1 | - | - | - | - | - | - | - | 1 | - | 1 | - | - |
| CO2 | 2 | 1 | - | - | - | - | - | - | - | 1 | - | 1 | - | - |
| CO3 | 3 | 2 | 1 | - | - | - | - | - | - | 1 | - | 1 | - | - |
| CO4 | 2 | 1 | - | - | - | - | - | - | - | 1 | - | 1 | - | - |
| CO5 | 2 | 1 | - | - | - | - | - | - | - | 1 | - | 1 | - | - |
| Average | 3 | 2 | 2 | 1 | - | - | - | - | - | 1 | - | 1 | - | - |

CO PO MAPPING

B.E. MECHANICAL ENGINEERING

- To study and acquire knowledge on engineering and Managerial solutions in Assignment and scheduling problems.
- To give exposure to inventory in industry.
- To make the student acquire sound knowledge on sequences to perform operation among various alternatives.
- To provide an overview of various tools in various sections of industries like marketing, material handling etc.
- To understand the Engineering and Managerial situations inTransportation.

COURSE OUTCOME

23BEMEOE04

COURSE OBJECTIVE

At the end of the course, student will be able to

- Understand the concepts of Linear programming technique.
- Apply LPP technique of Transportation models.
- Understand the techniques of scheduling and sequencing.
- Acquire knowledge in Inventory control and Queuing theory.
- Perform network analysis for a project.
- Understand the concept of replacement models.

UNIT I INTRODUCTION TO OPERATIONS RESEARCH

Operations research and decision-making - types of mathematical models and constructing the model - Roleof computers in operations research -Linear Programming Techniques: Formulation of linear programming problem, applications and limitations, graphical method, simplex method – The Big –M method - the two-phase method.

UNIT II TRANSPORTATION PROBLEMS

Least cost method, North west corner rule, Vogel's approximation method, modified distribution method, unbalance and degeneracy in transportation model, shortest route algorithm- dijkestra algorithm.

UNIT III ASSIGNMENT MODELS AND SCHEDULING

Assignment models - Hungarian algorithm, unbalanced assignment problems - maximization case inassignment problems, traveling salesman problem. Scheduling - processing n jobs through two machines, processing n jobs through three machines, processing two jobs through 'm' machines, processing n jobs through m machines.

OPERATIONS RESEARCH Instruction Hours/week: L:3 T:0 P:0

Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

3H-3C

9

UNIT IV INVENTORY CONTROL AND QUEUING THEORY

Variables in inventory problems, inventory models with penalty, shortage and quantity discount, safety stock, multi-item deterministic model.Queuing Models: Queues-Notation of queues, performance measures. The M/M/1 queue, The M/M/m queue, batch arrival queuing system, queues with breakdowns.

UNIT V PROJECT MANAGEMENT AND REPLACEMENT MODELS

Basic terminologies, constructing a project network, network computations in CPM and PERT, cost crashing.Replacement Models: Replacement of Items due to deterioration with and without time value of Money, Group replacement policy, Staff replacement

TOTAL:45

TEXT BOOKS:

- 1. Kanti Swarup, Operations Research, 12th edition, Sultan Chand and Sons, New Delhi, 2010.
- 2. Viswanathan N and Narahari Y, Performance Modeling of Automated Manufacturing Systems, 2nd edition, Prentice Hall of India, New Delhi, 2005
- 3. Prem kumar Gupta and Hira D.S, Operation Research, 1st edition, S Chand and Company Limited, New Delhi, 2017

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|-----|-----|-----|-----|-----|-----|------------|-----|-----|------|------|------|------|------|
| CO1 | 3 | 2 | 1 | - | - | - | - | - | - | 1 | - | 1 | - | - |
| CO2 | 3 | 3 | 2 | 1 | - | - | - | - | - | 1 | - | 1 | - | - |
| CO3 | 2 | 1 | 3 | - | - | - | - | - | - | 1 | - | 1 | - | - |
| CO4 | 3 | 2 | 1 | - | - | - | - | - | - | 1 | - | 1 | - | - |
| CO5 | 3 | 2 | 1 | - | - | - | - | - | - | 1 | - | 1 | - | - |
| Average | 2.8 | 2.6 | 1.6 | 1 | - | - | - | - | - | 1 | - | 1 | - | - |

CO PO MAPPING

243

9

B. Tech ARTIFICIAL INTELLIGENCE & DATA SCIENCE

23BTADOE01

FUNDAMENTALS OF DATA SCIENCE

3H-3C

Instruction Hours/week: L:3 T:0 P:0

Marks: Internal:40 External:60 Total:100 End Semester Exam: 3Hours

COURSE OBJECTIVES:

The goal of this course is for the students to

- Study the basic concepts of Data Science and data life cycle
- Understand the theoretical and mathematical aspects of Data Science models
- Learn common random variables and their uses, and with the use of empirical distributions
- Obtain the knowledge in data management tools
- Explore the major techniques for data science

COURSE OUTCOMES:

Upon completion of this course, the students will be able to

- Identify the key concepts in data science and data processing.
- Apply sampling and probabilistic models to a real time application.
- Make use of data normalization and data management tools.
- Distinguish between supervised and unsupervised machine learning techniques.
- Inspect different analytics used in business intelligence.

UNIT I INTRODUCTION

The Big Picture: What is Data Science? –The data life cycle: pre-processing, analysis, post-processing – Pre-processing: Data gathering, cleansing, visualization, and understanding (Mean, Variance, Standard Deviation. Percentiles.)–Data Storage (Relational databases, e.g. MySQL)

UNIT II PROBABILISTIC MODELS

Sampling – Probability Models for Statistical Methods: Discrete and continuous probability distributions, density functions. Random variables, expected values, variance, correlation.

UNIT III NORMALIZATION

Data Normalization (z-values, transforms) -Random processes -Data Management: Tools for Data

Analysis, Case Study: Data analysis using Python-Arrays, Visualization.

UNIT IV DATA MINING

Major Techniques in Data Science: Data mining, Data warehousing, Data mining vs Data warehouse– Machine Learning- Supervised Learning, Unsupervised Learning.

9

9

9

UNIT V BUSINESS INTELLIGENCE AND ANALYTICS

Business Intelligence –Descriptive Analytics, Diagnostic Analytics, Predictive Analytics, Prescriptive Analytics– Cloud computing-definition, Cloud services, types of clouds, some of commercial and non-commercial cloud service providers.

TEXT BOOKS:

 Glenn J. Myatt, Wayne P. Johnson, Making Sense of Data I: A Practical Guide to Exploratory Data Analysis and Data Mining, John Wiley & Son Publication, Second Edition, 2014.
Saltz Jeffrey S, An Introduction to Data Science, Sage Publications Inc, Second Edition, 2019.

REFERENCE BOOKS:

1.Murtaza Haider, Getting Started with Data Science: Making Sense of Data with Analytics, IBM Press, First Edition, 2015.

2. Peter Bruce & Andrew Bruce, Practical Statistics for Data Scientists, O'Reilly Publication, First Edition, 2017.

WEBLINKS:

- 1. https://www.inferentialthinking.com/chapters/intro
- 2. https://swayam.gov.in/nd1_noc20_cs36/preview
- 3. https://swayam.gov.in/nd1_noc19_cs60/preview
- 4. <u>https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-0002-introduction-to-computational-thinking-and-data-science-fall-2016/</u>

CO- PO Mapping

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|--------|-----|-----|-----|------------|-----|------------|------------|------------|-----|------|------|------|------|------|
| | | | | | | | | | | | | | | |
| CO1 | 3 | 2 | 1 | - | - | - | - | - | 1 | 1 | - | 1 | - | - |
| CO2 | 3 | 2 | 1 | - | - | - | - | - | 1 | 1 | - | 1 | - | - |
| CO3 | 3 | 2 | 1 | - | - | - | - | - | 1 | 1 | - | 1 | - | - |
| CO4 | 3 | 3 | 2 | 1 | - | - | - | - | 1 | 1 | - | 1 | - | - |
| CO5 | 3 | 3 | 2 | 1 | - | - | - | - | 1 | 1 | - | 1 | - | - |
| Averag | 3 | 2.4 | 1.4 | 1 | - | - | - | - | 1 | 1 | - | 1 | - | - |
| е | | | | | | | | | | | | | | |

TOTAL: 45

23BTADOE02 FUNDAMENTALS OFARTIFICIAL INTELLIGENCE 3H-3C

Instruction Hours/week: L:3 T:0 P:0

Marks: Internal: 40 External:60 Total:100 End Semester Exam: 3Hours

COURSE OBJECTIVES:

The goal of this course is for the students to

- Understand the various characteristics of Intelligent agents
- Learn the different search strategies in AI
- Represent knowledge in solving AI problems.
- Illustrate the different ways of designing software agents
- Know the various applications of AI.

COURSE OUTCOME:

Upon completion of the course, the students will be able to

- Apply search algorithms in real world scenarios.
- Identify different methods of knowledge representation.
- Examine description logic and conceptional dependencies.
- Inspect strategies for optimal decision-making in the context of game-playing scenarios.
- Categorize the properties of Markov process and the concept of transition probabilities.

UNIT I INTRODUCTION

Introduction: Objective, scope and outcome of the course Meaning and definition of artificial intelligence, Physical Symbol System Hypothesis, production systems, Characteristics of production systems; Breadth first search and depth first search techniques. Heuristic search Techniques: Hill Climbing, Iterative deepening DFS, bidirectional search. Analysis of search methods. A* algorithm, and their analysis. Introduction to Genetic Algorithms.

UNIT II KNOWLEDGE REPRESENTATION

Knowledge Representation, Problems in representing knowledge, knowledge representation using propositional and predicate logic, logical consequences, syntax and semantics of an expression, semantic Tableau. Forward and backward reasoning. Proof methods, substitution and unification, conversion to clausal form, normal forms, resolution, refutation, deduction, theorem proving, inferencing, monotonic and non-monotonic reasoning. Introduction to prolog.

UNIT III NETWORK-BASED REPRESENTATION

Network-based representation and reasoning, Semantic networks, Conceptual Graphs, frames. Description logic (DL), concept language, reasoning using DL. Conceptual dependencies (CD), scripts, reasoning using CD. Introduction to natural language processing.

9

9

Karpagam Academy of Higher Education (Deemed to be University) - Coimbatore

UNIT IV GAME THEORY

Adversarial search and Game theory, classification of games, game playing strategies, prisoner's Dilemma. Game playing techniques, minimax procedure, alpha-beta cut-offs. Complexity of alphabeta search. Automated planning, classical planning problem, forward planning, partial order planning, planning with proposal logic, hierarchical task planning, multiagent planning.

UNIT V FUZZY LOGIC

Reasoning in uncertain environments, Fuzzy logic, fuzzy composition relation, operations on fuzzy sets. Probabilistic reasoning, Bayes theorem, construction of Bayesian networks, belief propagation. Markov processes and Hidden Markov models.

TEXTBOOKS

- 1. "Artificial Intelligence", Elaine Rich, Kevin Knight, Mc-GrawHill, 2020.
- 2. "Introduction to AI & Expert System", Dan W. Patterson, PHI,2020.

REFERENCE BOOKS:

1. "Artificial Intelligence" by Luger (Pearson Education),2020.

•

2. Russel Norvig, "Artificial Intelligence: A Modern Approach", Pearson Education, 2020.

WEBLINKS:

1. https://www.pluralsight.com/blog/data-professional/fundamentals-of-artificial-intelligence

| 00 | | | | | | • | | | | | | | | |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 2 | 1 | - | - | - | - | - | 1 | 1 | - | 1 | - | - |
| CO2 | 3 | 2 | 1 | - | - | - | - | - | 1 | 1 | - | 1 | - | - |
| CO3 | 3 | 3 | 2 | 1 | - | - | - | - | 1 | 1 | - | 1 | - | - |
| CO4 | 3 | 3 | 2 | 1 | - | - | - | - | 1 | 1 | - | 1 | - | - |
| CO5 | 3 | 3 | 2 | 1 | - | - | - | - | 1 | 1 | _ | 1 | - | - |
| Average | 3 | 2.6 | 1.6 | 1 | - | - | - | - | 1 | 1 | - | 1 | - | - |

CO PO MAPPING

9

TOTAL: 45

B. Tech ARTIFICIAL INTELLIGENCE & DATA SCIENCE

23BTADOE03INTERNET PROGRAMMING3H-3C

Instruction Hours/week: L:3 T:0 P:0

Marks: Internal: 40 External:60 Total:100 End Semester Exam:3Hours

COURSE OBJECTIVES:

The goal of this course is for the students to

- Recall fundamental tags used in HTML5 and CSS to create simple web application.
- Rephrase the concept to create static and dynamic webpage with validation controls and event handling methods.
- Make use of servlets and JSP tag to develop server-side scripting.
- Summarize the tags in PHP and XML to create simple php web application.
- Interview the basic concept and tags are used in web service application using ajax.

COURSE OUTCOMES:

Upon completion of this course the students will be able to:

- Develop a basic website using HTML and Cascading Style Sheets.
- Build dynamic web page with validation using Java Script objects and by applying different event handling mechanisms.
- Experiment with server-side programs using Servlets and JSP.
- Model a simple web pages in PHP and represent data in XML format.
- Develop simple web service application using Ajax.

UNIT I – WEBSITE BASICS, HTML 5, CSS 3, WEB 2.0

Web Essentials: Clients, Servers and Communication – The Internet – Basic Internet protocols – World wide web – HTTP Request Message – HTTP Response Message – Web Clients – Web Servers – HTML5 – Tables – Lists – Image – HTML5 control elements – Semantic elements – Drag and Drop – Audio – Video controls – CSS3 – Inline, embedded and external style sheets – Rule cascading – Inheritance – Backgrounds – Border Images – Colors – Shadows – Text – Transformations – Transitions – Animations.

UNIT II - CLIENT-SIDE PROGRAMMING

Java Script: An introduction to JavaScript–JavaScript DOM Model-Date and Objects, -Regular Expressions- Exception Handling-Validation-Built-in objects-Event Handling- DHTML with JavaScript- JSON introduction – Syntax – Function Files – Http Request – SQL.

UNIT III – SERVER-SIDE PROGRAMMING

Servlets: Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions- Session Handling- Understanding Cookies- Installing and Configuring Apache Tomcat Web Server DATABASE CONNECTIVITY: JDBC perspectives, JDBC program example – JSP: Understanding

Karpagam Academy of Higher Education (Deemed to be University) - Coimbatore

9

9

UNIT IV – PHP AND XML

introduction to PHP: PHP- Using PHP- Variables- Program control- Built-in functions- Form Validation- Regular Expressions – File handling – Cookies – Connecting to Database. XML: Basic XML- Document Type Definition- XML Schema DOM and Presenting XML, XML Parsers and Validation, XSL and XSLT Transformation, News Feed (RSS and ATOM).

UNIT V – INTRODUCTION TO AJAX AND WEB SERVICES

AJAX: Ajax Client Server Architecture-XML Http Request Object-Call Back Methods; Web Services: Introduction- Java web services Basics – Creating, Publishing, Testing and Describing a Web services (WSDL)-Consuming a web service, Database Driven web service from an application –SOAP.

TOTAL: 45

TEXT BOOKS:

- 1. Anuratha A Puntembekar," Internet Programming", Technical Publication, 2020.
- 2. John Dean, "Web Programming with HTML5, CSS and JavaScript", Jones & Part left Learning,2018.
- 3. Sriram K Vasudevan, Meenakshi Sundaram, and Chandni Suresh" Essential of Internet Programming" DreamTech Press, Willey, 2015.

REFERENCE BOOKS:

- 1. Abiket Nagane," Internet Programming II", Nirali Prakashan,2016.
- 2. Max Bramer,"Web Programming With PHP and MySQL", A Practical guide, Springer, 2015
- 3. Gopalan N.P. and Akilandeswari J., -Web Technologyl, Prentice Hall of India, 2011.
- 4. UttamK.Roy, —Web Technologies, Oxford University Press, 2011.

WEBLINKS:

- 1. https://www.geeksforgeeks.org/internet-and-web-programming/
- 2. http://www.eie.polyu.edu.hk/~em/it0506pdf/4%20Internet%20Programming.pdf
- 3. https://www.techopedia.com/definition/23898/web-programming
- 4. <u>https://www.tutorialspoint.com/internet_technologies/index.htm</u>

9 An

CO PO MAPPING

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|-----|-----|-----|-----|-----|-----|------------|-----|-----|------|------|------|------|------|
| | | | | | | | | | | | | | | |
| CO1 | 3 | 2 | 1 | - | - | - | - | - | 1 | 1 | - | 1 | - | - |
| CO2 | 3 | 2 | 1 | - | - | - | - | - | 1 | 1 | - | 1 | - | - |
| CO3 | 3 | 2 | 1 | - | - | - | - | - | 1 | 1 | - | 1 | - | - |
| CO4 | 3 | 2 | 1 | - | I | - | I | - | 1 | 1 | - | 1 | - | - |
| CO5 | 3 | 2 | 1 | - | I | - | I | - | 1 | 1 | - | 1 | - | - |
| Average | 3 | 2 | 1 | - | - | - | - | - | 1 | 1 | - | 1 | - | - |

Karpagam Academy of Higher Education (Deemed to be University) - Coimbatore

B. Tech ARTIFICIAL INTELLIGENCE & DATA SCIENCE

23BTADOE04

ROBOTICS AND AUTOMATION

3H-3C

Instruction Hours/week: L:3 T:0 P:0

Marks: Internal: 40 External:60 Total:100 End Semester Exam:3Hours

COURSE OBJECTIVES:

The goal of this course is for the students:

- To introduce the functional elements of Robotics.
- To impart knowledge on the forward and inverse kinematics.
- To interpret the manipulator differential motion and control.
- To educate on various path planning techniques.
- To understand about hydraulics system.

COURSE OUTCOMES:

Upon completion of this course the students will be able to:

- Apply basic concept of robotics fundamental principles, components, and applications of robotic systems.
- Discuss the dynamics of robotic systems and implications for planning and control.
- Outline the principles of state estimation, prediction, and update steps involved in the Kalman filtering process.
- Analyze the components, working principles, and applications of Pneumatic and Hydraulic system.
- Model the principles of fluidic devices and fluidic logic circuits and their applications in automation.

UNIT I KINEMATICS CONCEPTS

Introduction – Actuators – Sensors – Rigid body – coordinate systems – Kinematics – Forward Kinematics & Inverse Kinematics – Velocity Kinematics – Angular velocity – Linear velocity – Singularity – Force and torque.

UNIT II MOBILE ROBOTS

Dynamics – Mobile Robots – Planning and Control – Path & Trajectory planning – Probabilistic Roadmaps – Localization.

UNIT III PROBABILISTIC METHODS FOR ROBOTICS

Basics of probability – Kalman Filtering – Extended Kalman – Particle filter – Localization – Computer Vision – Vision Based Controls.

UNIT IV AUTOMATION FUNDAMENTALS AND PRINCIPLES

Automation – Basic Laws and Principles – Basic Pneumatic and Hydraulic system – Pumps and compressors – Fluid accessories.

Karpagam Academy of Higher Education (Deemed to be University) - Coimbatore

9

9

9

UNIT V ELECTRICAL AND ELECTRONIC CONTROLS

Cylinders and Motors – Control valves – Circuits – Pneumatic logic circuits – Fluidics – Electrical and electronic controls – Transfer devices and Feeders.

TEXT BOOKS:

- 1. "Robot Modeling and Control", Mark W.Spong, Seth Hutchinson and Vidyasagar. M, Wiley Publishers, Second Edition, 2020.
- 2. "Robot Building for Beginners", David Cook, Apress Publishers, Third Edition, 2015.

REFERENCE BOOKS:

- 1. "Industrial Automation and Robotics", Gupta. A.K and S.K Arora, University Science Press, Third Edition, 2013.
- 2. "Industrial Robotics", Groover. M.P, Weiss. M, Nageland. R.N and Odrej. N.G, Tata McGraw Hill, Singapore, Second Edition, 2017.
- 3. "Embedded Systems & Robotics", Ghoshal. S, Cengage Learning, First Edition, 2009.
- 4. "Introduction to Robotics Mechanics and Control", John J.Craig, Pearson Education, Third Edition, 2009.

WEBLINKS:

- 1. www.nptel.ac.in/courses/112/101/112101099/
- 2. www.nptel.ac.in/courses/112/101/112101098/
- 3. www.toptal.com/robotics/programming-a-robot-an-introductory-tutorial
- 4. www.cyberbotics.com/doc/guide/tutorial-1-your-first-simulation-in-webots
- 5. www.ocw.mit.edu/courses/mechanical-engineering/2-12-introduction-to-robotics-fall-2005/

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 3 | 2 | 2 | - | 2 | - | - | 2 | - | 2 | 2 | - | - |
| CO2 | 2 | 2 | 2 | 2 | - | 2 | - | - | 2 | - | 2 | 2 | - | - |
| CO3 | 3 | 3 | 3 | 3 | - | 2 | - | - | 2 | - | 2 | 2 | - | - |
| CO4 | 3 | 3 | 3 | 3 | - | 2 | - | - | 2 | - | 2 | 2 | - | - |
| CO5 | 3 | 3 | 3 | 3 | 2 | 2 | - | - | 2 | - | 2 | 2 | - | - |
| Average | 3 | 3 | 3 | 3 | 2 | 2 | - | - | 2 | - | 2 | 2 | _ | _ |

CO PO MAPPING

9

TOTAL: 45

BASIC BIOINFORMATICS

3H-3C

2023-2024

Instruction Hours/week: L:3 T:0

Marks: Internal:40 External:60Total:100 End Semester Exam:3Hours

COURSE OBJECTIVE

The goal of this course is for students to

- Elaborate the available tools and databases for performing research in bioinformatics.
- Expose students to sequence alignment tool in bioinformatics.
- Construct the phylogenetic trees for evolution.
- Discuss the 3D structure of protein and classification.
- Acquire basic knowledge in protein secondary structure prediction.

COURSE OUTCOMES

After completing the course, the students will be able to

- 1. Summarize the basic concepts of bioinformatics.
- 2. Outline the sequence retrieval and analysis tools using bioinformatics.
- 3. Infer the methods used to construct phylogenetic tree for evolution analysis.
- 4. Apply the protein structure knowledge for modeling
- 5. Make use of bio-informatics principles towards biological applications.

UNIT I OVERVIEW OF BIOINFORMATICS

Aims and tasks of Bioinformatics - applications of Bioinformatics - challenges and opportunities. The scope of bioinformatics; bioinformatics & the internet; useful bioinformatics sites. Data acquisition: sequencing DNA, RNA & proteins; determination of protein structure; gene & protein expression data; protein interaction data. Databases – contents, structure & annotation: file formats; annotated sequence databases; miscellaneous databases.

UNIT II RETRIEVAL OF BIOLOGICAL DATA

Data retrieval with Entrez & DBGET/ LinkDB; data retrieval with SRS (sequence retrieval system).Searching sequence databases by sequence similarity criteria: sequence similarity searches; amino acid substitution matrices; database searches, FASTA & BLAST; sequence filters; iterative database searches & PSI-BLAST. Multiple-sequence alignment, gene & protein families: multiple-sequence alignment & family relationships; protein families & pattern databases; protein domain families.

UNIT III PHYLOGENETICS

Introduction to Phylogenetics, Molecular Evolution and Molecular Phylogenetics, Phylogenetic tree, Forms of Tree Representation, Rooted and un-rooted trees, Phylogenetic Tree Construction Methods: Distance based methods- NJ, UPGMA PGMA, cladistics & ontology; building phylogenetic trees; evolution of macromolecular sequences. Sequence annotation: principles of genome annotation;

9

9

9

annotation tools & resources.

UNIT IV STRUCTURAL BIOINFORMATICS

Protein sequence data-bases- SwissProt/ TrEMBL, PIR, Sequence motif databases -Pfam,PROSITE, Protein structure databases, Protein Data Bank-SCOP, CATH, KEGG, Chembank, Sequence, structure and function relationship. Conceptual models of protein structure; the relationship of protein three-dimensional structure to protein function; the evolution of protein structure & function; obtaining, viewing & analyzing structural data; structural alignment; classification of proteins of known three-dimensional structure; introduction to protein structure prediction; Protein structure prediction, modeling.

UNIT V MICROARRAY DATA ANALYSIS

Microarray data, analysis methods; microarray data, tools & resources; sequence sampling & SAGE. Bioinformatics in pharmaceutical industry: informatics & drug discovery; pharma informatics resources. Basic principles of computing in bioinformatics: running computer software; computer operating systems; software downloading & installation; database management.

TOTAL: 45

TEXT BOOKS

- 1. Dan E krane Michael L Rayme. (2004). Fundamental concepts of Bioinformatics. Pearson Education.
- 2. Andreas D Baxevanis B.F. Franchis Ouellette. (2004). Bioinformatics: A practical guide to the analysis of genes and proteins. Wiley-Interscience.
- 3. David W. Mount. (2004). Sequence and Genome Analysis. Cold Spring Harbor Laboratory.

REFERENCE BOOKS

- 1. Jonathan Pevsner.(2015). Bioinformatics and functional genomics. wiley-Liss.
- 2. Rastogi, S. C., Parag Rastogi, and Namita Mendiratta(2013). Bioinformatics Methods And Applications: Genomics Proteomics And Drug Discovery. 4 th Edition, PHI Learning Pvt. Ltd.,

WEB SITES

- 1. <u>https://www.ncbi.nlm.nih.gov/pmc/</u>
- 2. <u>https://biology.mit.edu/faculty-and-research/areas-of-research/computational-biology/</u>

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| | | | | | | | | | | | | | | |
| CO1 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO3 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO4 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO5 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - |
| Average. | 2.2 | 1.2 | 1 | - | - | - | - | - | - | - | - | - | - | - |

CO PO MAPPING

9

23BTBTOE02 FUNDAMENTALS OF NANOBIOTECHNOLOGY 3H-3C

Instruction Hours/week: L:3 T:0 P:0

Marks: Internal:40 External:60 Total:100 End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course is for students to

- Impart the skills in the field of nanotechnology and its applications.
- Acquire knowledge in nano particle synthesis and its characterization.
- Gain the basic knowledge on the application of bionanomaterials in biotechnology
- Provide the knowledge in the field of medical nanotechnology.
- Analysis the ethical issues involve in nanotechnology

COURSE OUTCOMES:

After completing the course, the students will be able to

- 1. Summarize the basics of nanotechnology and its applications.
- 2. Outline the techniques involves in nanoparticles synthesis and characterization.
- 3. Apply the principles of biomolecules for the fabrication of nanoparticles
- 4. Develop nanoscale devices for the medical applications.
- 5. Analyze the socio-economic and ethical issues in Nano biotechnology.

UNIT I INTRODUCTION

9

9

Introduction to Nanotechnology and nanobiotechnology: Properties at nanoscale, Scope and Overview, Length scales, Importance of Nanoscale and Technology, History of Nanotechnology, Future of Nanotechnology: Nano Technology Revolution, ; General synthesis methods of nanoscale materials; top down and bottom up approaches; Silicon based Technology, Benefits and challenges in Molecular manufacturing: The Molecular assembler concept, Controversies and confusions, Understanding advanced capabilities, Nanotechnology in Different, Fields: Nanobiotechnology, Materials, Medicine, Dental care.

UNIT II NANO PARTICLES

Introduction, Types of Nanoparticles, Techniques to Synthesize Nanoparticles, Characterization of Nanoparticles, Applications, Toxic effects of Nanomaterials, Significance of Nanoparticles Nanofabrications- MEMS/NEMS, Atomic Force Microscopy, Self assembled monolayers/ Dippen Nanolithography, Soft Lithography, PDMS Molding, Nano Particles, Nano wires and Nanotubes. X-ray diffraction technique; Scanning Electron Microscopy with EDX;Transmission Electron Microscopy including high-resolution imaging;

UNIT III MEDICAL NANOTECHNOLOGY

Nanomedicine, Nanobiosensor and Nanofludics. Nanocrystals in biological detection, Electrochemical DNA sensors and Integrated Nanoliter systems. Nano-Biodevices and Systems. Fabrication of Novel Biomaterials through molecular self-assembly- Small scale systems for in vivo drug delivery-Future nanomachine. Case study on drug delivery ofgold nanoparticles against breast cancer
UNIT IV NANOBIOTECHNOLOGY

Nanoscale devices for drug delivery: micelles for drug delivery; targeting; bioimaging; microarray and genome chips; Clinical applications of nanodevices. Artificial neurons. Real-time nanosensors- Applications in cancer biology. Nanomedicine. Synthetic retinyl chips based on bacteriorhodopsins. High throughput DNA sequencing with nano carbontubules. Nanosurgical devices.

UNIT V ETHICAL ISSUES IN NANOTECHNOLOGY

Introduction, Socioeconomic Challenges, Ethical Issues in Nanotechnology: With Especial Reference to Nanomedicine, Nanomedicine Applied in Nonmedical Contexts, Social Issues Relating to Nanomedicine. Social and Ethical Issues, Economic Impacts, Other Issues, Nanotechnology and Future Socio-economic challenges.

TOTAL: 45

TEXT BOOKS

- 1. Goodsell, D.S. (2004). Bionanotechnology. John Wiley and Sons, Inc.
- 2. Shoseyov, O. and Levy, I (2008).Nanobiotechnology: Bioinspired Devices andMaterials of the Future. Humana Press.

REFERENCE BOOKS

- 1. Bhushan, B. (2017). Springer Handbook of Nanotechnology. Springer-Verlag BerlinHeidelberg.
- 2. FreitasJr R.A (2006) Nanomedicine. Landes Biosciences.
- 3. Kohler, M. and Fritzsche, W. (2008). Nanotechnology An Introduction to NanostructuringTechniques. Wiley-VCH.
- 4. Niemeyer, C. M., and CA Mirkin, C. A., (2010); NanoBiotechnology II Moreconcepts, and applications. First edition, Wiley –VCH publications

WEB SITES

- 1. <u>https://mitnano.mit.edu/</u>
- 2. <u>https://nptel.ac.in/courses/118102003</u>

CO PO MAPPING

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-------|------------|-----|-----|-----|-----|-----|------------|-----|-----|------|------|------|------|------|
| | | | | | | | | | | | | | | |
| CO1 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO3 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO4 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - |
| CO5 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| Avera | 2.2 | 1.2 | 1 | - | - | - | - | - | - | - | - | - | - | - |
| ge. | | | | | | | | | | | | | | |

23BTSHOE01

MASS COMMUNICATION

3H-3C

Instruction Hours/week: L:3 T:0 P:0

Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

COURSE OBJECTIVES

On completion of the course, student will be able to

- Outline the basic concepts of communication and its types.
- Extend the knowledge with process of mass communication and their relevance.
- Explain the functions of mass communication with real time experience.
- Utilize the mass communication theories in media communication.
- Plan research proposals using international concepts in mass communication.

COURSE OUTCOMES

On completion of the course, student will be able to

- Identify the process and types of human communication.
- Recognize the function and characteristics of mass communication.
- Describe correlation and culture of mass communication.
- Replicate the concepts of mass communication theories in real life situation.
- Explain the impact of media theory in international communication

UNIT I BASIC CONCEPTS OF COMMUNICATION

Types of Communication; Functions of Mass Communication; Barriers, Intertextuality.

UNIT II MODELS AND THEORIES OF COMMUNICATION

Various models and theories of communication.

UNIT III MEDIA THEORY

Paradigm Shifts in Mass Communication Theories

UNIT IV FOLK MEDIA AND INTERNATIONAL COMMUNICATION THEORY 9

Folk Media and Electronic Media; International Communication Theories: World Systems, Dependency and Structural Media Monopoly – Cross Media Ownership.

UNIT V FOLK MEDIA AND INTERNATIONAL COMMUNICATION THEORY 9

Folk Media and Electronic Media; International Communication Theories: World Systems, Dependency and Structural Media Monopoly – Cross Media Ownership.

TOTAL: 45

9

9

TEXT/REFERENCE BOOKS

- 1. Mass Communication in India By Keval J. Kumar, 1994
- 2. Mass Communication Theory: Foundations, Ferment and Future By Stanley J. Baran and Dennis K. Devis, 2015.
- 3. Introduction to Communication Studies By John Fiske, 2010.
- 4. Mcquail's Mass Communication Theory By Denis Mcquail, 2010.

CO PO MAPPING

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|-----|-----|-----|-----|-----|-----|------------|-----|-----|------|------|------|------|------|
| | | | | | | | | 1 | 2 | 2 | | 2 | | |
| COI | - | - | - | - | - | - | - | 1 | 2 | 3 | - | Z | - | - |
| CO2 | - | - | - | - | - | - | - | 2 | 2 | 3 | - | 2 | - | - |
| CO3 | - | - | - | - | - | - | - | 2 | 2 | 3 | - | 2 | - | - |
| CO4 | - | - | - | - | - | - | - | 2 | 2 | 3 | - | 2 | - | - |
| CO5 | - | - | - | - | - | - | - | 2 | 2 | 3 | - | 2 | - | - |
| Average | - | - | - | - | - | - | - | 1.8 | 2 | 3 | - | 2 | - | _ |

23BTSHOE02

FUZZY MATHEMATICS

3H-3C

Instruction Hours/week: L:3 T:0 P:0

Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course is for students :

- To understand basic knowledge of fuzzy sets and fuzzy logic
- To apply basic knowledge of fuzzy operations.
- To know the basic definitions of fuzzy relations
- To apply basic fuzzy inference and approximate reasoning
- To know the applications of fuzzy Technology.
- Provide a firm basis for further reading and study in the subject.

COURSE OUTCOMES:

Upon completion of this course, the student will be able to:

- Infer the basics of Fuzzy sets and functions.
- Utilize the method of operations in fuzzy sets.
- Interpret the idea of Fuzzy relations and relational equations.
- Make use of the Possibility theory and probability measures in Fuzzy sets.
- Apply the logic of Fuzzy decision making.

UNIT I FUZZY SETS

Fuzzy Sets: Basics Classical sets vs Fuzzy Sets – Need for fuzzy sets – Definition and Mathematical representations – Level Sets – Fuzzy functions - Zadeh's Extension Principle

UNIT II OPERATIONS ON FUZZY SETS

Operations on Fuzzy Sets Operations on [0,1] – Fuzzy negation, triangular norms, to norms, fuzzy implications, Aggregation Operations, Fuzzy Functional Equations

UNIT III FUZZY RELATIONS

Fuzzy Relations Fuzzy Binary and n-ary relations – composition of fuzzy relations – Fuzzy Equivalence Relations – Fuzzy Compatibility Relations – Fuzzy Relational Equations

UNIT IV FUZZY MEASURES

Possibility Theory Fuzzy Measures – Evidence Theory – Necessity and Belief Measures – Probability Measures vs Possibility Measures

le

9

9

9

UNIT V FUZZY INFERENCE

Approximate Reasoning Fuzzy Decision Making - Fuzzy Relational Inference – Compositional rule of Inference - Efficiency of Inference - Hierarchical

TOTAL: 45

TEXT BOOKS:

- 1. George J Klir and Bo Yuan, (2003) Fuzzy Sets and Fuzzy Logic: Theory and Applications, Prentice Hall of India, New Delhi.
- 2. Zimmermann H.J. (2001) Fuzzy Set Theory and its Applications, Kluwer Academic publishers, USA.
- 3. Michal Baczynski and Balasubramaniam Jayaram, (2008) Fuzzy Implications, Springer-Verlag publishers, Heidelberg.
- 4. Kevin M Passino and Stephen Yurkovich, (1998) Fuzzy Control, Addison Wesley Longman publishers, USA.

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|-----|-----|-----|-----|-----|-----|------------|-----|-----|------|------|------|------|------|
| CO1 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | - | - |
| CO2 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | - | - |
| CO3 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | - | - |
| CO4 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | - | - |
| CO5 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | - | - |
| Average | 2.6 | 1.6 | 1 | - | - | - | - | - | - | - | - | 1 | - | - |

CO PO MAPPING

SCIENCE AND HUMANITIES

23BTSHOE03

MATERIAL SCIENCES

3H-3C

Instruction Hours/week: L:3 T:0 P:0

Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course is for students :

- To inculcate the fundamental principles and concepts of magnetic materials for different engineering applications.
- To impart basic knowledge of superconductivity and associated applications.
- To serve the fundamental concepts of dielectric materials for diverse applications in energy engineering.
- To divulge the basics of crystals, their structures and different crystal growth techniques.
- To make the students familiar in the fundamentals of ceramics, composites and nonmaterial.

COURSE OUTCOMES:

Upon the successful completion of this course

- Illustrate the theory of magnetism and magnetic properties of the materials
- Explain the theory of superconductivity and its application in SQUID
- Infer the types of polarization and dielectric breakdown
- Outline the basics of crystals, structures and its defects
- Summarize the types of ceramics, metallic glsses and alloys

UNIT I MAGNETIC MATERIALS

Origin of magnetic moment; Bohr magneton; comparison of Dia, Para and Ferro magnetism; Langevin theory of diamagnetism and paramagnetism; Quantum theory of paramagnetism; Curie-Weiss law; Temperature dependence of saturation magnetization; Domain theory; Hysteresis; soft and hard magnetic materials; antiferromagnetic materials; Ferrites and its applications.

UNIT II SUPERCONDUCTING MATERIALS

Superconductivity, properties; Meissner effect; Type I and Type II superconductors; London equation; BCS theory of superconductivity (Qualitative), Flux quantization; High Tc superconductors; Josephson superconductor tunnelling, DC and AC Josephson effect; Applications of superconductors, SQUID, cryotron, magnetic levitation.

9

UNIT III DIELECTRIC MATERIALS

Electrical susceptibility, dielectric constant; electronic, ionic, orientational and space charge polarization; frequency and temperature dependence of polarization; internal field; Clausius - Mossotti relation (derivation); dielectric loss; dielectric breakdown, uses of dielectric materials (capacitor and transformer); ferroelectricity and applications.

UNIT IV CRYSTAL PHYSICS

Lattice, Unit cell, Bravais lattice; Lattice planes; Miller indices; d spacing in cubic lattice; Calculation of number of atoms per unit cell, Atomic radius, Coordination number, Packing factor for SC, BCC, FCC and HCP structures; Crystal imperfections; Crystal growth techniques; solution, melt (Bridgman and Czochralski) and vapour growth techniques (qualitative).

UNIT V NEW MATERIALS

Ceramics; types and applications; composites: classification, role of matrix and reinforcement, processing of fiber reinforced plastics; metallic glasses: types, glass forming ability of alloys, melt spinning process, applications; shape memory alloys: phases, shape memory effect, applications; nanomaterials: preparation (bottom up and top down approaches), properties and applications.

TEXT BOOKS:

- 1. C. Kittel, Introduction to Solid State Physics, 7th Edition, Wiley Eastern, New Delhi, 2006.
- 2. A. J. Dekker, Solid State Physics, Published by Macmillan India, 2000
- 3. William D CallisterJr, "Materials Science and Engineering An Introduction", John Wiley and Sons Inc.,7th edition, New York, 2006
- 4. S.O. Pillai, Solid State Physics. New Age International(P) Ltd., publishers, 2009
- 5. M.A. Wahab, Solid State Physics: Structure and Properties of Materials. Narosa Publishing House, 2009.
- 6. M. Arumugam, Materials Science. Anuradha publishers, 2010.

JOURNALS

- Nature Physics
- Journal of Applied Mechanics (ASME)
- Journal of Electronic Materials (IEEE/TMS)
- Applied Thermal Engineering (Elsevier)
- Physical Review B (American Physical Society).
- Nature Nanotechnology

WEBLINKS

- 1. https://nptel.ac.in/courses/122/103/122103011/
- 2. https://nptel.ac.in/courses/113/104/113104081/
- 3. https://nptel.ac.in/courses/108/108/108108122/
- 4. http://hyperphysics.phy-astr.gsu.edu/hbase/optmod/lascon.html

9

9

CO PO MAPPING

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|------------|-----|-----|-----|-----|-----|-----|------------|------------|-----|------|------|------|------|------|
| | | | | | | | | | | | | | | |
| CO1 | 2 | 1 | - | - | - | - | - | - | - | 1 | - | 1 | - | - |
| CO2 | 2 | 1 | - | - | - | - | - | - | - | 1 | - | 1 | - | - |
| CO3 | 2 | 1 | - | - | - | - | - | - | - | 1 | - | 1 | - | - |
| CO4 | 2 | 1 | - | - | - | - | - | - | - | 1 | - | 1 | - | - |
| CO5 | 2 | 1 | - | - | - | - | - | - | - | 1 | - | 1 | - | - |
| Average | 2 | 1 | - | - | - | - | - | - | - | 1 | - | 1 | - | - |

GREEN CHEMISTRY

3H-3C Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

COURSE OBJECTIVES

23BTSHOE04

The goal of this course for students is :

Instruction Hours/week: L:3 T:0 P:0

- To make the students conversant about the green chemistry
- To make the student acquire sound knowledge of the atom efficient process and synthesis elaborately.
- To acquaint the student with concepts of green technology.
- To develop an understanding of the basic concepts of renewable energy resources.
- To acquaint the students with the basics information on catalysis.
- To apply the concepts of green catalysts in the synthesis.

COURSE OUTCOMES

After completion of this course, students will be able to

- Outline the basic principles of green chemistry.
- Explain the chemical synthesis in terms of atom efficiency
- Relate the concepts of green chemistry in biotechnology.
- Illustrate the importance of renewable feedstocks.
- Extend the phenomena of catalysis in green synthesis.

UNIT I INTRODUCTION TO GREEN CHEMICAL PRINCIPLES 9 Definition, tools, and twelve principles of green chemistry, solvent-less reactions and reactions in water, microwaves and fluorous solvents, green resolution of racemic mixtures, materials for a sustainable economy, chemistry of longer wear, agrochemicals: problems and green alternate solutions.

UNIT II ATOM EFFICIENT PROCESSES

Atom efficient processes, evaluating chemical reagents according to their yield and atom efficiency, examples of efficient stoichiometric and catalytic processes, atom economy and homogeneous catalysis, halide-free synthesis and alternatives to Strecker synthesis.

UNIT III BIOTECHNOLOGY AND GREEN CHEMISTRY

Bio technology and its applications in environmental protection - Bio informatics-Bio remediation, biological purification of contaminated air. Green chemistry for clean technology- Significance of green chemistry-Basic components of green chemistry, Industrial applications of green chemistry, green fuels-e-green propellants and bio catalysts.

9

9

Mark

UNIT IV RENEWABLE RESOURCES

Use of renewable materials, evaluating feedstock and starting materials and their origins, toxicity, sustainability and the downstream implications of the choice of feedstock, commodity chemicals from glucose and biomass conversion.

UNIT V CATALYSIS IN GREEN CHEMISTRY

Catalysis, energy requirements and usage, optimization of the reaction by minimizing the energy requirements, examples of efficient catalytic reactions including the use of heterogeneous catalysis, zeolites, oxidation using molecular oxygen.

TEXT BOOKS:

- 1. Sanjay K. Sharma, Ackmez Mudhoo (2010) Green Chemistry for Environmental Sustainability CRC Press, London
- 2. Chandrakanta Bandyopadhyay (2019) An Insight into Green Chemistry, Books and Allied (P) Ltd, Kolkata.
- Ahluwalia V. K. (2018) Green Chemistry A Textbook 4th Reprint Narosa Publishing House Pvt. Ltd, New Delhi.
- 4. Ahluwalia V. K. and M.Kidwai (2007) New Trends in Green Chemistry 2nd edition Anamaya publishers., New Delhi.
- 5. Dr. Sunita Ratan (2012) A Textbook of Engineering Chemistry S.K. Kataria and Sons., New Delhi
- 6. Mukesh Doble. Ken Rollins, Anil Kumar (2007) Green Chemistry and Engineering, 1st edition Academic Press, Elesevier., New Delhi.
- 7. Desai K. R. (2005) Green Chemistry Himalaya Publishing House, Mumbai.

WEBLINKS

- 1. <u>http://www.organic-chemistry.org/topics/green-chemistry.shtm</u>
- 2. <u>http://www.essentialchemicalindustry.org/processes/green-chemistry.html</u>
- 3. <u>http://www.chm.bris.ac.uk/webprojects2004/vickery/green_solvents.html</u>
- 4. <u>http://www.epa.gov/research/greenchemistry/</u>
- 5. http://www.amazon.in/Green-Chemistry-Catalysis

CO PO MAPPING

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|------------|-----|-----|-----|-----|------------|------------|------------|------------|------|------|------|------|------|
| | | | | | | | | | | | | | | |
| CO1 | 2 | 1 | - | - | - | 2 | 2 | 3 | - | 1 | - | 2 | - | - |
| CO2 | 2 | 1 | - | - | - | 2 | 2 | 3 | - | 1 | - | 2 | - | - |
| CO3 | 2 | 1 | - | - | - | 2 | 2 | 3 | - | 1 | - | 2 | - | - |
| CO4 | 2 | 1 | I | - | - | 2 | 2 | 3 | - | 1 | - | 2 | - | - |
| CO5 | 2 | 1 | I | - | - | 2 | 2 | 3 | - | 1 | - | 2 | - | - |
| Average | 2 | 1 | - | - | - | 2 | 2 | 3 | - | 1 | - | 2 | - | - |

9

Total: 45

List of Open Electives

Faculty of Arts, Science, Commerce and Management

ARTS, SCIENCE, COMMERCE AND MANAGEMENT

| 23PHPOE301 | MATERIAL CHARACTERIZATIO | Ν | 3H-2C |
|-----------------------------|--------------------------|-------------------------------|-------------|
| Instruction Hours/week: L:3 | Г:0 Р:0 | Marks: Internal:40 External:6 |) Total:100 |

End Semester Exam:3 Hours

2023-2024

COURSE OBJECTIVES

The goal of this course is for the students:

- Study materials is always important, for any application, including fabrication of satellites.
- Introduce various methods available for characterizing the materials. The characterization of materials specifically addresses that portfolio with which researchers and educators must have working familiarity.
- Provide an introduction to materials characterization and its importance
- Discuss different types of characterization techniques and their uses.
- Introduce the students to the principles of optical and electron microscopy, X-ray diffraction and various spectroscopic techniques Introduction:

COURSE OUTCOMES

Upon completion of this course the students will be able to

- Utilize X-ray, thermal, microscopic, and electrical methods of characterization.
- Explain the fundamental principles behind the methods of characterization which are included in the curriculum
- Interpret the observations by spectroscopic method.
- Infer the uncertainty of observations and results from the different methods.
- Infer the history of materials science with basic understanding of metals, binary alloys, magnetic materials, dielectric materials and polymers

UNIT I- X-RAY TECHNIQUE

X-ray techniques for materials characterization X-ray diffraction: Principle, measuring system and applications for characterization of powdered materials. X-ray diffraction profile and analysis: FWHM and line broadening, Crystallite size effect and Scherrer formula, Effect of strain (tensile vs compressive, uniform vs. non-uniform) Introduction to Extended X-ray absorption fine structure (EXAFS), Surface extended X-ray absorption (SEXAFS).

UNIT II- MICROSCOPIC TECHNIQUES

Microscopic techniques Principles, instrumentations and applications of Optical microscope, Scanning Electron Microscope (SEM), Transmission Electron Microscope (TEM) for

9

characterization of different samples. Energy dispersive X-ray microanalysis (EDS) - Basic aspects of Atomic force microscopy (AFM).

UNIT III- SPECTROSCOPIC METHODS

Spectroscopic methods Principle, instrumentation and applications of UV-Visible Diffuse Reflectance (UV-Vis DRS) spectroscopy, Ft-Ir, Raman and Fluorescence spectroscopy. Hand of experience on operation of UV-Vis-DRS, FT-IR, Raman and data analysis.

UNIT IV- THERMOANALYTICAL METHODS

Thermoanalytical Methods Principle, instrumentation and applications of Thermogravimetric Analysis (TGA), Differential Temperature Analysis (DTA) and Differential Scanning Calorometry (DSC). Factors affecting the TGA/DTA/DSC results and their interpretations. Hand on on experience of operation of TG/DSC and data analysis.

UNIT V- ELECTROANALYTICAL TECHNIQUES

Electroanalytical Techniques Voltammetric principles, hydrodynamic voltammetry, stripping voltammetry, cyclic voltammetry, criteria of reversibility of electrochemical reactions, quasi-reversible and irreversible processes, qualitative and quantitative analysis current-potential relation applicable for Linear Sweep Voltammetry (LSV) and Cyclic Voltammetry (CV), interpretation of cyclic voltammograms and parameters obtainable from voltammograms. Hand on experience on operation of CV and data analysis.

TOTAL: 45

9

9

9

TEXT BOOKS

- 1. Theory and Applications of UV Spectroscopy, H.H.Jaffe and M.Orchin, IBH-Oxford.
- 2. Inorganic spectroscopic methods, A.K. Brisdon, Oxford Chem. Primers, 1997, New York.
- 3. Applied Electron Spectroscopy for Chemical Analysis Ed. H. Windawi and F.L.Ho, Wiley Inter science.

REFERENCES BOOKS

- 1. Introduction to Spectroscopy, Pavia, Brooks/Cole Cenage, 4th edition, 2009, Belmont.
- 2. Introduction to Photoelectron Spectroscopy, P.K.Ghosh, John Wiley.
- 3. Fundamental of Molecular Spectroscopy, C. N. Banwell and E. McCash, Tata McGraw Hill, 4th edition, 1994, New Delhi.

WEBLINKS:

https://onlinecourses.nptel.ac.in/noc22_mm14/preview

CO-PO MAPPING

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|-----|-----|-----|-----|-----|------------|------------|------------|-----|------|------|------|------|------|
| CO1 | 3 | 2 | 1 | - | - | - | - | - | 1 | - | - | 1 | - | - |
| CO2 | 2 | 1 | - | - | - | - | - | - | 1 | - | - | 1 | - | - |
| CO3 | 2 | 1 | - | - | - | - | - | - | 1 | - | - | 1 | - | - |
| CO4 | 2 | 1 | - | - | - | - | - | - | 1 | - | - | 1 | - | - |
| CO5 | 2 | 1 | - | - | - | - | - | - | 1 | - | - | 1 | - | - |
| Average | 2.2 | 1.2 | 1 | - | - | - | - | - | 1 | - | - | 1 | - | - |

Karpagam Academy of Higher Education (Deemed to be University) - Coimbatore

23CHPOE301

CHEMISTRY IN EVERYDAY LIFE

Instruction Hours/week: L:3 T:0 P:0

Marks: Internal:40 External:60 Total:100 End Semester Exam:3 Hours

COURSEOBJECTIVES

The goal of this course is for the students

- Gain knowledge in the importance of chemistry in food industry.
- Understand the chemistry of medicines and cosmetics.
- Evaluate the solar energy utilization and its storage.
- Knowledge about the production of electricity by a nuclear reactor.
- Know about the chemistry of soaps, detergents and textiles.

COURSE OUTCOMES

Upon completion of this course the students will be able to

- Infer the importance of chemistry in food industry.
- Explain the chemistry of medicines and cosmetics.
- Outline the solar energy utilization and its storage.
- Interpret the production process of electricity by a nuclear reactor.
- Demonstrate the chemistry of soaps, detergents and textiles.

UNIT I - IMPORTANCE OF CHEMISTRY IN FOOD

Chemicals in food, colouring agents, artificial preservatives, flow stabilizers, binding substance, flavours and sweeteners, antioxidants, minerals, vitamins. Chemistry at the breakfast table, raising agents- gluten, the taste maker- glutamic acid, stimulants-Caffeine, chemistry of onion, garlic and curcumin.

UNIT II - CHEMISTRY IN MEDICINES AND COSMETICS

Elements in the human body, drugs and their classification, drug-target interaction, action of different classes of drugs, antiseptics and disinfectants.

Cosmetics: Chemistry behind the lotions, fragrances, talcum powder, sunblock and sunscreen, toothpaste, lipsticks, nail polishes.

2023-2024

3H-2C

9

UNIT III - CHEMISTRY IN ENERGY

Solar energy - fuel from sun light - splitting of water - hydrogen from sunlight - hydrogen economy - fuel cells - batteries - photovoltaics - stealing the sun - nuclear energy - nuclear fission and fusion - production of electricity by a nuclear reactor - radioactivity and the hazards of radioactivity - living with nuclear power.

UNIT IV - IMPORTANCE OF CHEMISTRY IN SOAPS, DETERGENTS AND TEXTILES

Detergents and soaps, types of soaps and detergents, saponification, cleansing action of soaps and detergents, perfumes used in soaps.

Textiles: Chemistry behind wool, silk, jute, cotton, glass fibre, polyester, acrylic, nylon, and other raw materials.

UNIT V - CHEMISTRY OF POLYMERS, FUEL AND AGRICULTURE

Polymers, types, polyethylene, plastics, disposal of plastics, degradation of polymers and plastics using nano materials. Petrochemistry, petrol, diesel, LPG, CNG, kerosene, oils, and other fuels. Agriculture: fertilizers, herbicides, insecticides, and fungicides.

TOTAL: 45

TEXT BOOKS

- 1. Tripathy, S. N., &Sunakar Panda (2004). Fundamentals of Environmental Studies (II Edition). New Delhi: Vrianda Publications Private Ltd.
- 2. Arvind Kumar (2004). A Textbook of Environmental Science. New Delhi: APH Publishing Corporation.
- 3. Anubha Kaushik, C. P., & Kaushik (2004). Perspectives in Environmental Studies. New Delhi: New Age International Pvt. Ltd. Publications.

REFERENCES BOOKS

- 1. Seymour R. B., & Charles, E. (2003). Seymour's Polymer Chemistry: An Introduction. Marcel Dekker, Inc.
- 2. Stocchi. E, (1990). Industrial Chemistry (Vol-I). UK: Ellis Horwood Ltd.
- 3. Jain, P. C., & Jain, M. (2004). Engineering Chemistry. Delhi: Dhanpat Rai & Sons.
- 4. Sharma, B. K., & Gaur, H. (1996). Industrial Chemistry. Meerut : Goel Publishing House.

WEBLINKS:

- 1. https://nptel.ac.in/courses/104106119
- 2. https://nptel.ac.in/courses/104105103

9

CO-PO MAPPING

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|-----|-----|-----|-----|-----|-----|------------|------------|-----|------|------|------|------|------|
| CO1 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | - | - |
| CO2 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | - | - |
| CO3 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | - | - |
| CO4 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | - | - |
| CO5 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | - | - |
| Average | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | - | - |

ARTS, SCIENCE, COMMERCE AND MANAGEMENT

ENGLISH FOR COMPETITIVE EXAMINATIONS 23MBPOE301 3H-2C Marks: Internal:40 External:60 Total:100

Instruction Hours/week: L:3 T:0 P:0

COURSE OBJECTIVES

The goal of this course is for the students

- Train learners to crack competitive exams •
- Know of various tools that is essential for competitive exams
- Enhance their ability to speak in english and face an interview.
- Make the student apply, prepare and clear the competitive exams.
- Prepare the student to concentrate, stay positive and confident. •

COURSE OUTCOMES

Upon completion of this course the students will be able to

- The student may settle in life with a government job.
- The student may develop various skills
- The successful student may guide other students to success.
- Analyse logical reasoning questions, error analysis, and correct usage of words
- Develop the knowledge of grammatical system of English language.

UNIT I GRAMMAR

Number-Subject, Verb and Agreement-Articles-Sequences of Tenses-Common Errors

UNIT II WORD POWER

Idioms and Phrases-One word substitution-Synonyms-Antonyms-Words often confused

UNIT III PARAGRAPH

Expansion of an idea

UNIT IV WRITING

Essay- Letters-Memos-Agenda-Resume writing

2023-2024

End Semester Exam:3 Hours

9

9

9

UNIT V SPEAKING

TOTAL: 45

TEXT BOOKS:

1. V. Saraswathi, Maya K. Mudbhatkal (2014). English for Competitive Examinations. Emerald: Chennai.

WEBLINKS:

- 1. https://onlinecourses.nptel.ac.in/noc23_hs52/preview
- 2. https://onlinecourses.nptel.ac.in/noc22_hs33/preview

CO-PO MAPPING

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|-----|-----|-----|------------|-----|------------|------------|------------|-----|------|------|------|------|------|
| CO1 | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - |
| CO2 | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - |
| CO3 | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - |
| CO4 | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - |
| CO5 | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - |
| Average | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - |

Karpagam Academy of Higher Education (Deemed to be University) - Coimbatore

ARTS, SCIENCE, COMMERCE AND MANAGEMENT

23BTPOE301

SERICULTURE

Instruction Hours/week: L:3 T:0 P:0

COURSE OBJECTIVES

The goal of this course is for the students

- Apply knowledge and skills of seri biotechnology for development new mulberry variety and silkworm breeds suitable for varied agro-climatic zones.
- Apply tools and techniques of biostatics for critical analysis and interpretation of data accrueded.
- Use bioinformatics tools and techniques for the analysis and interpretation of bimolecular data for better understating mulberry and silkworm.
- Demonstrate communication skills, scientific writing, data collection and interpretation abilities in all the fields of seribiotechnology.
- Thorough knowledge and application of good laboratory and good manufacturing practices in sericulture and biotech industries.

COURSE OUTCOMES

Upon completion of this course the students will be able to

- Explain the different components and chain link of sericulture industry.
- Relate concepts of sericulture industry and demonstrate interdisciplinary skills
- Infer mulberry plant cultivation and silkworm rearing.
- Demonstrating the Laboratory and field skills in mulberry cultivation and silkworm
- Outline the technological aspects.

UNIT I INTRODUCTION

Introduction to Sericulture - History of Sericulture - Sericulture organization in India, By products of silk industry. Mulberry and Non - mulberry silkworm types–Morphology and Life cycle of Bombyxmori

UNIT II MULBERRY CULTIVATION

3H-2C

2023-2024

Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

9

Mulberry Cultivation: Mulberry Varieties – Methods of Irrigation –Nutrient Management and Weed control. Pruning and Harvesting – Crop improvement – Mechanism in Moriculture – Pest and Disease, deficiencies and symptoms in Mulberry.

UNIT III REARING OF SILKWORM

Rearing of silkworm – Rearing Appliances – rearing operation. Harvesting and marketing of cocoons. Cocoon processing and reeling - Appliances used for reeling. Pre reeling process – Cocoon boiling. Reeling technology – re-reeling technology.

UNIT IV SCOPE OF NON-MULBERRY SERICULTURE

Non – Mulberry Sericulture Scope of Non-mulberry Sericulture - Non-mulberry silk varieties and fauna, tasar, muga, eri – Silk Production and Marketing – Tropical tasar / muga – Morphology, anatomy grainage

UNIT V DISEASES OF SILKWORM

Diseases of silkworm –Pebrine Protozoan, Flacherie bacterial, Nuclear Polyhedrosisviral and Muscardine fungal diseases. Pests of Silkworm.

TOTAL: 45

9

9

9

TEXT BOOKS

- Krisnamoorthy S., Improved Method of Rearing Young Age Silk Worms: Reprinted by CSB, Bangalore, 1986.
- 2. Tanaka Y., Sericology, CSB, Pub., Bangalore, 1964.
- Ullal S.R., and Narasimhan M.N., Hand Book of Practical Sericulture, CSB, Bangalore, 1987.
- 4. HisaoAruga, Principles of sericulture, Oxford and IBH Publishing Company, 1994.
- Hrccrama Reddy, G. 1998. Silkworm Breeding, Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi.
- Otsuki el.al. 1987. Silkworm Egg Production (Translated from Japanese Language), Oxford wild IBH Publishing Co. Pvt. Ltd., New Delhi.

REFERENCES BOOKS

- 1. Yasuji Hamamura, 2001 Silkworm Rearing on Artificial Diet (Translated from Japanese Language),Oxford wild IBH Publishing Co. Pvt. Ltd., New Delhi.
- 2. Mahadevappa, D. Halliyal, V.G., Sankar, D.G and Bhandiwad, R. 2000. Mulberry Silk Reeling Technology, Oxford wild IBH Publishing Co. Pvt. Ltd., New Delhi.
- 3. Dandin, S.B et.al. 2003. Advances in Tropical Sericulture, National Academy of Sericulture Sciences India, Central Silk Board, Bangalore, India.

- 4. Ganga G., Sulochanachetty. J. An Introduction of Sericulture. Oxford, New Delhi 1977.
- 5. Johnson M., and Kesary M., Sericulture, CSI Press, Marthandam, 2008.
- 6. Text Book of Tropical Sericulture, Pub., Japan Overseas Volunteers, 1975.

CO-PO MAPPING

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|-----|-----|-----|------------|-----|------------|------------|------------|-----|------|------|------|------|------|
| CO1 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | - | - |
| CO2 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | - | - |
| CO3 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | - | - |
| CO4 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | - | - |
| CO5 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | - | - |
| Average | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | - | - |