B.S. Abdur Rahman Crescent Institute of Science & Technology

Deemed to be University u/s 3 of the UGC Act, 1956

Regulations 2019

Curriculum and Syllabi

(Amendments updated upto December 2020)

M.Tech.
(Food Biotechnology)

B.S. Abdur Rahman Crescent Institute of Science & Technology
Deemed to be University u/s 3 of the UGC Act, 1956

REGULATIONS 2019
CURRICULUM AND SYLLABI (I & II Semesters)
(Amendments updated uptoDecember 2020)

M.TECH.
FOOD BIOTECHNOLOGY

VISION AND MISSION OF THE INSTITUTION

VISION

B.S.Abdur Rahman Crescent Institute of Science and Technology aspires to be a leader in Education, Training and Research in multidisciplinary areas of importance and to play a vital role in the Socio-Economic progress of the Country in a sustainable manner.

MISSION

- To blossom into an internationally renowned Institute.
- To empower the youth through quality and value-based education.
- To promote professional leadership and entrepreneurship.
- To achieve excellence in all its endeavors to face global challenges.
- To provide excellent teaching and research ambience.
- To network with global Institutions of Excellence, Business, Industry and Research Organizations.
- To contribute to the knowledge base through Scientific enquiry, Applied Research and Innovation.

SCHOOL OF LIFE SCIENCE

VISION AND MISSION

VISION

To attain new heights in biotechnology research, shaping life sciences into a premier precision tool for the future for creation of wealth and ensuring social justice-specially for the welfare of the poor

MISSION

The mission of the School of Life Sciences and Technology is to maximize the benefits of biotechnology to the Institute, the nation and the globe by being an excellent quality, comprehensive, multidisciplinary school that supports, coordinates, disseminates and advances biotechnology in the areas of social welfare and entrepreneurship.

PROGRAMME EDUCATIONAL OBJECTIVES AND OUTCOMES

M. Tech. (Food Biotechnology)

PROGRAMME EDUCATIONAL OBJECTIVES

- To deliver advanced food biotechnology knowledge and capabilities.
- To educate the necessary skillsets for food production and manufacturing in accordance with industry needs.
- To instill confidence and provide the required environment for basic and practical research in food biotechnology-related fields with societal significance.
- To teach the necessary analytical skills and strategies for addressing issues of varying degrees of complexity.
- To develop the required skills for efficient communication and teamwork to have a successful professional career.

PROGRAMME OUTCOMES

On successful completion of the programme, the graduates will be able to

- Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- Identify, formulate, research literature, and analyses complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- Design solutions for complex engineering problems 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.
- Use research –based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.

- 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.
- Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- 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.
- 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

PSO1 : Design, analyze, and develop essential proficiency in the areas of chemistry, microbiology, nutrition, processing, packaging, nutraceuticals, enzymes, global marketing, standards, quality control, and management aspects of the food industry, and apply the knowledge to real-world problems.

PSO2: Apply Food Biotechnology expertise in other fields to discover research gaps and propose optimal solutions.

B.S.ABDUR RAHMAN CRESCENT INSTITUTE OF SCIENCE & TECHNOLOGY,CHENNAI – 600 048.

REGULATIONS -2019 FOR

M.Tech. / MCA / M.Sc. / M.Com. DEGREE PROGRAMMES

(Under Choice Based Credit System)

1.0 PRELIMINARY DEFINITIONS AND NOMENCLATURE

In these Regulations, unless the context otherwise requires

"Programme" means Post Graduate Degree Programme (M.Tech. / MCA/ M.Sc. / M.Com.)

"Course" means a theory / practical / laboratory integrated theory / mini project / seminar / internship / Project and any other subject that is normally studied in asemester like Advanced Concrete Technology, Electro Optic Systems, Financial Reporting and Accounting,Analytical Chemistry, etc.,

"Institution" means B.S. Abdur Rahman Crescent Institute of Science & Technology.

"Academic Council" means the Academic Council, which is the apex body on all academic matters of B.S. Abdur Rahman Crescent Institute of Science & Technology.

"Dean (Academic Affairs)" means Dean (Academic Affairs) ofB.S. Abdur Rahman Crescent Institute of Science & Technology who administers the academic matters.

"Dean (Student Affairs)" means Dean (Student Affairs) of B.S. Abdur Rahman Crescent Institute of Science & Technology, who looks after the welfare and discipline of the students.

"Controller of Examinations" means the Controller of Examinations of B.S. Abdur Rahman Crescent Institute of Science & Technology who is responsible for the conduct of examinations and declaration of results.

2.0 PROGRAMMES OFFERED AND ADMISSION REQUIREMENTS

2.1 Programmes Offered

The various programmes and their mode of study are as follows:

Degree	Mode of Study
M.Tech.	Full Time
MCA	
M.Sc.	
M.Com.	

2.2 ADMISSION REQUIREMENTS

2.2.1 Students for admission to the first semester of the Master's Degree Programme shall be required to have passed the appropriate degree examination of this Institution as specified in the clause 3.2 [Eligible entry qualifications for admission to P.G. programmes] or any other degree examination of any University or authority accepted by this Institution as equivalent thereto.

2.2.2 Eligibility conditions for admission such as class obtained, number of attempts in the qualifying examination and physical fitness will be as prescribed by the Institution from time to time.

3.0DURATION, ELIGIBILITY AND STRUCTURE OF THE PROGRAMME

3.1. The minimum and maximum period for completion of the Programmesare given below:

Programme	Min. No. of Semesters	Max. No. of Semesters
M.Tech.	4	8
MCA (3 years)	6	12
MCA (Lateral Entry)	4	8
MCA (2 years)	4	8
M.Sc.	4	8
M.Com.	4	8

3.1.1 Each academic semester shall normally comprise of 90 working days. Semester End Examinations shall follow within 10 days of the last Instructional day.

3.1.2 Medium of instruction, examinations and project report shall be in English.

3.2 ELIGIBLE ENTRY QUALIFICATIONS FOR ADMISSION TO PROGRAMMES

Sl. No.	Name of the Department	Programmes offered	Qualifications for admission
1.	Aeronautical Engineering	M.Tech. (Avionics)	B.E. / B. Tech. (Aeronautical Engineering)
2.	Civil Engineering	M.Tech. (Structural Engineering)	B.E. / B. Tech. (Civil Engineering) / (Structural Engineering)
		M. Tech. (Construction Engineering and Project Management)	B.E. / B. Tech. (Civil Engineering) / (Structural Engineering) / B. Arch.
3.	Mechanical Engineering	M.Tech. (Manufacturing Engineering)	B.E. / B.Tech. (Mechanical / Automobile / Manufacturing / Production / Industrial / Mechatronics / Metallurgy / Aerospace /Aeronautical / Material Science / Marine Engineering)
		M.Tech. (CAD/CAM)	
4.	Electrical and Electronics Engineering	M.Tech. (Power Systems Engg.)	B.E. /B.Tech. (EEE/ECE/E&I/I&C / Electronics / Instrumentation)
		M.Tech. (Power Electronics and Drives)	
5.	Electronics and Communication Engineering	M.Tech. (Communication Systems)	B.E. / B.Tech. (EEE/ ECE / E&I /CSE IT / I&C / Electronics / Instrumentation)
		M.Tech. (VLSI and Embedded Systems)	B.E./ B.Tech. (ECE / E&I / I&C / EEE / CSE / IT)
6.	Electronics and Instrumentation Engineering	M.Tech. (Electronics and Instrumentation	B.E./ B.Tech. (EIE/ICE/Electronics/ECE/EEE)

		Engineering)	
7.	Computer Science and Engineering	M.Tech. (Computer Science and Engineering)	B.E. / B.Tech. (CSE/IT/ECE/EEE/EIE/ICE/ Electronics / MCA)
		M.Tech. (Artificial Intelligence and Data Science)	B.E. / B.Tech. (CSE/IT/ECE/EEE/EIE/ICE/ Electronics / MCA)
		M.Tech. (Data Science)	B.E. / B.Tech. (CSE/IT/ECE/EEE/EIE/ICE/ Electronics / MCA)
8.	Information Technology	M.Tech. (Information Technology)	B.E. / B.Tech. (IT/CSE/ECE/EEE/EIE/ICE/ Electronics / MCA)
9.	Computer Applications	MCA (3 years)	Bachelor Degree in any discipline with Mathematics as one of the subjects (or) Mathematics at +2 level
		MCA – (Lateral Entry)	B.Sc. Computer Science / B.Sc. Information Technology / BCA
		MCA (2 years)	Bachelor Degree in any discipline with Mathematics as one of the subjects (or) Mathematics at +2 level or B.Sc. Computer Science / B.Sc. Information Technology / BCA
10.	Mathematics	M.Sc. (Actuarial Science)	Any Degree with Mathematics / Statistics as one of the subjects of study
11.	Physics	M.Sc.(Physics)	B.Sc. (Physics / Applied Science / Electronics / Electronics Science / Electronics & Instrumentation)

12.	Chemistry	M.Sc.(Chemistry)	B.Sc. (Chemistry / Applied Science)
13.	Life Sciences	M.Sc. Molecular Biology &Biochemistry	B.Sc. in any branch of Life Sciences
		M.Sc. Biotechnology	B.Sc. in any branch of Life Sciences
		M.Sc. Microbiology	B.Sc. in any branch of Life Sciences
		M.Tech. Biotechnology	B.Tech. (Biotechnology / Chemical Engineering) / M.Sc. in any branch of Life Sciences
		M.Tech. Food Biotechnology	B.Tech. (Biotechnology / Chemical Engineering) / M.Sc. in any branch of Life Sciences
14.	Commerce	M.Com	Candidates who have passed B.Com/BBA degree (General or any Specialization) of this Institution or authority accepted by this Institution as equivalent thereto.

3.3.STRUCTURE OF THE PROGRAMME

3.3.1 The PGprogrammes consist of the following components as prescribed in the respective curriculum

i. Core courses
ii. Elective courses
iii. Laboratory oriented core courses
iv. Project work / thesis / dissertation
v. Laboratory Courses
vi. Seminars
vii. Mini Project
viii. Industrial Internship
ix. Value Added Courses
x. MOOC Courses (NPTEL, SWAYAM, etc.,)

3.3.2 The curriculum and syllabi of all programmes shall be approved by the Academic Council of this Institution.

3.3.3 For the award of the degree, the student has to earn a minimum total credits specified in the curriculum of the respective specialization of the programme.

3.3.4 The curriculum ofprogrammes shall be so designed that the minimum prescribed credits required for the award of the degree shall be within the limits specified below:

Programme	Range of credits
M.Tech.	74-80
MCA (3 years)	118 - 126
MCA(Lateral Entry)	80 - 85
MCA (2 years)	85 - 90
M.Sc.	77- 82
M.Com.	88

3.3.5 Credits will be assigned to the courses for all programmes as given below:

- ❖ Onecredit for one lecture period per week or 15 periods of lecture per semester
- ❖ One credit for one tutorial period per week or 15 periods per semester
- ❖ One credit each for seminar/practical session/project of two or three periods per week or 30 periods per semester
- ❖ One credit for four weeks of industrial internship or 160 hours per semester.

3.3.6 The number of credits the student shall enroll in a non-project semester and project semester is as specified below to facilitate implementation of Choice Based Credit System.

Programme	Non-project semester	Project semester
M.Tech.	9 to 28	18 to 26
MCA	12 to 33	12 to 26
M.Sc.	9 to 32	10 to 26

3.3.7 The student may choose a course prescribed in the curriculum

from any department offering that course without affecting regular class schedule. The attendance will be maintained course wise only.

3.3.8 The students shall choose the electives from the curriculum with the approval of the Head of the Department / Dean of School.

3.3.9 Apart from the various elective courses listed in the curriculum for each specialization ofprogramme, the student can choose a maximum of two electives from any other similar programmes across departments, during the entire period of study, with the approval of the Head of the department offering the course and parent department.

3.4.ONLINE COURSES

3.4.1 Students are permitted to undergo department approved online courses under SWAYAM up to 20% of credits of courses in a semester excluding project semester with the recommendation of the Head of the Department / Dean of School and with the prior approval of Dean Academic Affairs during his/ her period of study. The credits earned through online courses ratified by the respective Board of Studies shall be transferred following the due approval procedures. The online courses can be considered in lieu of core courses and elective courses.

3.4.2 Students shall undergo project related online course on their own with the mentoring of the faculty member.

3.5PROJECT WORK/DISSERTATION

3.5.1 Project work / Dissertation shall be carried out by the student under the supervision of a Faculty member in the department with similar specialization.

3.5.2 A student may however, in certain cases, be permitted to work for the project in an Industry / Research Organization, with the approval of the Head of the Department/ Dean of School. In such cases, the project work shall be jointly supervised by a faculty of the Department and an Engineer / Scientist from the organization and the student shall be instructed to meet the

faculty periodically and to attend the review meetings for evaluating the progress.

3.5.3 The timeline for submission of final project report / dissertation is within 30 calendar days from the last Instructional day of the semester in which Project / Dissertation is done.

3.5.4 If a student does not comply with the submission of project report / dissertation on or before the specified timeline he / she is deemed to have not completed the project work / dissertation and shall re-register in the subsequent semester.

4.0CLASS ADVISOR AND FACULTY ADVISOR

4.1 CLASS ADVISOR

A faculty member shall be nominated by the HOD/ Dean of School as Class Advisor for the whole class. He/she is responsible for maintaining the academic, curricular and co-curricular records of all students throughout their period of study.

4.2 FACULTY ADVISOR

To help the students in planning their courses of study and for general counseling on the academic programme, the Head of the Department / Dean of School of the students shall attach a certain number of students to a faculty member of the department who shall function as Faculty Advisor for the students throughout their period of study. Such Faculty Advisor shall offer advice to the students on academic and personal matters, and guide the students in taking up courses for registration and enrolment in every semester.

5.0CLASS COMMITTEE

5.1 A class committee comprising faculty members handling the classes, student representatives and a senior faculty member not handling the courses as chairman will be constituted in every semester:

5.2 The composition of the class committee will be as follows:

i) One senior faculty member preferably not handling courses for the concerned semester, appointed as chairman by the Head of the Department

ii) Faculty members of all courses of the semester
iii) All the students of the class
iv) Faculty advisor and class advisor
v) Head of the Department – Ex officio member

5.3 The class committee shall meet at least three times during the semester. The first meeting shall be held within two weeks from the date of commencement of classes, in which the nature of continuous assessment for various courses and the weightages for each component of assessment shall be decided for the first and second assessment. The second meeting shall be held within a week after the date of first assessment report, to review the students' performance and for follow up action.

5.4 During these two meetings the student members, shall meaningfully interact and express opinions and suggestions to improve the effectiveness of the teaching-learning process, curriculum and syllabus.

5.5 The third meeting of the class committee, excluding the student members, shall meet within 5 days from the last day of the semester end examination to analyze the performance of the students in all the components of assessments and decide their grades in each course. The grades for a common course shall be decided by the concerned course committee and shall be presented to the class committee(s) by the concerned course coordinator.

6.0COURSE COMMITTEE

6.1 Each common theory / laboratorycourse offered to more than one group of students shall have a “Course Committee” comprising all the teachers handling the common course with one of them nominated as course coordinator. The nomination of the course coordinator shall be made by the Head of the Department / Dean (Academic Affairs) depending upon whether all the teachers handling the common course belong to a single department or from several departments. The Course Committee shall meet as often as possible to prepare a common

question paper, scheme of evaluation and ensure uniform evaluation of the assessment tests and semester end examination.

7.0REGISTRATION AND ENROLLMENT

7.1 The students of first semester shall register and enroll at the time of admission by paying the prescribed fees.

7.2 For the subsequent semesters registration for the courses shall be done by the student one week before the last working day of the previous semester.

7.3 A student can withdraw from an enrolled course at any time before the first assessment test for genuine reasons, with the approval of the Dean (Academic Affairs), on the recommendation of the Head of the Department of the student.

7.4 A student can change an enrolled course within 10 working days from the commencement of the course, with the approval of the Dean (Academic Affairs), on the recommendation of the Head of the Department of the student.

8.0TEMPORARY BREAK OF STUDY FROM THE PROGRAMME

8.1 A student may be permitted by the Dean (Academic Affairs) to avail temporary break of study from the programme up to a maximum of two semesters for reasons of ill health or other valid grounds. A student can avail the break of study before the start of first assessment test of the ongoing semester. However the total duration for completion of the programme shall not exceed the prescribed maximum number of semesters (vide clause 3.1). If any student is debarred for want of attendance or suspended due to any act of indiscipline, it will not be considered as break of study. A student who has availed break of study has to rejoin in the same semester only in the subsequent year. The student availing break of study is permitted to write arrear examinations by paying the prescribed fees.

9.0 MINIMUM REQUIREMENTS TO REGISTER FOR PROJECT / DISSERTATION

9.1 A student is permitted to register for project semester, if he/she

has earned the minimum number of credits specified below:

Programme	Minimum no. of credits to be earned to enroll for project semester
M.Tech.	18
MCA (3 years)	45
MCA (Lateral Entry)	22
MCA (2 years)	22
M.Sc.	18
M.Com	NA

9.2 If the student has not earned minimum number of creditsspecified, he/she has to earn the required credits, at least to the extent of minimum credits specified in clause 9.1 and then register for the project semester.

10.0 ATTENDANCE

10.1 A student shall earn 100% attendance in the contact periods of every course, subject to a maximum relaxation of 25% (for genuine reasons such as medical grounds, representing for the institution in approved events, etc.) to become eligible to appear for the semester end examination in that course, failing which the student shall be awarded "I" grade in that course. The courses in which the student is awarded "I" grade, shall register and redo the course when it is offered next.

10.2 The faculty member of each course shall cumulate the attendance details for the semester and furnish the names of the students who have not earned the required attendance in that course to the Class Advisor. The Class Advisor will consolidate and furnish the list of students who have earned less that 75% attendance, in various courses, to the Dean (Academic Affairs) through the Head of the Department / Dean of School. Thereupon, the Dean (Academic Affairs) shall announce the names of such students prevented from writing the semester

end examination in each course.

10.3 A student who has obtained 'I' grade in all the courses in a semester is not permitted to move to next higher semester. Such student shall redo all the courses of the semester in the subsequent academic year.However he / she is permitted to redo the courses awarded with 'I' grade / arrear in previous semesters. They shall also be permitted to write arrear examinations by paying the prescribed fee.

10.4 A student shall register to redo a core course wherein "I" or "W" grade is awarded. If the student is awarded, "I" or "W" grade in an elective course either the same elective course may be repeated or a new elective course may be chosen with the approval of Head of the Department / Dean of School.

11.0REDO COURSES

11.1 A student can register for a maximum of two redo courses per semester in the evening after regular working hours, if such courses are offered by the concerned department. Students may also opt to redo the courses offered during regular semesters, without affecting the regular academic schedule and not exceeding prescribed maximum credits.

11.2 The Head of the Department with the approval of Dean (Academic Affairs) may arrange for the conduct of a few courses in the evening after regular working hours, depending on the availability of faculty members and subject to a specified minimum number of students registering for each of such courses.

11.3 The number of contact hours and the assessment procedure for any redo course will be the same as those during regular semesters except that there is no provision for any substitute examination and withdrawal from an evening redo course.

12.0ASSESSMENTS AND EXAMINATIONS

12.1 Every theory course shall have a total of three assessments during a semester as given below:

Assessments	Weightageof Marks
Continuous Assessment 1	25%
Continuous Assessment 2	25%
Semester End Examination	50%

12.2 Appearing for semester end theory examination for each course is mandatory and a student should secure a minimum of 40% marks in each course in semester end examination for the successful completion of the course.

Every practical course shall have 75% weightage for continuous assessments and 25% for semester end examination. However a student should have secured a minimum of 50% marks in the semester end practical examination for the award of pass grade.

12.3 For laboratory integrated theory courses, the theory and practical components shall be assessed separately for 100 marks each and consolidated by assigning a weightage of 75% for theory component and 25% for practical component. Grading shall be done for this consolidated mark. Assessment of theory component shall have a total of three assessments with two continuous assessments having 25% weightage each and semester end examination having50% weightage. The student shall secure a separate minimum of 40% in the semester end theory examination for the award of pass grade. The evaluation of practical component shall be through continuous assessment.

12.4 The components of continuous assessment for theory/practical/laboratory integrated theory courses shall be finalized in the first class committee meeting.

12.5 In the case of Industrial training, the student shall submit a report, which shall be evaluated along with an oral examination by a committee of faculty members constituted by the Head of the Department. The student shall also submit an internship completion certificate issued by the industry / research organisation. The weightage for Industry internship reportshall be 60% and 40% for viva voce examination.

12.6 In the case of project work, a committee of faculty members constituted by the Head of the Department will carry out three periodic reviews. Based on the project report submitted by the student, an oral examination (viva voce) shall beconducted as semester end examination by an external examiner approved by Controller of Examinations. The weightage for periodic reviews shall be 50%. Of the remaining 50%, 20% shall be for the project report and 30% for the Viva Voce examination.

12.7 For the first attempt of the arrear theory examination, the internal assessment marks scored for a course during first appearance shall be considered for grading along with the marks scored in the semester end arrear examination. From the subsequent appearance onwards, full weightage shall be assigned to the marks scored in the semester end examination to award grades and the internal assessment marks secured during the course of study shall not be considered.

In case of laboratory integrated theory courses, after one regular and one arrear appearance, the internal mark of theory component is invalid and full weightage shall be assigned to the marks scored in the semester end arrear examination for theory component. There shall be no arrear or improvement examination for lab component.

13.0 SUBSTITUTE EXAMINATIONS

13.1 A student who is absent, for genuine reasons, may be permitted to write a substitute examination for any one of the two continuous assessment tests of a course by paying the prescribed substitute examination fee. However, permission to take up a substitute examination will be given under exceptional circumstances, such as accidents, admission to a hospital due to illness, etc. by a committee constituted by the Head of the Department / Dean of School for that purpose. However there is no substitute examination for semester end examination.

13.2 A student shall apply for substitute exam in the prescribed form to the Head of the Department / Dean of School within a week

from the date of assessment test. However the substitute examination will be conducted only after the last working day of the semester and before the semester end examination.

14.0 SUPPLEMENTARY EXAMINATION

14.1 Final Year students can apply for supplementary examination for a maximum of three courses thus providing an opportunity to complete their degree programme. Likewise students with less credit can also apply for supplementary examination for a maximum of three courses to enable them to earn minimum credits to move to higher semester. The students can apply for supplementary examination within three weeks of the declaration of results in both odd and even semester.

15. PASSING, DECLARATION OF RESULTS AND GRADE SHEET

15.1 All assessments of a course shall be made on absolute marks basis. However, the Class Committee without the student members shall meet within 5 days after the semester end examination and analyze the performance of students in all assessments of a course and award letter grades. The letter grades and the corresponding grade points are as follows:

Letter Grade	Grade Points
S	10
A	9
B	8
C	7
D	6
E	5
U	0
W	0
I	0
AB	0

"W" denotes withdrawal from the course.

“I” denotes inadequate attendance and hence prevented from

appearing for semester end examination

"U" denotes unsuccessful performance in the course.

"AB" denotes absence for the semester end examination.

15.2 A student who earns a minimum of five grade points ('E' grade) in a course is declared to have successfully completed the course. Such a course cannot be repeated by the student for improvement of grade.

15.3 The results, after awarding of grades, shall be signed by the Chairman of the Class Committee and Head of the Department/Dean of School and it shall be declared by the Controller of Examinations.

15.4 Within one week from the date of declaration of result, a student can apply for revaluation of his / her semester end theory examination answer scripts of one or more courses, on payment of prescribed feeto the Controller of Examinations. Subsequently the Head of the Department/ Dean of School offered the course shall constitute a revaluation committee consisting of Chairman of the Class Committee as convener, the faculty member of the course and a senior faculty member knowledgeable in that course as members. The committee shall meet within a week to re-evaluate the answer scripts and submit its report to the Controller of Examinations for consideration and decision.

15.5 After results are declared, grade sheets shall be issued to each student, which contains the following details: a) list of courses enrolled during the semester including redo courses / arrear courses, if any; b) grades scored; c) Grade Point Average (GPA) for the semester and d) 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 of courses registered and the grade points 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.

If C_i, is the number of credits assigned for the i^{th} course and GP_i

is the Grade Point in the i^{th} course

$$GPA = \frac{\sum_{i=1}^{n}(C_i)(GPi)}{\sum_{i=1}^{n} C_i}$$

Where n = number of courses

The Cumulative Grade Point Average (CGPA) is calculated in a similar manner, considering all the courses enrolled from first semester.

“I” and "W" grades are excluded for calculating GPA.

"U", “I”, "AB" and **"W"** grades are excluded for calculating CGPA.

The formula for the conversion of CGPA to equivalent percentage of marks is as follows:

Percentage Equivalent of Marks = CGPA X 10

15.6 After successful completion of the programme, the Degree shall be awarded upon fulfillment of curriculum requirements and classification based on CGPA as follows:

Classification	CGPA
First Class with Distinction	8.50 and above and passing all the courses in first appearance and completing the programme within the minimum prescribed period.
First Class	6.50 and above and completing the programme within a minimum prescribed period plus two semesters.
Second Class	Others

However, to be eligible for First Class with Distinction, a student should not have obtained ‘U’ or ‘I’ grade in any course during his/her period ofstudy and should have completed the P.G. programme within a minimum period (except break of study). To be eligible for First Class, a student should have passed the examination in all the courses within the specified minimum number of semesters reckoned from his/her commencement of study plus two semesters. For this purpose, the authorized

break of study is not considered. The students who do not satisfy the above two conditions shall be classified as second class. For the purpose of classification, the CGPA shall be rounded to two decimal places. For the purpose of comparison of performance of students and ranking, CGPA will be considered up to three decimal places.

16.0DISCIPLINE

16.1 Every student is expected to observe disciplined and decorous behaviour both inside and outside the campus and not to indulge in any activity which tends to affect the reputation of the Institution.

16.2 Any act of indiscipline of a student, reported to the Dean (Student Affairs), through the HOD / Dean shall be referred to a Discipline and Welfare Committee constituted by the Registrar for taking appropriate action.

17.0 ELIGIBILITY FOR THE AWARD OF THE MASTERS DEGREE

17.1 A student shall be declared to be eligible for the award of the Masters Degree, if he/she has:

i. Successfully acquired the required credits as specified in the curriculum corresponding to his/her programme within the stipulated time.
ii. No disciplinary action is pending against him/her.
iii. Enrolled and completed at least one value added course.
iv. Enrollment in at least one MOOC / SWAYAM course (non-credit) before the final semester.

17.2 The award of the degree must have been approved by the Institute.

18.0POWER TO MODIFY

Notwithstanding all that have been stated above, the Academic Council has the right to modify any of the above regulations from time to time.

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B.S. ABDUR RAHMAN CRESCENT INSTITUTE OF SCIENCE AND TECHNOLOGY

M.TECH. FOOD BIOTECHNOLOGY
CURRICULUM & SYLLABUS, REGULATIONS 2019

SEMESTER I

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1	PC	LTD 6111	Chemistry of Foods	3	0	2	4
2	PC	LTD 6112	Modern Food Microbiology	3	0	2	4
3	PC	LTD 6113	Advanced Nutritional Biochemistry	4	0	0	4
4	PC	LTD 6114	Modern Food Processing Techniques	3	0	0	3
5	FC	LTD 6101	Applied Biostatistics for Biotechnologists	3	0	0	3
6	PE		Professional Elective - I	3	0	0	3
			Credits				**21**

SEMESTER II

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1	PC	LTD 6211	Technology in Food Packaging	3	0	2	4
2	PC	LTD 6212	Applied Food Biotechnology	4	0	0	4
3	PC	LTD 6213	Research Methodology	4	0	0	4
4	PE		Professional Elective –II	3	0	0	3
5	PE		Professional Elective – III	3	0	0	3
6	PE		Professional Elective – IV	3	0	0	3
7			Value added course *				-
			Credits				**21**

* Any relevant certification course offered by the institution / other institutions / universities / IIT Bombay (ST), MOOC courses, etc.

SEMESTER III

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1	PE		Professional Elective -V	3	0	0	3
2	PE		Professional Elective – VI	3	0	0	3
3	GE		General Elective	3	0	0	3
4	PC	LTD 7111	Internship #				1
5	PC	LTD 7112	Project Work (Phase I)	0	0	12	6**
6			MOOC course (related to project)				-
			Credits				**16**

SEMESTER IV

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1	PC	LTD 7121	Project Work (Phase II)	0	0	36	18
			Total Credits				**6 + 18 =24**

Overall Total Credits - 76

Industrial training will be undertaken during first year summer vacation for 30 days. The credit will be awarded in the 3rd Semester.

** Credits for Project Phase I to be accounted along with Project Phase II in IV Semester.

LIST OF PROFESSIONAL ELECTIVE COURSES

(ODD SEMESTER)

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	LTDY 051	Aromatic and Medicinal Plants	3	0	0	3
2.	PE	LTDY 052	Sanitation and Waste Management in Food Industries	3	0	0	3
3.	PE	LTDY 053	Functional Foods and Nutraceuticals	3	0	0	3
4.	PE	LTDY 054	Applications of Enzymes in Food Industry	3	0	0	3
5.	PE	LTDY 055	Quality Evaluation of Foods	3	0	0	3

(EVEN SEMESTER)

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	LTDY 081	Flavour Processing Technology	3	0	0	3
2.	PE	LTDY 082	Meat ProcessTechnology	3	0	0	3
3.	PE	LTDY 083	Marine Food Process Technology	3	0	0	3
4.	PE	LTDY 084	Food Informatics	3	0	0	3
5.	PE	LTDY 085	Post - Harvest Technology of Fruits and Vegetables	3	0	0	3
6.	PE	LTDY 086	Dairy Technology	3	0	0	3
7.	PE	LTDY 087	Food Nutrigenomics	3	0	0	3
8.	PE	LTDY 088	Food Product Design and Development	3	0	0	3

GENERAL ELECTIVE

Sl. No.	Course Code	Course Title	L	T	P	C
1.	GEDY 101	Project Management	3	0	0	3
2.	GEDY 102	Society, Technology and Sustainability	3	0	0	3
3.	GEDY 103	Artificial Intelligence	3	0	0	3
4.	GEDY 104	Green Computing	3	0	0	3
5.	GEDY 105	Gaming Design	3	0	0	3
6.	GEDY 106	Social Computing	3	0	0	3
7.	GEDY 107	Soft Computing	3	0	0	3
8.	GEDY 108	Embedded System Programming	3	0	0	3
9.	GEDY 109	Principles of Sustainable Development	3	0	0	3
10.	GEDY 110	Quantitative Techniques in Management	3	0	0	3
11.	GEDY 111	Programming using MATLAB and SIMULINK	1	0	2	2
12.	GEDY 112	JAVA Programming	3	0	0	3
13.	GEDY 113	PYTHON Programming	3	0	0	3
14.	GEDY 114	Intellectual Property Rights	1	0	0	1
15.	GEDY 115	Research and Publication Ethics	2	0	0	2
16.	GEDY 116	IPR and Entrepreneurship	3	0	0	3
17.	GEDY 117	Nanotechnology in Food Applications	3	0	0	3

SEMESTER I

LTD 6111	CHEMISTRY OF FOODS	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

COB1: Students will understand the carbohydrates and its Physical and chemical properties

COB2: Students will understand the proteins and its Physical and chemical properties

COB3: Students will understand the lipids and its Physical and chemical properties

COB4: Students will understand the vitamins and its Physical and chemical properties

COB5: Students will learn the Chemistry of color, flavour and pigments

MODULE I CARBOHYDRATES 9

Nomenclature Classification and structure of carbohydrates, Chemical reactions of carbohydrates. Physical and chemical properties of sugars. Chemistry, properties and preparation of gums & polysaccharides. Starch and its hydrolytic products, maltodextrins, Cellulose, Cyclodextrins. Modified Starches, Conversion of starch to sugars; Heteroploysaccharides and Gums.

MODULE II PROTEINS 9

Importance of Proteins. Nomenclature, classification, structure and chemistry of amino acids, peptides and Proteins. Sources and distribution of Proteins. Isolation, identification and purity of proteins. Denaturation. Physical andchemical characteristics of Proteins.

MODULE III LIPIDS 9

Introduction and classification of lipids. Chemistry of fatty acids & glycerides. Components of Fatty acids, Phospholipids and unsaponifiables. Auto oxidation and hydrolysis, Physical & chemical characteristics of fats & oils, hydrogenated fats, shortening agents, confectionary fats etc. Flow chart representation of manufacture of edible oils. Refining of oils and hydrogenation of oils.

MODULE IV VITAMINS 9

Summary of vitamin stability – Toxicity and sources of vitamins – Bioavailability of vitamins –Reasons for the loss of vitamins in foods – Fat-soluble and water-soluble vitamins – Choline, carnitine.

MODULE V CHEMISTRY OF COLORS, PIGMENTS AND FLAVOURS 9

Fat & Water Soluble, Meat Pigments. Chlorophyll & chlorophyll derivatives, Haems and bilins, Carotenoids, annatto, saffron, turmeric- Stability to pH, temperature and other processing conditions - Technology for the production of dried colourants - Caramel colour. Ingredients, Taste, Aroma, Undesirable flavors. Classification – Alliaceous flavours – Bittering agents, Coffee and Cocoa, Fruit flavours.

PRACTICALS

1. Stoichiometric determination and estimations- volumetry and gravimetry
2. Determination of carbonate and bicarbonate in a mixture by PH -metric titration and comparison with visual acid-base titration
3. Quantitative Estimation of Reducing Sugars from food samples
4. Preparation of food relevant organic compounds
5. Estimation of vitamins from natural foods
6. Determination of protein concentration by different methods
7. Emulsification test for lipids from oils of various seeds
8. Estimation of crude fibre content
9. Determination of micronutrients in commercial food samples

L – 45; P – 30; Total Hours –75

TEXT BOOKS:

1. Meyer L.M. Food chemistry. CBS Publishers & Distributors
2. Fundamentals of Biochemistry, J.L. Jain.
3. Textbook of Biochemistry, Lehninger.
4. Biochemistry, L. Stryer, W.H. Freeman and Company.
5. Outline of Biochemistry, Conn &Stumph.
6. Owen R Fennema : Food Chemistry – III edition Marcel Dekkar Inc. New York (1996).
7. Natural Food Colorants: Science and Technology, By Gabriel J. Lauro, , Frederick John Francis, CRC Press Pub., 2000.
8. Flavor Chemistry and Technology, By Gary Reineccius, Henry B. Heath, 2nd Edn., Taylor and Francis group, CRC Press, 2006.

COURSE OUTCOMES:

CO1: Recognize both major and minor food components.

CO2: Student understand the proteins from foods and its importance

CO3: Students recognize the role of lipids in lipids and its importance’s

CO4: Students will understand the importance of vitamins and physical and chemical characteristics.

CO5: Understand the sensory evaluation of the food.

Board of Studies (BoS) :
8th BoS of SLS held on 5.07.2021

Academic Council:
17th AC held on 15.07.2021

LTD 6112	MODERN FOOD MICROBIOLOGY	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

COB1: The course aims to develop the knowledge of students in the basic area of Food Microbiology**.**

COB2: This course will enable students to appreciate the role of microbes in food spoilage, preservation of foods and food borne infections.

COB3: To give knowledge about the role of microbes in food production

COB4: This is necessary for effective understanding of food processing and technology subjects as well as food safety.

COB5: To educate the important' to students about the microbial Examination of Foods.

MODULE I BASICS OF FOOD MICROBIOLOGY 9

Foods as ecological niches, relevant microbial groups, Microbes found in raw materials and foods that are detrimental to quality, Factors that influence the development of microbes in food, newer and rapid methods for qualitative and quantitative assay demonstrating the presence and characterization of microbes, Stress, damage, adaptation, reparation, death.

MODULE II MICROBIAL GROWTH IN FOOD 9

Microbial growth in food: intrinsic, extrinsic and implicit factors, Microbial interactions, Inorganic, organic and antibiotic additives. Effects of enzymes and other proteins, Combination systems, Adaptation phenomena and stress phenomena, Effect of injury on growth or survival, commercially available databases.

MODULE III MICROBIAL BEHAVIOUR -NEWER METHODS 9

Microbial behaviour against the newer methods of food processing, Adoption and resistance development, Microbes as test organisms, as sensors and as tools for future applications in energy production and food and non-food industrial products.

MODULE IV MODERN METHODS 9

Modern methods of cell culture: synchronous and co- cell culture, continuous cell culture in liquid and solid media, Cell immobilization and applications, Pre and probiotics cultures.

MODULE V MICROBIAL EXAMINATION OF FOODS 9

Detection and Enumeration of microbes in foods; Indicator organisms and microbiological criteria; Rapid and automated microbial methods – development and impact on the detection of food borne pathogens; Applications of immunological, techniques to food industry; Detection methods for E. coli, Staphylococci, Yersinia, Campylobacter, B. cereus, Cl. botulimum& Salmonella, Listeria monocytogenes Norwalk virus, Rotavirus, Hepatitis A virus from food samples.

PRACTICALS

List of Experiments:

1. Food Microbiology Laboratory Safety and Notebook Record
2. Staining Technology and Bright-Field Microscope Use
3. Enumeration of Bacteria in Broth Suspension by Spread and Pour Plating
4. Isolation of Foodborne Pathogens on Selective, Differential, and Enriched Medium by Streak Plating
5. Enumeration of Aerobic Plate Counts, Coliforms, and Escherichia coli of Organic Fruit Juice on Petrifilm
6. Enumeration and Identification of Staphylococcus aureus in Chicken biryani
7. Enumeration and Identification of Listeria monocytogenes on Ready-to-Eat (RTE) foods
8. Isolation and Identification of Salmonella and Campylobacter spp. on Broiler Chicken
9. Thermal Inactivation of Escherichia coli O157:H7 in Non-intact Reconstructed meat patties
10. Cultivation of Anaerobic Bacteria in Canned FoodObservation and Enumeration of Molds from Spoiled Bread

L – 45; P – 30; Total Hours –75

TEXT BOOKS:

1. Banwart, G.J. Basic Food Microbiology 2nd Edition. CBS Publishers, 1998.
2. Jay, J.M. Modern Food Microbiology. 4th Edition. CBS Publishers, 2003.
3. Khetarpaul, Neelam. Food Microbiology Daya Publishing House, 2006.

REFERENCES:

1. Montville, Thomas J. and Karl R. Matthews Food Microbiology: An

Introduction. ASM Press, 2005
2. Pawsey, R. K. Case Studies in Food Microbiology for Food Safety and Quality. The Royal Society of Chemistry, 2001.
3. Forsythe, S.J. The Microbiology of Safe Food. Blackwell Science, 2000.
4. Doyle, Michael P. Food Microbiology: Fundamentals and Frontiers. 2nd Edition, ASM Press, 2001.
5. Adams M. 2006. Emerging Food-borne Pathogens.
6. Woodhead Publ. Adams MR & Moss MO. 2000.
7. Food Microbiology. Panima. Easter MC. 2003.
8. Rapid Microbiological Methods in the Pharmaceutical Industry.
9. Harrigan W. 2003. Laboratory Methods in Food Microbiology. University of Reading, UK, Elsevier.
10. James MJ, Loessner MJ & David A. 2005. Modern Food Microbiology. 7th Ed. Golden Food Science Text Series. Pederson CS.1979.
11. Microbiology of Food Fermentations. AVI Publ. Roberts R .2002.
12. Practical Food Microbiology. Blackwell Publ. Rossmore HW. 1995.
13. Handbook of Biocide and Preservative. Blackie Wood JBB. 1999.
14. Microbiology of Fermented Foods. Vols. I, II. Blackwell.

COURSE OUTCOMES:

CO1: Be able to understand and identify the various microbes associated with foods and food groups

CO2: Be able to understand and identify the role of these microbes in food spoilage, food preservation.

CO3: Understand the role of pathogens in food borne infections. Understand the methods used to detect pathogens in foods.

CO4: Collect, organise, analyseand evaluate modern methods available for the food preservation industry.

CO5: Able tounderstand the microbial examination of foods related information effectively to use in the industry.

Board of Studies (BoS) :
8th BoS of SLS held on 5.07.2021

Academic Council:
17th AC held on 15.07.2021

LTD 6113	ADVANCED NUTRITIONAL BIOCHEMISTRY	L	T	P	C
		4	0	0	4

COURSE OBJECTIVES:

COB1: The course will also make the student to understand the importance of correct nutrition

COB2: To understand currently important aspects of nutrition in human performance, health, and selected diseases.

COB3: To trace the transformation of energy in food to chemical energy available to cells and stored in cells

COB4: To study the cellular effects of food energy and macronutrients on regulated metabolism, tissue homeostasis, inter-organ relationships, and overall body function

COB5: To study biochemical and physiological influences of ingestion, digestion, absorption, transport and utilization of the macronutrients on overall metabolism.

MODULE I BASICS OF ENERGY METABLISM AND NUTRITION 12

Unit of measuring energy calorific value of food BMR & factors affecting it. SDA of food calculation of energy requirement, balanced diet Definition of energy Unit of energy i.e. calories and joules Energy Balance i.e. positive & negative energy balance Basal Metabolic Rate:-Factors considered while measuring BMR Factors affecting BMR Calculation of energy Definition of Balance diet.

MODULE II CARBOHYDRATES RELATED METABOLISM 9

Glycolysis Reactions of glycolysis Definition of citric acid cycle Reactions of citric acid cycle Pathway of gluconeogenesis Pathway of glycogenolysis Location of HMP Shunt pathway Reaction of HMP Shunt pathway Metabolism and hormonal mechanism of glucose homeostasis, biomedical importance of carbohydrate digestion & absorption of carbohydrate.

MODULE III CHEMSITRY OF PROTEINS AND THEIR RELATED METABOLISM 12

Introduction, definition and classification of proteins, biomedical importance Metabolism: Transformation, Decarboxylation, Ammonia formation & transport Urea cycle Classification of proteins, Urea cycle, Digestion, absorption process, Structure of protein, Functions of protein, Biomedical importance, Denaturation of proteins, Biomedical importance.

MODULE IV CHEMISTRY OF LIPIDS OF LIPIDS AND THEIR RELATED METABOLISM **9**

The chemical structure of lipids The Classifications of fats Oxidation of fatty acids Ketosis, Methods of identification of fats Beta oxidation pathway, Biomedical importance Properties of fatty acids Biochemical abnormalities in diabetic ketoacidosis, Biomedical importance Brief outline of metabolism Beta oxidation of fatty acids ketosis Measurements of serum enzyme levels Bile pigment metabolism: Jaundice – its types and their biochemical findings.

MODULE V LIVER FUNCTIONS AND THEIR ASSESSMENT **12**

Lipid Metabolism Measurements of serum enzyme levels Bile pigment metabolism: Jaundice – its types and their biochemical findings. Introduction to liver function test, Liver function test, LFT profile Indications of LFT Indications of ranges.

L – 60; Total Hours –60

TEXT BOOKS:

1. Ferrier, D.R., Lippincott's Illustrated Reviews: Biochemistry, 5th or 6th Edition, Lippincott Williams & Wilkins, Baltimore, MD 2011 or 2013.

REFERENCES:

1. Bowman, Barbara A. & Russell, Robert M., Present Knowledge in Nutrition, 9th Edition, International Life Sciences Inst. Press, Washington, DC 2006.
2. Robert Murray, Victor Rodwell, David Bender, Kathleen M. Botham, P. Anthony Weil, Peter J. Kennelly, Harper's Illustrated Biochemistry, 28th Edition, LANGE Basic Science, McGraw Hill Companies, Inc. 2009.

COURSE OUTCOMES:

CO1: Understand nutrient metabolism in normal and disease states

CO2: Be able to integrate the regulation of metabolism of nutrients under normal and disease state conditions

CO3: Be able to think critically about nutrient claims and fads using your knowledge of nutritional biochemistry.

CO4: Integrate current research in the area of metabolism and micronutrient function into existing knowledge and formulate new hypotheses to guide future research.

CO5: Understand the biochemical and molecular functions of nutrients we consume

LTD 6114	MODERN FOOD PROCESSING TECHNIQUES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

COB1: To apply different engineering approaches for processing food.

COB2: To understand the food properties required in optimal food processing.

COB3: To engineer the processing approaches for good food quality and food safety.

COB4: To apply engineering approaches in thermal processing for minimal nutrition loss.

COB5: To provide advanced knowledge about modern food processing techniques**.**

MODULE I FRUIT & VEGETABLE PROCESSING TECHNIQUES 8

Size reduction, Mixing, Separation, Concentration, Freezing & Refrigeration, Drying & Dehydration techniques, Processing by using Chemicals& Pulsed Light and Irradiation.

MODULE II DAIRY PROCESSINGTECHNIQUES 8

Separation, Homogenization, Pasteurization, Standardization, Sterilization (UHT), Evaporation (Spray Drying), Chilling, Freezing & Refrigeration.

MODULE III MEAT, POULTRY, EGG & SEA FOOD PROCESSING TECHNIQUES 10

Dielectric, Ohmic and Infra-red heating, Smoking, Canning, Drying, Cooling, Canning Pulsed Electric Field processing techniques.

MODULE IV CEREAL, MILLETS, PULSE PROCESSING TECHNIQUES 10

Parboiling, Milling, High-Pressure Processing, Germination, Malting, Fermentation, Malting, Enzymatic hydrolyzation.

MODULE V SPICE AND OIL SEED PROCESSING TECHNIQUES 9

Irradiation, chemical fumigation, Cryogenic grinding, Solvent extraction for spice oleoresins. Extrusion techniques, enzyme-assisted liquefaction of spice, lyophilization.

L – 45; Total Hours –45

TEXT BOOKS:

1. P.J.Fellows. Food processing technology, , 4th Edition, Elsevier

REFERENCES:

1. G. Sumit. Dairy processing. 1st Edition Elsevier
2. Ashok K.Agrawal.Processing technologies for milk and milk products, 1st Edition, Taylor & Francis

COURSE OUTCOMES:

CO1: At the end of the course, the student will be able to apply different engineering approaches for processing food.

CO2: Understand the food properties required in optimal food processing

CO3: Engineer the processing approaches for good food quality and food safety.

CO4: Apply engineering approaches in thermal processing for minimal nutrition loss.

CO5: Analyze different modern food processing techniques.

Board of Studies (BoS) :
8th BoS of SLS held on 5.07.2021

Academic Council:
17th AC held on 15.07.2021

LTD 6101	APPLIED BIOSTATISTICS FOR BIOTECHNOLOGISTS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

COB1: Students will be able to make informed decisions based on data

COB2: Students will be able to correctly apply a variety of statistical procedures and tests

COB3: Students will know the uses, capabilities and limitations of various statistical procedures

COB4: Students will be able to interpret the results of statistical procedures and tests.

COB5: Students will be able to solve ANOVA

COB6: To learn about analysing the survey results

MODULE I CONCEPTS IN STATISTICS 09

Population and sample, qualitative and quantitative data, nominal, ordinal, ratio,

interval data; cross sectional and time series data; discrete and continuous data.Descriptive statistics and Random variables; Measures of central tendency:mean, median, mode; the uses of measure of central tendency, Measures ofspread: range, percentile, standard deviation, some properties of variance andstandard deviation, the coefficient of variation, group data.

MODULE II INFERENTIAL STATISTICS 08

Displaying data: frequency table, line graph, bar chart, histograms, stem andleaf plots, dot plot, scatter plot, box plots, frequency distributions; definition ofprobability, rules for calculating probability, definition from epidemiology, Bayes'theorem, probability in sampling, Bernoulli, Binomial, Poisson; Geometricdistributions; Continuous random variables: Normal; Exponential distributions;Standard normal distribution. Counting and Probability, Permutations;Combinations.

MODULE III INTERVAL ESTIMATION 12

Prediction, confidence and tolerance Intervals, distribution free interval,

confidence interval based on normal distribution, confidence interval and samplesize, Point and interval estimates; the relation between population and sample,Random-Number tables, randomized clinical trials, estimation of the Mean ofDistribution, estimation of -variance of distribution, binominal

distribution andpoisson distribution.

MODULE IV HYPOTHSIS TESTING 12

Hypothesis testing: null and alternative hypotheses, decision criteria, critical values, type I and type II errors, Meaning of statistical significance; Power of a test; One sample hypothesis testing: Normally distributed data: z, t and chisquare tests; Binomial proportion testing, nonparametric hypothesis testing, Twosample hypothesis testing; Nonparametric methods: signed rank test, rank sumtest; Kruskal-Wallis test;

MODULE V CURVE FITTING AND ANOVA 12

Regression and correlation: simple linear regression; Least squares method; Analysis of enzyme kinetic data; Michaelis-Menten; Lineweaver-Burk and the direct linear plot; Logistic Regression; Polynomial curve fitting. Analysis of variance: One-way ANOVA, two-way ANOVA. Fixed effect model, Random effect model, the intraclass correlation coefficient.

MODULE VI ANALYSIS OF SURVEY DATA 08

Introduction, study design, measures of effect for categorical data, attribution risk, confounding and standardization, methods of inference for stratified categorical data-The Mantel-Haenszel test, power and sample, multiple logistic regression, meta Analysis, equivalence study, the cross-over design, longitudinal data analysis, measurement-error Methods.

L – 60; Total Hours –60

TEXT BOOKS:

1. Gupta.S.C.,‖Fundamentals of Applied Statistic, Sultan Chand & Sons ,New Delhi 2014.

REFERENCES:

1. Norman T J Bailey, ‖Statistical Methods in Biology — (3rd Edition), Cambridge University Press 1995
2. Gerald van Belle, L.D. Fisher, P.J. Heagerty, and T. Lumney, —Introduction to Biostatistics‖ Second Edition, John Wiley & Sons, New Jersey 2004
3. Wong Limsoon, ‖Essence of biostatistics ‖, NUS Lecture Notes Series 2003.

COURSE OUTCOMES:

CO1: After the completion of the course students will have a detailed understanding of concepts in statistics.

CO2: Understand the principle and applications of different forms of data display.

CO3: Understand the concept of interval estimation

CO4: Understand the principle and applications of making a hypothesis of the data and testing it.

CO5: Have basic knowledge of curve fittng the data and design and categorize the data

CO6: Acquire knowledge to analyze survey results

Board of Studies (BoS) :
8th BoS of SLS held on 5.07.2021

Academic Council:
17th AC held on 15.07.2021

SEMESTER II

		L	T	P	C
LTD6211	**TECHNOLOGY IN FOOD PACKAGING**	**3**	**0**	**2**	**4**

COURSE OBJECTIVES:

COB1: Understand the properties of food packaging materials and their suitability in extending shelf life of food products

COB2: Impart knowledge on rationale in selecting packaging material for processed food products

COB3: Learn about laws and regulations of packaging materials and labeling of foods

COB4: Learn about the filling techniques in food packaging

COB5: Students will learn about testing and labeling of packaging materials

MODULE I FUNCTIONS OF FOOD PACKAGING MATERIALS 9

Introduction- Science and technology of food packaging- Socio economic needs - functions of food packaging- Food Packaging environments- functions and environments grids-Food packaging systems-Food package development.

MODULE II RIGID AND SEMI RIGID FOOD PACKAGING MATERIALS 9

Paper - different types - corrugated paper boards- definition - types - manufacturing method-paper board products - Polymer - basic concept of polymer- polymerization- plastics versus polymersAdvantages and disadvantages of plastics- polymer properties - molecular weight - chain entanglement- plastics - morphology-definition- different types of food packaging polymers- polymer processing methods- heat sealing - adhesives and labels- Nano composite food packaging materialsbio-degradable food packaging materials- bag in box system of food, Smart packaging, Intelligent packaging, Modified atmospheric packaging and control atmospheric storage.

MODULE III FLEXIBLE FOOD PACKAGING MATERIALS 9

Paper - different types - corrugated paper boards- definition - types - manufacturing method-paper board products - Polymer - basic concept of polymer- polymerization- plastics versus polymersAdvantages and disadvantages of plastics- polymer properties - molecular weight - chain entanglement- plastics - morphology-definition- different types of food packaging polymers- polymer processing methods- heat sealing - adhesives and labels- Nano composite food packaging materialsbio-degradable food packaging

materials- bag in box system of food, Smart packaging, Intelligent packaging, Modified atmospheric packaging and control atmospheric storage.

MODULE IV FILLING SYSTEMS 9

Filling of liquid and wet products- to predetermined level and predetermined volume- filling of dry solids- by count- volume-weight - methods of wrapping and bagging- form -fill -seal methodsvarious forms of packaging - vacuum packaging- blister packaging-shrink packaging - stretch packaging.

MODULE V TESTING AND LABELING OF PACKAGING MATERIALS 9

Principles of measuring water vapour transmission rate and gas permeability rate through given flexible film, OUR from food and OTR from film.Testing of packaging materials using - UTMMullen Bursting strength tester- drop tester- Pouch burst tester- cob tester- gauge tester- torque testertear tester- gas analyzer-cushioning materials. Labeling, regulation and traceability. Global migration testing and design aspects.

PRACTICALS:

1. Identification of different types of packaging and packaging materials
2. Determination of tensile strength of given material
3. To perform different destructive tests for glass containers
4. To perform non-destructive tests for glass containers
5. Determination of wax weight
6. Determination of tearing strength of paper
7. Measurement of thickness of packaging materials
8. To perform grease-resistance test in plastic pouches
9. Determination of bursting strength of packaging material
10. Determination of water-vapour transmission rate
11. Demonstration of can-seaming operation
12. Testing of chemical resistance of packaging materials
13. Determination of drop test of food package
14. Visit to relevant industries
15. Introducing the students with the latest trends in packaging consulting the websites and magzines

L – 45; P – 30; Total Hours – 75

TEXT BOOKS:

1. Paine, Frank A., Paine, Heather Y.Handbook of Packaging. Springer US, 1992. ISBN: 978-1-4615-2810-4
2. S Ranganna. Manual of Analyzing for Fruits and Vegetables

Products.Tata McGraw-Hill, 1977

REFERENCES:

1. Richard Coles, Derek McDowell, Mark J. Kirwan, Food Packaging Technology, Blackwell Publishers, 2003.
2. Gordon L. Robertson, Food Packaging: Principles and Practice, Second Edition (Food Science and Technology), Taylor & Francis, CRC Press, 2005
3. NIIR Board, Food Packaging Technology Handbook (2nd Revised Edition), NIIR Project Consultancy Services, 2012.
4. Richard Coles and Mark J. Kirwan, Food and Beverage Packaging Technology, Second Edition, Wiley & Blackwell, 2011.
5. K.L. Yam and D.S. Lee, Emerging Food Packaging Technologies, Principles and Practice, A volume in Woodhead Publishing series in Food Science, Technology and Nutrition, 2012.
6. Dong Sun Lee, Kit L. Yam and Luciano Piergiovanni, Food Packaging Science and Technology, CRC Press, 2008.

COURSE OUTCOMES:

CO1: Apply the functions of food packaging for socio economic needs

CO2: Select suitable packaging materials for the extension of shelf life of food products

CO3: Apply the new innovation in developing advanced packaging material

CO4: Choose the different filling systems for whole and ground food products

CO5: Analyze the testing and labeling regulatory requirements with respect to food packaging

Board of Studies (BoS) : 8th BoS of SLS held on 5.07.2021

Academic Council: 17th AC held on 15.07.2021

LTD 6212 APPLIED FOOD BIOTECHNOLOGY L T P C

4 0 0 4

COURSE OBJECTIVES:

The purpose of this course is:

COB1: Provide a programme of education which can enable its graduates toenter a career in the food industry as technologists capable of ensuringthe production and marketing of safe and quality foods

COB2: Provide a broadly based technological education whose graduates canalso enter into employment in other sectors of the food chain, or relatedtechnical sectors, where they can apply their technological skills.

COB3: To provide a framework of the professional disciplines such as medical food, probiotics, fermented milk and food products.

COB4: To develop the students' ability to analyze and solve problems

COB5: Allow individuals to develop their capacity to undertake research intoproblems relating to the production and marketing of safe and qualityfoods.

MODULE I INTRODUCTION OF FOOD BIOTECHNOLOGY 12

Food Biotechnology: Introduction & Applications; Methods for the microbiological examination of water and foods; Control of Microbiological quality and safety; Food borne illnesses and diseases; Microbial cultures for food fermentation, their maintenance, strain development.

MODULE II GENETICALLY MODIFIED FOOD 12

GM foods: Introduction and controversies related to GMOs. Ethical issues concerning GM foods; testing for GMOs; current guidelines for the production, release and movement of GMOs; labelling and traceability; trade related aspects; biosafety; risk assessment and risk management. Public perception of GM foods. IPR. GMO Act–2004. New products and processes in various food commodities including plant and animal products.

MODULE III FOOD QUALITY AND ITS REGULATIONS 12

Analysis of food, major ingredients present in different product, Food additives colour, flavour, vitamins, Microbial safety of food products, Chemical safety of food products, heavy metal, fungal toxins, pesticide and herbicide contamination.

MODULE IV PRODUCTION OF FOOD PRODUCTS 12

Production of organic acids (vinegar, lactic acid), alcoholic beverages (beer, wine, and distilled alcoholic beverages such as whiskey, rum, vodka), glycerol;

Propagation of baker's yeasts.Microbial production of vitamins (B2 and B12), antibiotics (penicillin, streptomycin, tetracycline); Enzymatic production of glucose, fructose, starch, SCP and mushrooms.

MODULE V APPLICATIONS OF APPLIED FOOD BIOTECHNOLOGY **12**

Starter cultures–types, designing and development, micro encapsulation and packaging, scopes and challenge; Development and formulation of novel products such as probiotic foods. Nutrogenomics-concept, working, significance and relevance. Biosensors and novel tools and their application in food science & Technology.

L – 60; Total Hours – 60

TEXT BOOKS:

1. B. Srilakshmi, Food science, New Age Publishers,2002.
2. James M. Jay, Modern Food Micro-Biology, (2000), 6th edition, An Aspen Publication, Maryland, USA.
3. Coles R, McDowell D and Kirwan MJ, Food Packaging Technology, CRC Press, 2003.
4. Lee, B. H. Fundamentals of Food Biotechnology.VCH. 2006.

REFERENCES:

1. G.F.G. Lopez & G.V.B. Canovas, Food Science and Food Biotechnology (2003), CRCPress, Florida, USA
2. Ranganna S, Handbook of Analysis and Quality Control for Fruits and Vegetable Products (1986), 2nd ed. TMH Education Pvt. Ltd.
3. GokogluN.Novel natural food preservatives and applications in seafood preservation: a review.(2019), Journal of Science Food and Agriculture, Voulme 99, Issue 5, Page number 2068-2077.

COURSE OUTCOMES:

The students would be more confident and able to:

CO1: integrate the scientific disciplines relevant to food

CO2: develop newly formulated food and products.

CO3: enquire quality assurance in for public and the environment.

CO4: apply and communicate technological knowledge to meet the needs of industry and the consumer for the production and marketing of safe and quality foods.

CO5: understand the technical skills for presereving and other events involved for food production.

Board of Studies (BoS) :
8th BoS of SLS held on 5.07.2021

Academic Council:
17th AC held on 15.07.2021

LTD 6213	RESEARCH METHODOLOGY	L	T	P	C
		4	0	0	4

COURSE OBJECTIVES:

COB1: Students must be exposed to learn about the research and the significance of research

COB2: Students will learn the basic ethics of research

COB3: Student will be exposed to laboratory safety and experimental research and disposal of food wastes

COB4: Student will be exposed how to interpret and analyse the results

COB5: Student will learn about basic scientific writing and technical publication

MODULE I RESEARCH METHODOLOGY-INTRODUCTION 12

Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Research Process, Criteria of Good Research, Problems Encountered by Food researchers.

MODULE II RESEARCH ETHICS – AN OVERVIEW 12

Philosophy of Science, natural science and social science; Ethics and scientific conduct- introduction to ethics, scientific conduct and misconduct, Misconduct and why it occurs, Fabrication, Authorship issues, The investigation and punishment of scientific misconduct.

MODULE III LABORATORY SAFETY AND EXPERIMENTAL RESEARCH 12

Safety in the Biology Laboratory, Safety Symbols, Science Safety Rules-Dress Code, First Aid, Heating and Fire Safety, Using Chemicals and glassware's, Handling living organisms, handling human blood and some other body fluids and tissue, disposal of bio hazardous waste. Food borne pathogens and safety procedures. Disposal of contaminated foods. Analzing the quality of Foods. Measures to minimize the wastage of Foods.

MODULE IV INTERPRETATION OF RESULTS AND ANALYSIS 12

Importance and scientific methodology in recording results, importance of negative results, different ways of recording, industrial requirement, artifacts

versus true results, types of analysis (analytical, objective, subjective) and cross verification, correlation with published results, discussion, outcome as new idea, hypothesis, concept, theory, model etc.

MODULE V SCIENTIFIC WRITING AND TECHNICAL PUBLICATION 12

Different types of scientific and technical publications in the area of Life sciences, and their specifications-Research, review, systematic review, Editorial, &Methods. Ways to protect intellectual property – Patents, technical writing skills, definition and importance of impact factor and citation index - assignment in technical writing.

L – 60; Total Hours –60

TEXT BOOKS:

1. Essentials of Research Design and Methodology Geoffrey R. Marczyk, David DeMatteo, David Festinger, 2005 John Wiley & Sons Publishers, Inc
2. Irwin H. Segel, Biochemical Calculations: How to Solve Mathematical Problems in General Biochemistry, 2nd Edition, 1976 John Wiley & Sons Publishers, Inc, 1976
3. Ann M. Korner, Guide to Publishing a Scientific paper, Bioscript Press, 2004.

REFERENCES:

1. P Laake, H B Benestad, B R Olsen. Research Methodology in the medical and biological sciences. Academic Press, 2007.
2. R Arora. Encyclopaedia of Research Methodology in Biological Sciences. Anmol Publishing, 2004.

COURSE OUTCOMES:

CO1: By learning end of this module students understand the basics of research and its true meaning

CO2: Students learn the basic ethics to be followed during the time of research

CO3: Students tend to understand the safety procedures to be followed during the food experimental research

CO4: Students understand the interpretation and analysis of results

CO5: Students would have learned the types of scientific publishing and technical writing

Board of Studies (BoS) :
8thBoS of SLS held on 5.07.2021

Academic Council:
17th AC held on 15.07.2021

VALUE ADDED COURSE	L	T	P	C
	0	0	0	0

OBJECTIVES:

- To expose the latest technology / tools used in the industry and enable the students acquire knowledge and skill set in the same.

GENERAL GUIDELINES:

- Students should undergo any relevant certification course offered by the institution or other institutions / universities / IIT / IISc etc. for a minimum of 40 hours.
- Selection and completion of value added course by the students shall be endorsed by Head of the Department.

OUTCOMES:

- Students should be exposed and gained knowledge in any one latest technology used in the industry

MOOC COURSE	L	T	P	C
	0	0	0	0

OBJECTIVES:

- To learn the basics principles and concepts of the topic in which a project work is undertaken by the student.

GENERAL GUIDELINES:

- Students shall identify a MOOC course related to his/her project topic in consultation with the project supervisor.
- Student shall register for a MOOC course with minimum two credit offered by any recognized organization during the project phase I.
- Selection and completion of MOOC course by the students shall be endorsed by Head of the Department.

OUTCOMES:

Students will be able to

- Familiarize the basic principles and concepts related to the topic of his/her project work.
- Utilize the knowledge gained in the field of study to perform literature review with ease.
- Formulate the experimental / analytical methodology required for the project work

PROFESSIONAL ELECTIVES - ODD SEMESER

LTDY 051	AROMATIC AND MEDICINAL PLANTS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

COB1: Students must be exposed to basics and history of Aromatic and Medicinal plants

COB2: Srtudents will be exposed to the promotional and functional activities of plant boards.

COB3: Students will be exposed to Indian medicinal plants

COB4: Students will be exposed to commercial Indian medicinal plants

COB5: Students will be exposed to the techniques related to Medicinal plants

MODULE I INTRODUCTION & HISTROY OF AROMATIC AND MEDICINAL PLANTS 7

MAPs: definition, history, importance and future prospects. Medicinal Plants – past and present status in world and India. MAPs as industrial crops - constraints and remedial measures. Medicinal plant diversity & local healthcare. Medicinal plant conservation – issues and approaches. Medicinal plant conservation areas (MPCA), Non-timber forest products (NTFP), Good Agriculture Practices (GAP). Indian Himalayan region (IHR).

MODULE II PLANT BOARDS (NATIONAL & INTERNATIONAL) 8

Promotion of medicinal plant sector at national level: National Medicinal Plant Board and State Medicinal Plant Boards - objectives and functions. Other organizational initiatives for promotion of MAPs at National and International levels. Demand and supply of medicinal plants. Herbal industries.

MODULE III INDIAN MEDICINAL PLANTS-I 8

Important medicinal plants of India with their systematics, geographical distribution and uses. Acoruscalamus, Adhatodavasica, Abrusprecatorius, Aloe vera, Phyllanthusamarus, Stevia rebaudiana, Belladona and Cinchona.

MODULE IV INDIAN MEDICINAL PLANTS-II 11

Important aromatic plants of India with their systematics, geographical distribution and uses. Introduction and historical background of aromatic plants. Aromatic and cosmetic products. Raw material for perfumes etc. Cosmetic

Industries. Major, minor and less known aromatic plants of India. Taxonomic descriptions and uses of important aromatic plants – citronella, davana, damask rose, geranium, khus grass, large cardamom, lavender, lemon grass, mentha, holy basil, patchouli, rosemary Palmarosa, vetiver, artemisia, eucalyptus, thyme, marjoram and oreganum. Aromatic spices - clove, cinnamon, nutmeg, ajwain, dill, celery, tamarind, garcinia, curryleaf and saffron.

MODULE V TECHNIQUES TO EVALUATING MEDICINAL PLANTS **11**

Drug examination; Macroscopic and Microscopic evaluation; Moisture content; Microbial infestation; Contaminations and Aflatoxins; Development of standard parameters; Solvent extractive values; Ash values; Crude fiber; Bitter value, foaming index, Swelling index, Heavy metals. Adulteration and deterioration- Quality Control, Quality Assurance and Stability testing, Physical quality assurance, Good Manufacturing Practices; Good Laboratory Practices, Validation; Marker compound evaluation. Methods of isolation; Extraction methods; Thin layer chromatography; HPTLC; Column Chromatography; HPLC; Gas Chromatography; Methods of characterization; Spectroscopic methods, UV, Visible, IR, NMR, Mass Spectrometry, Atomic absorption/ ICP/ICP-MS, GC-MS, LC-MS.

L – 45; Total Hours –45

TEXT BOOKS:

1. C.P. Kala. Medicinal Plants of Uttarakhand (2010).
2. P.C. Trivedi. Indian Medicinal Plants (2009).
3. S.S. Samant and U. Dhar.Medicinal Plants of Indian Himalaya.
4. S.K. Bhattacharjee.Hand Book of Aromatic Plants (2004).
5. S.K. Bhattacharjee.Handbook of MAPs 2009.
6. S.K. Bhattacharjee.Handbook of Medicinal and Aromatic Plants (2004).
7. A.K. Sharma. Recent Progress in Medicinal Plants Vol.12, Globalization of Herbal Health. 2006.

REFERENCES:

1. Ashok N Kamthane, “Computer Programming”, Pearson Education, 2nd Edition, India, 2012. (ISBN 13: 9788131704370)
2. Karavokyros, L.,Katsiotis, N., Tzanis, E., Batis, G., and Beazi-Katsioti, M., “The Effect of Mix-Design and Corrosion Inhibitors on the Durability of Concrete”, Journal of Materials Science and Chemical Engineering, Vol. 8, pp. 64-77, 2020. https://doi.org/10.4236/msce.2020.84005
3. http://www.leanconstruction.org/readings.html

4. Harvard University. *Soft robotic gripper for jellyfish* [Video], 2019. https://www.youtube.com/watch?v=guRoWTYfxMs

COURSE OUTCOMES:

CO1: Get knowledge of Medicinal and aromatic plants

CO2: Students will learn about the functions of state and Indian medicinal pant boards

CO3: Students will learn about the Indian medicinal plants such as Aloe vera, Phyllanthusamarus, Stevia rebaudiana, Belladona and Cinchona.

CO4: Students will learn about the Indian commercial medicinal plants such aslarge cardamom, lavender, lemon grass, mentha, holy basil, etc.

CO5: Students will understand the techniques used for the evaluation of aromatic and medicinal plants

Board of Studies (BoS) :
8th BoS of SLS held on 5.07.2021

Academic Council:
17th AC held on 15.07.2021

LTDY 052	SANITATION AND WASTE MANAGEMENT IN FOOD INDUSTRIES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

COB1: To educate the students on the principles rural water supply and sanitation.

COB2: Develop an understanding of the characteristics of water and wastewater that must be considered during design of a treatment plant.

COB3: Develop understanding of events governing the rural water supply and sanitation.

COB4: To minimize all resource wastages and support growth of company

COB5: To build ecofriendly culture in current generation.

MODULE I CLASSIFICATION AND CHARACTERIZATION OF FOOD INDUSTRY WASTES **9**

Introduction: Classification and characterization of food industrial wastes from fruit and vegetable processing industry, beverage industry, fish, meat and poultry industry, sugar industry and dairy industry; Waste disposal methods – physical, chemical and biological; Economical aspects of waste treatment and disposal.

MODULE II SANITARY PROCEDURES, PERSONAL HYGIENE, FOOD SAFETY & PEST CONTROL **9**

Importance of sanitary procedures in Food processing - Special Food Operations – Cleaning procedures -Cleaning & sanitizing, their importance mobile food units, vending machines, street side foods and diseases, Necessity for personal hygiene, health of staff,Personal appearance, sanitary practices habits protective clothing Importance of rest and exercise, Safety at the work place.

MODULE III TREATMENT METHODS FOR FOOD INDUSTRY LIQUID WASTES **9**

Treatment methods for liquid wastes from food process industries; Design of activated sludge process, rotating biological contactors, Trickling filters, UASB, Biogas plant.

MODULE IV TREATMENT METHODS FOR FOOD INDUSTRY SOLID WASTES **9**

Treatment methods of solid wastes: Biological composting, drying and incineration; Design of solid waste management system: Landfill digester,

Vermi-composting pit.

MODULE V RECOVERY AND REUSE FOR FOOD INDUSTRY WASTES **9**

Biofilters and bioclarifiers, Ion exchange treatment of waste water, Drinking-water treatment, Recovery of useful materials from effluents by different methods.

L – 45; Total Hours - 45

TEXT BOOKS:

1. Food Industry Wastes: Disposal and Recovery; Herzka A & Booth RG; 1981, Applied Science Pub Ltd.
2. Water & Wastewater Engineering; Fair GM, Geyer JC &Okun DA; 1986, John Wiley & Sons, Inc.

REFERENCES:

1. Symposium: Processing Agricultural & Municipal Wastes; Inglett GE; 1973, AVI.
2. Food Processing Waste Management; Green JH & Kramer A; 1979, AVI.
3. Environmental Biotechnology: Principles and Applications; Rittmann BE & McCarty PL; 2001, Mc-Grow-Hill International editions.
4. Environmental Biotechnology; Bhattacharyya B C & Banerjee R; Oxford University Press.
5. L.R. Verma and V. K Joshi. General concepts and principles.2000. Postharvest Technology of Fruits and Vegetables: Handling, Processing, Fermentation and waste management. M.L. Gidwani, Indus Publishing Company, New Delhi.

COURSE OUTCOMES:

CO1: Be able to list the nature of the wastes obtained from different food processing industries.

CO2: Understand the properties of different food industry wastes.

CO3: Able to recognize and communicate common processes which allow the different food processing waste to be converted into valuable products.

CO4: Be able to list the nature of the wastes obtained from different food processing industries

CO5: Students be able to understand recovery and reuse for food industry wastes

Board of Studies (BoS) :
8th BoS of SLS held on 5.07.2021

Academic Council:
17th AC held on 15.07.2021

LTDY053	FUNCTIONAL FOODS AND NUTRACEUTICALS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

COB1: Students will be exposed to definition and marketing and regulatory aspects of functional foods and Nutraceuticals

COB2: Students will learn the basics of probiotics and its applications

COB3: Students will learn about the polyphenols and Phytoestrogens

COB4: Students will learn about active biodynamic principles in spices

COB5: Students will learn the non-nutrient effect of specific nutrients

MODULE I INTRODUCTION TO FUNCTIONAL FOODS AND NUTRACEUTICALS **9**

Introduction to Functional Foods and Nutraceuticals :Definition, History and Classification Perceived Effects of Functional Foods, Marketing and regulatory issues for functional foods and nutraceuticals Recent developments and advances in the area of nutraceuticals and functional foods.

MODULE II PROBIOTICS **9**

Introduction to Probiotics, Prebiotics and Synbiotics Probiotics: Taxonomy and Important Features of Probiotic Microorganisms Health Effects of Probiotic Microorganism, Probiotics in Various Foods, Quality Assurance of Probiotics and Safety.

MODULE III POLYPHENOLS, PHYTOESTROGENS AND ORGANOSULFUR COMPOUNDS **9**

Polyphenols: Flavonoids, Catechins, Isoflavones, Tannins, Phytoestrogens, Phytosterols, Glucosinolates, Pigments: Carotenoids, Lycopene, Curcumin Organosulphur Compounds-Introduction to Anti-nutritional Factors, Phytates.

MODULE IV ACTIVE BIODYNAMIC PRINCIPLES IN SPICES **9**

An introduction to Active Biodynamic Principles in Spices, Condiments and Plant extracts, Active Biodynamic Principles in Spices, Condiments and Plant extracts: Resveratrol, Kaempferol, Quercetin, Cinnamaldehyde, Crocin, Luteolin, Condiments and Plant extracts - Capsaicin, Piperine, Gingerol, Eugenol, Rosemarinicacid, Apigenine, Thymoquinone.

MODULE V NON-NUTRIENT EFFECT OF SPECIFIC NUTRIENTS 9

Non-Nutrient Effect of Specific Nutrients: Conjugated Linoleic Acid, Omega 3 Fatty acids, Proteins and Peptides and Nucleotides, Vitamins, Minerals.

L – 45; Total Hours –45

TEXT BOOKS:

1. Wildman, R. E. (2016). Handbook of Nutraceuticals and Functional Foods. CRC Press
2. Gibson, G. R. and Williams, M. C. (2001). Functional Foods Concept to Product. CRC Press.
3. Vattem, D.A. and Maitin V. (2016). Functional Foods, Nutraceuticals and Natural Products, Concepts and Applications. DEStech Publications, Inc
4. Gupta, R. C. (2016). Nutraceuticals: Efficacy, Safety and Toxicity. Academic Press

REFERENCES:

1. Saarela M. 2011. Functional Foods: Concept to Product. 2nd edition. Oxford, Cambridge. Woodhead Publishing Ltd
2. Bagchi D. 2014. Nutraceuticals and Functional Foods Regulations in the United States and Around the World 2nd edition. Elsevier.
3. Schmidl MK and Labuza TP. 2000. Essentials of Functional Foods, Functional Foods and Nutraceutical series. Technomic Publishing Co., Inc.
4. Zawistowski J. 2010. Tangible Health Benefits of Phytosterol Functional Foods.
5. J. Smith and E. Charter (Eds) In: Functional Food Product Development. Wiley Blackwell.
6. Zawistowski J and Kitts DD. 2004. Functional Foods – A New Step in the Evolution of Food Development. Clinical Nutrition Rounds. 4:1-6.

COURSE OUTCOMES:

CO1: At the end of the course students learn the definition for functional foods and nutrition and the recent developments in the area.

CO2: Student learn the importance of probiotics

CO3: Students learn the structure and key aspects of poly phenols and phytoestrogens.

CO4: They will learn about active biodynamic principles in spices.

CO5: They learn about non nutrient effect of specific nutrients.

Board of Studies (BoS) :
8th BoS of SLS held on 5.07.2021

Academic Council:
17th AC held on 15.07.2021

LTDY054	APPLICATION OF ENZYME AND FOOD INDUSTRY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

COB1: To understand the Enzyme Classification, Characterization and Production of Enzymes

COB2: To learn the importance of enzymes in food processing

COB3:to learn the immobilization techniques and its use in food industry

COB4: To learn the basics of fermentation process

COB5: To get a practical knowledge about running the fermenter and its scale – up and modes of operation etc

MODULE I INTRODUCTION TO ENZYME 9

Enzymes classification, Properties, Characterization, Production of enzymes and their downstream processing.

MODULE II ENZYMES AND THEIR ROLE IN FOOD PROCESSING 9

Enzymes for starch modification, Enzymes for protein modification, Enzymes for lipid modification, Enzymes as processing aids: Role of enzymes in Dairy Processing (cheese making and whey processing. Role of enzymes in meat processing, Role of enzymes in meat processing (tenderization and flavour development), Fish processing (Deskinning, collagen extraction etc), Egg processing. Role of enzymes in Brewing**,** Baking (fungal -amylase for bread making; maltogenic -amylases for anti-staling; xylanses and pentosanases as dough conditioners; lipases or dough conditioning; oxidases as replacers of chemical oxidants; synergistic effect of enzymes.

MODULE III ENZYME IMMOBILIZATION 9

Physical and chemical techniques for enzyme immobilization – adsorption, matrix entrapment, encapsulation, cross-linking, covalent binding etc., - examples, advantages and disadvantages.

MODULE IV OVERVIEW OF FERMENTATION PROCESSES 9

Overview of fermentation industry, general requirements of fermentation processes, basic configuration of fermentor and ancillaries, main parameters to be monitored and controlled in fermentation processes.

MODULE V RAW MATERIALS AND MEDIA DESIGN FOR FERMENTATION PROCESS 9

Criteria for good medium, medium requirements for fermentation processes,

carbon, nitrogen, minerals, vitamins and other complex nutrients, oxygen requirements, medium formulation of optimal growth and product formation, examples of simple and complex media, design of various commercial media for industrial fermentations – medium optimization methods.

L –45; Total Hours - 45

TEXT BOOKS:

1. Whitehurst, R.J. & Van-Oort, M. Enzymes in Food technology, Second edition, Blackwell Publishing Ltd, 2010
2. Aehle, W. (2007) Enzymes in Industry: Production and application. Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim
3. Rastall,R (2007) Novel enzyme technology for food applications Woodhead Publishing Limited, Abington Hall, Abington, Cambridge CB21 6AH, England
4. Kalaichelvan, P.T., (2002), Bio process technology, MJP publishers, Chennai
5. Bailey, J.E. and Ollis, D.F. “Biochemical Engineering Fundamentals”, 2nd Edition, McGraw Hill, 1986.
6. Blanch, H.W. and D.S. Clark “Biochemical Engineering”, Marcal Dekker, Inc., 1997.
7. Lee, James M. “Biochemical Engineering”, Prentice – Hall, 1992.

REFERENCES:

1. Palmer, Trevor “Enzymes: Biochemistry, Biotechnology, Clinical Chemistry”, Affiliated EastWest Press Pvt. Ltd., 2004.
2. Stanbury, P.F., A. Whitaker and S.J. Hall “Principles of Fermentation Technology”, 2nd Edition, Butterworth – Heinemann (an imprint of Elsevier), 1995.
3. Wiseman, Alan “Handbook of Enzyme Biotechnology”, 3rd Edition, Ellis Harwood Publications, 1999.
4. Hartmeier, Winfried “Immobilized Biocatalysts: An Introduction”, Springer –Verlag, 1986

COURSE OUTCOMES:

CO1: Understand the classification and characteristic features of Enzymes

CO2: Production of Enzymes and their role in food processing

CO3: Imoobilzation of enzymes and their role in food industry

CO4: Understand the concept of basic fermentation processes

CO5: Understanding the application during scaleup operations of fermentation

Board of Studies (BoS) : 8th BoS of SLS held on 5.07.2021

Academic Council: 17th AC held on 15.07.2021

LTDY 055	QUALITY EVALUATION OF FOOD	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

COB1: To learn the food quality and its role in Industry

COB2: To learn food quality and Quality Spectra

COB3: To understand the basic principles of viscosity and consistency of fluids

COB4: To learn defects and Entomological defects

COB5: To learn the texture, flavour and odour Classification

MODULE I FOOD QUALITY AND ITS ROLE IN INDUSTRY 9

Food quality and its role in food industry need of quality control, factors affecting quality control.

MODULE II QUALITY ATTRIBUTES, COLOR ROLE IN QUALITY SPECTRA 9

Quality attributes: dominant and hidden attributes, Color-role of colors in quality spectra, different types of colour measuring instruments.

MODULE III VISCOSITY AND CONSISTENCY OF FLUIDS 9

Viscosity:-types of fluids, different viscometers to measure viscosity, Consistency:- methods used to measure consistency or product difference between viscosity and consistency, Size and shape: - Method to find shape and size of food and food products.

MODULE IV TEXTURE, FLAVOUR AND ODOUR CLASSIFICATION 9

Texture: classification, role of firmness, yielding quality, juiciness, chewiness, fibrousness, grittiness, mealiness, stickiness,, measurement of texture/ kinesthetic characteristics.- by compression, mechanical thumb, puncture tester, succulometer, shearing by tenderometer, texturometer, maturometer, fibro meter, moisture content, by barbender moisture tester, alcohol insoluble solids, color, consistency & sound measurement for kinesthetics, Flavour: Definition and its role in food quality, Taste, classification, taste qualities, relative intensity, reaction time, effect of disease, temperature, and taste medium on taste, basic tastes and interaction of tastes. Odour: definition, Classification, neutral - mechanisms, Olfactory abnormalities, odor testing, techniques, thresholds, odor intensities.

MODULE V FACTORS INFLUENCING THE FOOD QUALITIES 9

Factors influencing the food qualities: Soil, field practices, harvesting practices,procedures, packaging, transportation, storage, conditions, processing conditions, packaging and storage conditions of finished products, Recording and reporting of quality.

L – 45; Total Hours - 45

TEXT BOOKS:

1. Krammer and Twigg. Fundamentals of Quality Control for Food Industry. Avi Publishing Company, 1966.
2. Krammer and Twigg. Quality Control in Food Industry. Avi Publishing Company, 1966
3. Herschdoerfer. Quality Control in Food Industry. Elsevier, 2012
4. Civillie and Carr. Sensory Evaluation Techniques. CRC Press, 2015
5. Ranganna S. Handbook of Analysis and Quality Control for Fruit and Vegetable Products. 2nd Ed. Tata-McGraw-Hill. 2001.

REFERENCES:

1. Van der Spiegel M, Luning PA, Ziggers GW, Jongen WM. Evaluation of performance measurement instruments on their use for food quality systems. Crit Rev Food Sci Nutr. 2004;44(7-8):501-12. doi: 10.1080/10408690490489350.
2. Aghalari Z, Hosseini SR, Jafarian S, Rezazadeh M, Mirzaei M, Esmaeili E, Hasanzadeh P. Evaluation of chemical and microbial quality of food in northern Iran. J Health PopulNutr. 2021 Sep 20;40(1):40. doi: 10.1186/s41043-021-00266-7. PMID: 34544487.
3. Elmasry G, Kamruzzaman M, Sun DW, Allen P. Principles and applications of hyperspectral imaging in quality evaluation of agro-food products: a review. Crit Rev Food Sci Nutr. 2012;52(11):999-1023. doi: 10.1080/10408398.2010.543495. PMID: 22823348.

COURSE OUTCOMES:

CO1: Food quality and its role in Industry

CO2: Food quality and Quality Spectra

CO3: The basic principles of viscosity and consistency of fluids

CO4: learn defects and Entomological defects

CO5: Understand the texture, flavour and odour classification

Board of Studies (BoS) :
8th BoS of SLS held on 5.07.2021

Academic Council:
17th AC held on 15.07.2021

PROFESSIONAL ELECTIVES - EVEN SEMESER

LTDY 081	FLAVOUR PROCESSING TECHNOLOGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

COB1: To explore about flavours and processing technology.

COB2: To understand the flavour compounds involved in development of flavour.

COB3: To get overview of mechanisms underlying flavour perception

COB4: To understand the analytical techniques involved in flavour analysis

COB5: To recognize off-flavour defects in foods and strategies of identification.

MODULE I INTRODUCTION 9

Description of food flavours, Chemical compound classes and their flavour responses; flavour development during biogenesis, flavour development during food processing; use of biotechnology to develop flavours, Flavour enhancers.

MODULE II CHEMICAL SENSES 9

Anatomy of the chemical senses; neural development of the chemical senses; receptor mechanisms, neural coding; the control of eating.

MODULE III FLAVOUR COMPOUNDS 9

Flavour profiling methods, flavouring components, extraction, evaluation, quality control and standards, formation of flavours in foods, technology, isolation and identification of flavouring materials, synthetic flavouring agents, flavour evaluation, standards / specifications.

MODULE IV FLAVOUR FORMATION 9

Various methods of flavor formation - Enzymatic and non-enzymatic methods, Lipid Oxidation methods of flavour formation, Mechanism of flavour-food interactions, Flavour release on flavour perception.

MODULE V FLAVOURS IN FOOD 9

Flavours in food - vegetable, fruit and spice flavours, flavours of milk and meat products, effect of processing on flavour components, influence of
colour and texture on flavor of food, Objectionable flavour in foods and methods

of detection, Monitoring Adulteration of Flavours

L – 45; Total Hours – 45

TEXT BOOKS:

1. Fisher, Carolyn and Thomas R. Scott. Food Flavours: Biology and Chemistry. The Royal Society of Chemistry, 1997.
2. Heath, H.B. and G. Reineccius. Flavor Chemistry and Technology. CBS Publishers, 1996.
3. Reineccius, Gary. Flavor Chemistry and Technology. II Edition, Taylor and Francis, 2006.
4. Shahidi, Fereidoon and Chi-Tang Ho. Flavor Chemistry of Ethnic Foods. Kluwer Academic / Plenum, 1999.
5. Ashurst, Philip R. Food Flavorings. III Edition, Aspen Publications, 1999.

REFERENCES:

1. Hofmann, Thomas. Challenges in Taste Chemistry and Biology. American Chemical Society Publications, 2004.
2. Charalambous, G. Food Flavors: Generation, Analysis and Process Influence. Elsevier, 1995.

COURSE OUTCOMES:

Students will be able toacquire knowledge on

CO1: contribution of different compounds for the development of flavor

CO2: analytical techniques involved in flavor analysis

CO3: identification of off-flavour defects in foods and strategies of detection.

CO4: mechanisms underlying flavour perception.

CO5: role of flavours in food processing.

Board of Studies (BoS) :
8th BoS of SLS held on 5.07.2021

Academic Council:
17th AC held on 15.07.2021

LTDY 082 MEAT PROCESSING TECHNOLOGY L T P C

3 0 0 3

COURSE OBJECTIVES:

COB1: To learn the development of meat industries

COB2: To learn about Muscle structure and chemical composition

COB3: To give basic idea on processing and preservation of meat

COB4: To give knowledge about the factors affecting post-mortem changes

COB5: To learn about the various preservation methods

MODULE I DEVELOPMENTS OF MEAT INDUSTRIES 9

Theory, Sources and Developments of meat industries in India and importance in National Economy.

MODULE II MUSCLE STRUCTURE, CHEMICAL COMPOSITION, CARE AND TRANSPORTATION 9

Muscle structure, chemical composition and physico-chemical properties of meat muscle, Abattoir design and layout, Pre-slaughter transport and care and antemortem inspection. Slaughtering of animals and post-mortem inspection and grading of meat, Factors affecting post-mortem changes, properties and shelf life of meat.

MODULE III PROCESSING OF MEAT 9

Processing and preservation of meat- mechanical deboning, aging or chilling, freezing, pickling, curing, cooking and smoking of meat, Meat tenderization. – principles and methods, Meat emulsions, Technology of manufacture of meat products, Meat plant sanitation and safety By-products utilization of abattoir.

MODULE IV FACTORS AFFECTING POST-MORTEM CHANGES 9

Factors affecting post-mortem changes, properties and shelf-life of meat. Meat tenderization and Meat quality evaluation. Modern abattoirs, slaughter house and its features.

MODULE V PRESERVATION OF MEAT 9

Preservation of meataging, pickling, smoking. Dried and Cured meat. Canned meat, Frozen meat, Cooked and Refrigerated meat, Sausages.

L – 45; Total Hours - 45

TEXT BOOKS:

1. Principles of Meat Science Aberle E.D. Kendall Hunt Publication ISBN: 9780787247201
2. Principles of Meat Technology Singh V. P. New India Publishing Agency, Delhi ISBN: 9789380235554
3. Handbook of Heat and Meat Processing Hue Y.H. CRC Press, New York ISBN: 9781439836835
4. Handbook of Meat, Poultry and Seafood Quality Kerth Wiley Backwell, 2012 SBN: 9780470958322
5. Lawrie, R.A. “Meat Science”, Second Edition. Pergamon Press, Oxford, UK. 1975.

REFERENCES:

1. Meat Science Lawrie R. A. Pergamon Press, New York ISBN: 080307906
2. Handbook of Meat Processing Fidel Toldra Wiley-Blackwell, Iowa, USA ISBN: 9780813821825
3. Meat Products Handbook – Practical Science and Technology Gerhard Feiner CRC Press, Boca Raton ISBN: 9780849380105
4. Outlines of Meat Science and Technology Sharma B.D. Jaypee Brother Medical Publishers, ISBN: 9789350254813
5. Joseph Kerry, John Kerry and David Ledwood. Meat processing. Wood Publishing Limited, England (CRC press), 2002.

COURSE OUTCOMES:

CO1: To learn the theory, sources, development of meat industries

CO2: Processing and preservation of meat

CO3: Acquire knowledge of Processing the meat

CO4: Grasp the changes in the composition of foods with respect to the type of processing technology used.

CO5: Grasp the knowledge of various preservation methods.

Board of Studies (BoS) :
8th BoS of SLS held on 5.07.2021

Academic Council:
17th AC held on 15.07.2021

LTDY 083	MARINE FOOD PROCESS TECHNOLOGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

COB1: To educate the students Preservation and Processing of the food

COB2: Develop an understanding of food preservation techniques of drying, dehydration and Irradiation.

COB3: To give knowledge about the importanceFreezing and cold storage techniques of food processing.

COB4: Cultivate an understanding about the importance of packing process in food process technology.

COB5: To educate the students about the fishery by products.

MODULE I PRESERVATION AND PROCESSING 9

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).

MODULE II DRYING AND IRRADIATION 9

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.

MODULE III FREEZING 9

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.

MODULE IV PACKING 9

Packing – function of packaging, special needs in food packaging, packaging materials, types -1 handling fresh fish, retail packing, whole sale 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.

MODULE V FISHERY BY – PRODUCTS 9

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.

L – 45; Total Hours – 45

TEXT BOOKS:

1. Govindan. T.K, “Fish Processing Technology”, Oxford and IBH Publishers, New Delhi, 1985.
2. Kreuzer R., 1974. Fishery Products, FAO Fishing News (Books) Ltd., England.
3. Anon, 1979. Handling, Processing and Marketing of Tropical fish, Tropical Products Institute, London.
4. Miller, M.D., 1990. Ciguatera Seafood Toxins, CRC Press.

REFERENCES:

1. Sikorski, Z.E., 1990. Seafood: Resource, Nutritional Composition, Preservation, CRC Press.
2. Sikorski, Z.E., 1990. Seafood: Resource, Nutritional Composition, Preservation, CRC Press.
3. Carison, V.R. and R.H Graves, 1996, Aseptic Processing and Packing of Food: A Food Industry Perspective, CRC Press.
4. Clucas, J and A.R. Ward., 1996. Post-Harvest Fisheries Development; A guide to Handling preservation, processing and Quality. Publishing Manager Natural Resources Institute, Central Avenue, United Kingdom.
5. Gopakumar K., 1977. Tropical Fishery Products. Oxford & IBH Publication.
6. Oliveira, F.A.R. and J.C Oliveira, 1999. Processing Foods: Quality Optimization and Process Assessment, CRC Press.
7. Chandran, K.K., 2000 Post Harvest Technology of Fish and Fishery Products, Daya Publishing House, New Delhi.

COURSE OUTCOMES:

At the end of the course the students will be able to

CO1: be familiar with preservation and processing of sea foods criteria for assessing freshness maintains the freshness of the sea foods.

CO2: categorize food preservation techniques of drying, dehydration and Irradiation

CO3: be familiar with freezing and cold storage techniques used in the sea food processing

CO4: acquire knowledge about the importanceFreezing and cold storage techniques of food processing.

CO5: able to apply knowledge on fishery by-products and its commerce

Board of Studies (BoS) :	**Academic Council:**
8th BoS of SLS held on 5.07.2021	17th AC held on 15.07.2021

LTDY 084	FOOD INFORMATICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

COB1: To learn the basic scope of Food Informatics

COB2: To get familiarized with food databases

COB3: To learn about the need of ontologies in Food Informatics

COB4: To explore the tools for food database management systems

COB5: To learn the various applications of Food informatics

MODULE I INTRODUCTION 9

Food Informatics-Introduction-Meaning and Scope-Areas of Food Science and Nutrition.

MODULE II NUTRITION DATABASES 9

Important search engines, Data bases in Food Science, Nutrition: Clinical nutrition, community nutrition, Human Nutrition, Dietetics, Institutional food service management. Food processing technology.

MODULE III ONTOLOGIES 9

Data collection, organization in areas of food and nutrition, Need for Ontologies, Major Ontology resources for food informatics-Gene Ontology, Food Ontology, Food Biomarker Ontology.

MODULE IV DATABASE MANAGEMENT 9

Data storage and distribution by using various information technology tools and methods. Database management system. Application of software.

MODULE V APPLICATIONS OF FOOD INFORMATICS 9

Food research, Food nutrient Analysis, Clinical Nutrition care, Inventory management systems-Examples, Challenges of Food Informatics.

L –45; Total Hours –45

TEXT BOOKS:

1. The landscape of nutri-informatics: a review of current resources and challenges for integrative nutrition research. Database, Vol. 00, Article ID baab003
2. Food Informatics and its Challenges and Opportunities- A Review

International Journal on Recent Researches in Science, Engineering and Technology, Vol.5, Issue 9, Sept 2017. ISSN (Print) 2347-6729 ; ISSN (Online) 2348-3105.

3. Jagadish, H. V., and Frank Olken. "Database management for life sciences research." *ACM SIGMOD Record* 33.2 (2004): 15-20.

REFERENCES:

1. McComb, Brenda, et al. "Database Management." Monitoring Animal Populations and their Habitats: A Practitioner's Guide.
2. Nutrition Informatics Hoggle, Lindsey B. et al.Journal of the American Dietetic Association, Volume 106, Issue 1, 134 – 139

COURSE OUTCOMES:

CO1: To appreciate the basics of food informatics

CO2: To appreciate the vast resources of food informatics

CO3: Understanding the usage of ontologies

CO4: Understanding database management system software in food informatics

CO5: Inferring food informatics applications in research problems

Board of Studies (BoS) :	**Academic Council:**
8th BoS of SLS held on 5.07.2021	17th AC held on 15.07.2021

LTDY 085	POST-HARVEST TECHNOLOGY OF FRUITS AND VEGETABLES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

COB1: Students will learn about basics of food consitituents and functions.

COB2: Students will learn about traditonal food preservation

COB3: Students will be exposed to food preservation methods that entertained in industries

COB4: Students will be exposed toaseptic Processing,Packaging&Active Packaging Technology

COB5: Students will be exposed to food fortification

MODULE I INTRODUCTION 9

Food Constituents and Functions, Quality and Safety Aspects of Food, Factors Affecting Quality During Processing and Storage, Role of Water in Food and its Shelf Life, Gelatinization &Retrogradation of Starch.

MODULE II TRADITONAL FOOD PRESERVATION 9

Browning Reactions, Food Proteins, Principles of Food Preservation, Traditional Food Preservation Technologies.

MODULE III FOOD PRESERVATION IN INDUSTRIES-I 9

High Pressure Processing of Food, Membrane Technology, Food Irradiation, Microwave Heating, Radio Frequency Drying, Super Critical Fluid Extraction, Freeze Drying, Food Extrusion Technology.

MODULE IV FOOD PRESERVATION IN INDUSTRIES-II 9

Textured Vegetable Protein (TVP), Aseptic Processing & Packaging, Hurdle Technology, Natural Antimicrobials, Food Lipids: Nature & Occurrence, Extraction of Oil, Refining of Oil, Modified Fats, Rancidity, Natural Antioxidants, Microencapsulation, Food nanotechnology, Respiration & Ripening, Modified Atmospheric Storage (MAP), Active Packaging Technology, Edible coating technology, Multiproduct CA / MA Storage Unit, Grain Storage, Ozonation of Food Grains.

MODULE V FOOD FORTIFICATION 9

Iron Fortified Rice (IFR), Nutri Dal and Fortified Noodles, High Energy RTE Food Paste, Functional Foods and Nutraceuticals, Algae Based Health Foods, Gluten

Free Bread and Pasta, Food Powder & Premixes, GMP/GHP in Food Industry.

L – 45; Total Hours –45

TEXT BOOKS:

1. Chadha, K.L. &Pareek, O.P. (Eds.). 1996: Advances in Horticulture,
2. Vol. IV. Malhotra Publ. House, Kriti Nagar, Delhi.
3. Giridhari, Lal, Siddappa, G.S., &Tandon, G.L. 1998: Preservation of
4. Fruits and Vegetables, Publication and Information Division, ICAR.
5. Srivastava, R.P., Sanjeev, Kumar.2006: Fruits and Vegetable
6. Preservation, International book distributing Co Lucknow.
7. Sudheer, K. P. Indira, V. 2007: Postharvest Technology of Horticultural Crops, New India Publishing, Delhi.
8. Verma, L. R & Joshi, V. K. 2000: Postharvest Technology of Fruits and
9. Vegetables, Indus Publishing House, Delhi.

COURSE OUTCOMES:

CO1: Students understand the basics of post harvest of fruits and agriculture goods.

CO2: Students will learnabouttraditonal food preservation

CO3: Students understand the food preservation methods that entertained in industries

CO4: Students understandaseptic Processing,Packaging&Active Packaging Technology

CO5: Acquire knowledge in Food Fortification and GMP in food

Board of Studies (BoS) :
8th BoS of SLS held on 5.07.2021

Academic Council:
17th AC held on 15.07.2021

LTDY 086 **DAIRY TECHNOLOGY** **L T P C**

3 0 0 3

COURSE OBJECTIVES:

COB1: To acquaint with the properties and role of various constituents in milk, interaction and changes during processing.

COB2: To explore the importance of various processing techniques.

COB3: To understand the methods of the collection and transportation of milk to the dairy plant.

COB4: To know the processing and packaging materials and machineries for milk and milk products.

COB5: To study the chemistry of milk.

MODULE I INTRODUCTION 9

Definition, Indian Standards, Food and nutritive value of milk, Collection and transportation of Milk, Preservation at farm, Refrigeration. Colostrums and its properties and difference from normal milk, Legal standards of milk, Chemical test, Adulteration in milk and their detection, Elementary knowledge about indigenous and modern dairy products.

MODULE II DAIRY CHEMISTRY 9

Definition and structure of milk, factors affecting composition of milk, Physico-chemical properties of milk, Nutritive value of milk, Coagulation of milk with heat, acid, enzymes and alcohol. Nomenclature and classification of milk proteins, carbohydrates, lipids, Immmunoglobulin and other minor milk proteins, Milk enzymes.

MODULE III MILK PROCESSING TECHNOLOGY 9

Reception and treatment of milk at the dairy plant: Reception, Chilling, Clarification, Separation, Bactofugation and storage. Homogenization – Definition, Effect of homogenization on physical properties of milk.

MODULE IV THERMAL PROCESSING OF MILK 9

Definition, Theoretical basis of sterilization, Description of processes – Pasteurization, Thermization, Sterilization and Ultra-High-Temperature Processing (UHT), Process quality of sterilized milk.

MODULE V SPECIAL MILK 9

Manufacturing of Special Milk – Toned, Doubled Toned, Homogenized milk, Flavoured milk, standardized milk, rehydrated milk, recombinant milk, UHT

milk.

L – 45; Total Hours – 45

TEXT BOOKS:

1. Jenness R and Patton S., Principles of dairy chemistry, John Wiley's, USA, 1959.
2. Khurody D. N., Dairying in India, Asia Publishing House, 1974.
3. Sukumar De, Outlines of Dairy Technology, Oxford University Press, India, 1980.
4. Modern Dairy Products, Lampert LH; Chemical Publishing Company. 1970.

REFERENCES:

1. P. F. Fox, Developments in Dairy Chemistry – Vol 1 & 2; Elsivier Applied Science Publishers, London & New York, 1985.
2. Khan A.Q, The technology of milk processing, 1991.
3. Manual for milk plant operations, Washington, 1957.
4. Kessler H.G., Food engineering and Dairy technology, 1981.

COURSE OUTCOMES:

Students will be able toacquire knowledge on

CO1: the chemistry and composition of milk.

CO2: the chemical test required to test adulteration in milk.

CO3: the methods of collection and transportation of milk to the dairy plant.

CO4: the techniques required for processing and packaging of different types of milk and milk products.

CO5: the importance of various processing techniques in dairy industry.

Board of Studies (BoS) :
8th BoS of SLS held on 5.07.2021

Academic Council:
17th AC held on 15.07.2021

LTDY 087 **FOOD NUTRIGENOMICS** **L T P C**

3 0 0 3

COURSE OBJECTIVES:

COB1: To learn basics of nutrigenomics

COB2: To gain knowledge of how diet and underlying genetics interact to increase susceptibility to disease

COB3: To learn the significance of gene-nutrient interactions

COB4: To learn the importance of dietary chemicals in nutrigenomics

COB5: To explore the applications of nutrigenomics in human health

MODULE I INTRODUCTION 9

Genome an introduction, genome organization and gene structure, Human Genome database, plant genomes, nutrigenomics-introduction-principles of nutrigenomics.

MODULE II NUTRIENT GENETICS 9

Genetic variations-role of SNPs: metabolism and dietary intake requirements - human diseases-FTO variant and adipocity-Copy number variations-AMY1-salivary amylase.

MODULE III GENE NUTRIENT INTERACTIONS 9

Types of gene nutrient interactions: Direct Interactions-Epigenetic interactions-nutrient gene-cancer interactions-diet related carcinogenesis.

MODULE IV NUTRIENTS AND GENE EXPRESSION 9

Dietary chemicals effect on gene expression: Macronutrients-Carbohydrates, Fats-PUFA, Proteins-Amino acids, Micronutrients-Vitamins and Minerals.

MODULE V APPLICATIONS OF NUTRIGENOMICS 9

Diet and the microbiome-personalised nutrition and health-novel biomarkers of Dietary Intake, Implications of animal nutrition, Mini gut and organoids, Limitations of nutrigenomics.

L – 45; Total Hours – 45

TEXT BOOKS:

1. Nutrigenomics: concept, advances and applications JagishKourReen*, Alok Kumar Yadav and Jitendra Singh, Asian J. Dairy & Food Res, 34(3) 2015: 205-212
2. Mathers, J.C., (2017). Nutrigenomics in the modern era. *Proceedings of the Nutrition Society*. 76(3)**,** 265-275.

REFERENCES:

1. QI L. Gene-Diet Interactions in Complex Disease: Current Findings and Relevance for Public Health, CurrNutr Rep 2012: 1: 222-227.
2. TUCKER K. L.,SMITH C. E., LAI C. Q., ORDOVAS J. M. Quantifying diet for nutrigenomic studies, Annual review of nutrition 2013: 33: 349-371.
3. DAVID L. A., MAURICE C. F., CARMODY R. N., GOOTENBERG D. B., BUTTON J. E., WOLFE B. E. et al. Diet rapidly and reproducibly alters the human gut microbiome, Nature 2013.
4. The role of nutrition related genes and nutrigeneticsinunderstanding the pathogenesis of cancer. A.Z. Elsamanoudy et al. / Journal of Microscopy and Ultrastructure 4 (2016) 115–122

COURSE OUTCOMES:

CO1: Obtain basic understanding of nutrition genomics and nutrition genetics

CO2: Appreciate the role of gene-nutrient interactions in carcinogenesis

CO3: Appreciation for the methods and strategies used to study complex trait genetics and nutrition.

CO4: Understanding of the application of -omics scale approaches to measure the effect of diet

CO5: Understanding the role of nutrigenomics in personalized diet and health

Board of Studies (BoS) :
8th BoS of SLS held on 5.07.2021

Academic Council:
17th AC held on 15.07.2021

LTDY 088	FOOD PRODUCT DESIGN AND DEVELOPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

COB1: To apply different engineering approaches for food product design and development.

COB2: To understand the food properties required in optimal food product design.

COB3: To understand consumer needs and wants for successful product development.

COB4: To apply computer-aided statistical approaches in food product design and optimization.

COB5: To provide knowledge about novel food products with competitive advantages.

MODULE I INTRODUCTION TO FOOD PRODUCT DESIGN AND DEVELOPMENT **9**

Knowledge base for product development, Product development process, Innovation strategy development, New product success and failure.

MODULE II CONSUMER IN PRODUCT DEVELOPMENT **9**

Understanding consumer behaviour and food choice, tackling consumer preferences, Societal setting, Consumer's avoidance and acceptance of new products, Integrating consumer needs and wants in product development, Sensory product attributes.

MODULE III FOOD PRODUCT DESIGN USING COMPUTER-AIDED STATISTICAL APPROACHES **9**

Modelling of food quality attributes, types of models, applications of models to reactions in foods, Optimization by Response Surface Methodology.

MODULE IV BARRIER TECHNOLOGY FOR FOOD PACKAGING DESIGN **9**

Packaging materials as a barrier, Heterogeneous films, Prevention of defects in barrier films, Mechanical behaviour, Wetting behaviour, Migration of other components, edible-barrier films Modified atmosphere packaging, Active packaging, High pressure processing, Intelligent packaging, Modelling in package design.

MODULE V CASE STUDIES IN PRODUCT DEVELOPMENT 9

Development of mango products and their competitive advantage in export markets, Process and management for whey proteins, Wafer Bars elevated in Protein, Emulsified variety sauces.

L – 45; Total Hours –45

TEXT BOOKS:

1. Food Product Design: An Integrated Approach, Anita R. Linnemann, M. A. J. S. van BoekelWageningen Academic Publishers, 2007

REFERENCES:

1. Food product development, Mary Earle, Richard Earle, 2001, Woodhead publisher
2. Methods for developing new food products, FadiAramouni, 2015, Destech publisher

COURSE OUTCOMES:

CO1: Apply different engineering approaches for food product design and development.

CO2: Identify the essential food properties required in optimal food product design.

CO3: Comprehend various consumer needs and wants for successful product development.

CO4: Apply computer-aided statistical approaches in food product design and optimization.

CO5: Develop novel food products with competitive advantages.

Board of Studies (BoS) :
8th BoS of SLS held on 5.07.2021

Academic Council:
17th AC held on 15.07.2021

GENERAL ELECTIVES

GEDY 101	PROJECT MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The objectives of the course would be to make the students

- Learn to evaluate and choose an optimal project and build a project profile.
- Attain knowledge on risk identification and risk analysis
- Gain insight into a project plan and components
- Familiar with various gamut of technical analysis for effective project implementation
- Learn to apply project management techniques to manage resources.

MODULE I INTRODUCTION & PROJECT INITIATION 09

Introduction to project and project management - projects in contemporary organization – The project life cycle - project initiation - project evaluation methods & techniques - project selection criteria - project profile.

MODULE II RISK ANALYSIS 09

Sources of risk: project specific - competitive - industry specific - market and international risk – perspectives of risk – risk analysis: sensitivity analysis - scenario analysis - breakeven analysis - simulation analysis - decision tree analysis – managing/mitigating risk – project selection under risk.

MODULE III PROJECT PLANNING & IMPLEMENTATION 09

Project planning – importance – functions - areas of planning - project objectives and policies - steps in planning process - WBS – capital requirements - budgeting and cost estimation - feasibility analysis - creation of project plan – project implementation: pre-requisites - forms of project organization

MODULE IV TECHNICAL ANALYSIS 09

Technical analysis for manufacturing/construction/infrastructure projects – process/technology - materials and inputs - product mix - plant capacity – plant location and site selection – plant layout - machinery and equipment – structures and civil works – schedule of project implementation – technical analysis for software projects.

MODULE V PROJECT MANAGEMENT TECHNIQUES 09

Project scheduling - network construction – estimation of project completion time – identification of critical path - PERT & CPM – crashing of project network - complexity of project scheduling with limited resources - resource allocation - resource leveling – resource smoothing – overview of project management software.

Total Hours: 45

REFERENCES:

1. Projects: Planning, Analysis, Financing, Implementation and Review, Prasanna Chandra, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2004.
2. Project Management and Control, Narendra Singh, Himalaya Publishing, New Delhi, 2015.
3. A Management Guide to PERT/CPM, Jerome, D. Weist and Ferdinand K. Levy, Prentice Hall of India, New Delhi, 1994.

OUTCOMES:

On successfully completing this course, the student will be able to:

- Evaluate & select a project as well as develop a project profile.
- Identify various risks associated with the project and manage it effectively.
- Prepare a detailed project plan addressing its components.
- Perform technical analysis for effective project implementation
- Apply project management techniques for maximizing resource utilization.

GEDY 102	SOCIETY, TECHNOLOGY & SUSTAINABILITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To aware of new technologies through advances in Science and Engineering.
- To make them realise the profound impact on society.
- To understand the ethical issues raised by technological changes and its effect on society.
- To introduce students a broad range of perspectives on the adoption and use of technologies.
- To make them realize the need of sustainability in the context of emerging technologies.

MODULE I TECHNOLOGY AND ITS IMPACTS 09

Origin and evolution of technologies – Nature of technology- Innovation – Historical Perspective of technology – Sources of technological change - Co-evolution of technology and economy – Scientific knowledge and technological advance – Science and Engineering aspects of Technology – Impact on the Society – Social and Ethical Issues associated with technological change – Social and environmental consequences - Impact of technological change on human life –Technology and responsibility – Technology and social justice.

MODULE II TECHNOLOGY AND ITS ADVANCEMENT 09

Sociological aspects of technology – Ethics and technology – Technology and responsibility – International Economics, Globalisation and Human Rights – Sustainability and Technology – Population and environment - Technology, Energy and Environment – Organisations and technological change.

MODULE III SOCIETY AND TECHNOLOGY 09

Impact of technologies on contemporary society – Role of society in fostering the development of technology – Response to the adaption and use of technology – Impact of technology on developer and consumers – Technological change and globalisation.

MODULE IV IMPACT OF A SPECIFIC TECHNOLOGY ON HUMAN WELFARE 09

Impact of the following technologies on Human life – Medical and Biomedical – Genetics Technology – Electronics and Communications – Electronic media

Technology – Information Systems Technology – Nanotechnology – Space Technology and Energy Technology.

MODULE V THE IMPORTANCE OF SUSTAINABILITY 09

Sustainability – A brief history – Concepts and contexts for sustainability – Ecological imbalance and biodiversity loss – Climate change – Population explosion. Industrial ecology – systems approach to sustainability – Green engineering and technology- sustainable design- sustainable manufacturing- Green consumer movements – Environmental ethics – Sustainability of the planet Earth – Future planning for sustainability.

Total Hours: 45

REFERENCES:

1. Volti Rudi, “Society and Technology Change”, 6th Edition, Worth publishers Inc, USA, 2009.
2. Arthur W.A, “The nature of Technology: What it is and how it evolves”, Free Press, NY, USA, 2009.
3. Winston M and Edelbach R, “Society, Ethics and Technology”, 3rd Edition, San Francisco, USA, 2005.
4. Martin A.A Abraham, “Sustainability Science and Engineering: Defining Principles”, Elsevier Inc, USA, 2006.
5. R.V.G.Menon, “Technology and Society”, Pearson Education, India, 2011.

OUTCOMES:

At the end of this course, the students will be able to

- Understand the benefits of modern technology for the well-being of human life.
- Connect sustainability concepts and technology to the real world challenges.
- Find pathway for sustainable society.

GEDY 103	ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Expose the history and foundations of artificial intelligence.
- Showcase the complexity of working on real time problems underlying the need for intelligent approaches.
- Illustrate how heuristic approaches provide a good solution mechanism.
- Provide the mechanisms for simple knowledge representation and reasoning.
- Highlight the complexity in working with uncertain knowledge.
- Discuss the current and future applications of artificial intelligence.

MODULE I HISTORY AND FOUNDATIONS 08

History – Scope – Influence from life – Impact of computing domains - Agents in environments - Knowledge representation – Dimensions of Complexity – Sample application domains – Agent structure.

MODULE II SEARCH 10

Problem solving as search – State spaces – Uninformed Search – Heuristic search – Advanced search – Constraint satisfaction - Applications.

MODULE III KNOWLEDGE REPRESENTATION AND REASONING 10

Foundations of knowledge representation and reasoning, representing and reasoning about objects, relations, events, actions, time, and space predicate logic, situation calculus, description logics, reasoning with defaults, reasoning about knowledge, sample applications.

MODULE IV REPRESENTING AND REASONING WITH UNCERTAIN KNOWLEDGE 08

Probability, connection to logic, independence, Bayes rule, Bayesian networks, probabilistic inference, sample applications.

MODULE V CASE STUDY AND FUTURE APPLICATIONS 09

Design of a game/Solution for problem in student's domain. Natural Language processing, Robotics, Vehicular automation – Scale, Complexity, Behaviour – Controversies.

Total Hours: 45

TEXT BOOK:

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, Prentice Hall, Third Edition, 2010.
2. David Poole, Alan Mackworth, Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press, 2010.
3. Nils J. Nilsson, The Quest for Artificial Intelligence, Cambridge University Press, Online edition, 2013.
4. Keith Frankish, William M. Ramsey (eds) The Cambridge Handbook of Artificial Intelligence, Cambridge University Press, 2014.

OUTCOMES:

Students who complete this course will be able to

- Discuss the history, current applications, future challenges and the controversies in artificial intelligence.
- Apply principle of AI in the design of an agent and model its actions.
- Design a heuristic algorithm for search problems.
- Analyze and represent the fact using logic for a given scenario
- Represent uncertainty using probabilistic models
- Develop a simple game or solution using artificial intelligence techniques.

GEDY 104	GREEN COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To focus on the necessity of green computing technology.
- To expose to various issues with information technology and sustainability.
- To attain knowledge on the technologies for enabling green cloud computing.
- To elaborate on the energy consumption issues
- To illustrate a Green and Virtual Data Center
- To develop into a Green IT Technologist.

MODULE I INTRODUCTION 08

Trends and Reasons to Go Green - IT Data Center Economic and Ecological Sustainment - The Growing Green Gap: Misdirected Messaging, Opportunities for Action - IT Data Center “Green” Myths and Realities - PCFE Trends, Issues, Drivers, and Related Factors - Green Computing and Your Reputation- Green Computing and Saving Money- Green Computing and the Environment

MODULE II CONSUMPTION ISSUES 10

Minimizing power usage – Cooling - Electric Power and Cooling Challenges - Electrical – Power -Supply and Demand Distribution - Determining Energy Usage - From Energy Avoidance to Efficiency - Energy Efficiency Incentives, Rebates, and Alternative Energy Sources - PCFE and Environmental Health and Safety Standards- Energy-exposed instruction sets- Power management in power-aware real-time systems.

MODULE III NEXT-GENERATION VIRTUAL DATA CENTERS 09

Data Center Virtualization - Virtualization beyond Consolidation - Enabling Transparency - Components of a Virtual Data Center - Datacenter Design and Redesign - Greening the Information Systems - Staying Green- Building a Green Device Portfolio- Green Servers and Data Centers- Saving Energy

MODULE IV TECHNOLOGIES FOR ENABLING GREEN AND VIRTUAL DATA CENTERS 08

Highly Effective Data Center Facilities and Habitats for Technology - Data Center Electrical Power and Energy Management - HVAC, Smoke and Fire Suppression - Data Center Location - Virtual Data Centers Today and Tomorrow - Cloud Computing, Out-Sourced, and Managed Services.

MODULE V SERVERS AND FUTURE TRENDS OF GREEN COMPUTING 10

Server Issues and Challenges - Fundamentals of Physical Servers - Types, Categories, and Tiers of Servers - Clusters and Grids - Implementing a Green and Virtual Data Center - PCFE and Green Areas of Opportunity- 12 Green Computer Companies- What's in Green computer science-Green off the Grid aimed for data center energy evolution-Green Grid Consortium- Green Applications- Green Computing Making Great Impact On Research

Total Hours: 45

REFERENCES:

1. Bud E. Smith,"Green Computing Tools and Techniques for Saving Energy, Money, and Resources", Taylor & Francis Group, CRC Press, ISBN-13: 978-1-4665-0340-3, 2014.
2. Jason Harris, "Green Computing and Green IT Best Practices, On Regulations and Industry Initiatives, Virtualization and power management, materials recycling and Tele commuting, EmereoPublishing .ISBN-13: 978-1-9215-2344-1,2014.
3. Ishfaq Ahmed & Sanjay Ranka, "Handbook of Energy Aware and Green Computing", CRC Press, ISBN: 978-1-4665-0116-4, 2013.
4. Kawahara, Takayuki, Mizuno, "Green Computing with Emerging Memory", Springer Publications, ISBN:978-1-4614-0811-6, 2012
5. Greg Schulz, "The Green and Virtual Data Center", CRC Press, ISBN-13:978-1-4200-8666-9, 2009.
6. Marty Poniatowski, "Foundation of Green IT: Consolidation, Virtualization, Efficiency, and ROI in the Data Center", Prentice Hall, ISBN: 9780-1-3704-375-0, 2009.

OUTCOMES:

Students who complete this course will be able to

- Demonstrate issues relating to a range of available technologies, systems and practices to support green computing.
- Select appropriate technologies that are aimed to reduce energy consumption.
- Address design issues needed to achieve an organizations' green computing objectives.
- Analyze the functionality of Data Centers.
- Critically evaluate technologies and the environmental impact of computing resources for a given scenario.
- Compare the impact of Green Computing with other computing techniques.

GEDY 105	GAMING DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To master event-based programming
- To learn resource management as it relates to rendering time, including level-of-detail and culling.
- To become familiar with the various components in a game or game engine.
- To explore leading open source game engine components.
- To become familiar of game physics.
- To be compatible with game animation.

MODULE I INTRODUCTION 09

Magic Words–What Skills Does a Game Designer Need? –The Most Important Skill -The Five Kinds of Listening-The Secret of the Gifted.

MODULE II THE DESIGNER CREATES AN EXPERIENCE 09

The Game Is Not the Experience -Is This Unique to Games? -Three Practical Approaches to Chasing Rainbows -Introspection: Powers, Perils, and Practice -Dissect Your Feelings -Defeating Heisenberg -Essential Experience.

MODULE III THE EXPERIENCE IN THE PLAYER MIND AND GAME MECHANICS 08

Modeling – Focus -Empathy –Imagination –Motivation – Space – Objects, Attributes, and States – Actions – Rules.

MODULE IV GAMES THROUGH AN INTERFACE 09

Breaking it Down –The Loop of Interaction – Channels of Information – Other Interface.

MODULE V BALANCED GAME MECHANICS 10

Balance –The Twelve Most Common Types of Game Balance –Game Balancing Methodologies - Balancing Game Economies.

Total Hours: 45

REFERENCES:

1. Jesse Schell, "The Art of Game Design: A Book of Lenses", 2nd Edition ISBN-10: 1466598646, 2014.

2. Ashok Kumar, Jim Etheredge, Aaron Boudreaux, “Algorithmic and Architectural Gaming Design: Implementation and Development", 1st edition, Idea Group, U.S ISBN-10: 1466616342, 2012.
3. Katie SalenTekinba, Melissa Gresalfi, Kylie Peppler, Rafi Santo, "Gaming the System - Designing with Gamestar Mechanic" MIT Press , ISBN-10: 026202781X, 2014.
4. James M. Van Verth, Lars M. Bishop "Essential Mathematics for Games and Interactive Applications", Third Edition,A K Peters/CRC Press, ISBN-10: 1482250926, 2015.

OUTCOMES:

Students who complete this course will be able to

- Realize the basic history and genres of games
- Demonstrate an understanding of the overall game design process
- Explain the design tradeoffs inherent in game design
- Design and implement basic levels, models, and scripts for games
- Describe the mathematics and algorithms needed for game programming
- Design and implement a complete three-dimensional video game

GEDY 106	SOCIAL COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To create original social applications, critically applying appropriate theories and effective practices in a reflective and creative manner.
- To critically analyze social software in terms of its technical, social, legal, ethical, and functional features or affordances.
- To encourage the development of effective communities through the design, use, and management of social software.
- To give students with a base of knowledge and advances for them to critically examine existing social computing services.
- To plan and execute a small-scale research project in social computing in a systematic fashion.
- To become familiar with the concept of computational thinking.

MODULE I BASIC CONCEPTS 09

Networks and Relations: Relations and Attributes, Analysis of Network Data, Interpretation of network data -New Social Learning – Four Changes that Shift Work - Development of Social Network Analysis: Sociometric analysis and graph theory, Interpersonal Configurations and Cliques – Analysing Relational Data.

MODULE II SOCIAL LINK 09

Individual Actors, Social Exchange Theory, Social Forces, Graph Structure, Agent Optimization Strategies in Networks – Hierarchy of Social Link Motivation- Social Context.

MODULE III SOCIAL MEDIA 08

Trends in Computing – Motivations for Social Computing – Social Media: Social relationships, Mobility and Social context – Human Computation – Computational Models- Business use of social Media.

MODULE IV SOCIAL INFORMATION FILTERING 09

Mobile Location Sharing – Location based social media analysis – Social Sharing and Social Filtering – Automated recommender Systems – Traditional and Social Recommender Systems.

MODULE V SOCIAL NETWORK STRATEGY 10

Application of Topic Models – Opinions and Sentiments – Recommendation Systems – Language Dynamics and influence in online communities –

Psychometric analysis – Case Study: Social Network Strategies for surviving the zombie apocalypse.

Total Hours: 45

REFERENCES:

1. Tony Bingham, Marcia Conner, “The New Social Learning, Connect. Collaborate. Work”, 2nd Edition, ATD Press, ISBN-10:1-56286-996-5, 2015.
2. Nick Crossley, Elisa Bellotti, Gemma Edwards, Martin G Everett, Johan Koskinen, Mark Tranmer, “Social Network Analysis for Ego-Nets”, SAGE Publication, 2015.
3. Zafarani, Abbasi and Liu, Social Media Mining: An Introduction, Cambridge University Press, 2014.
4. Christina Prell, “Social Network Analysis: History, Theory and Methodology”, 1st Edition, SAGE Publications Ltd, 2012.
5. John Scott, “Social Network Analysis”, Third Edition,SAGE Publication, 2013.
6. Jennifer Golbeck, “Analyzing the Social Web”, Elsevier Publication, 2013.
7. Huan Liu, John Salerno, Michael J. Young, “Social computing and Behavioral Modeling”, Springer Publication, 2009.

OUTCOMES:

Students who complete this course will be able to

- Realize the range of social computing applications and concepts.
- Analyze data left after in social media.
- Recognize and apply the concepts of computational models underlying social computing.
- Take out simple forms of social diagnostics, involving network and language models, applying existing analytic tools on social information.
- Evaluate emerging social computing applications, concepts, and techniques in terms of key principles.
- Design and prototype new social computing systems.

GEDY 107	SOFT COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

The aim of the course is to

- Enumerate the strengths and weakness of soft computing
- Illustrate soft computing methods with other logic driven and statistical method driven approaches
- Focus on the basics of neural networks, fuzzy systems, and evolutionary computing
- Emphasize the role of euro-fuzzy and hybrid modeling methods
- Trace the basis and need for evolutionary computing and relate it with other soft computing approaches

MODULE I SOFT COMPUTING - BASICS 06

Soft computing – Hard Computing – Artificial Intelligence as the basis of soft computing – Relation with logic driven and statistical method driven approaches- Expert systems – Types of problems: Classification, Functional approximation, Optimizations – Modeling the problem – Machine Learning – Hazards of Soft Computing – Current and future areas of research

MODULE II ARTIFICIAL NEURAL NETWORK 12

Artificial Neuron – Multilayer perceptron – Supervised learning – Back propagation network –Types of Artificial Neural Network: Supervised Vs Un Supervised Network – Radial basis function Network – Self Organizing Maps – Recurrent Network – Hopfield Neural Network – Adaptive Resonance Theory – Issues in Artificial Neural Network – Applications

MODULE III FUZZY SYSTEMS 09

Fuzzy Logic – Membership functions – Operators – Fuzzy Inference systems – Other sets: Rough sets, Vague Sets – Fuzzy controllers - Applications

MODULE IV NEURO FUZZY SYSTEMS 09

Cooperative Neuro fuzzy systems – Neural network driven fuzzy reasoning – Hybrid Neuro fuzzy systems – Construction of Neuro Fuzzy systems: Structure Identification phase, Parameter learning phase – Applications

MODULE V EVOLUTIONARY COMPUTING 09

Overview of evolutionary computing – Genetic Algorithms and optimization – Genetic Algorithm operators – Genetic algorithms with Neural/Fuzzy systems

– Variants of Genetic Algorithms– Population based incremental learning – Evolutionary strategies and applications

Total Hours: 45

TEXTBOOKS:

1. Samir Roy, “Introduction to Soft Computing: Neuro-Fuzzy and Genetic Algorithms”, Pearson, 2013
2. Anupam Shukla, Ritu Tiwari and Rahul Kala, “Real life applications of Soft Computing”, CRC press, 2010.
3. Fakhreddine O. Karray, “Soft Computing and Intelligent Systems Design: Theory, Tools and Applications”, Pearson, 2009

OUTCOMES:

At the end of the course the students will be able to

- Enumerate the theoretical basis of soft computing
- Explain the fuzzy set theory
- Discuss the neural networks and supervised and unsupervised learning networks
- Demonstrate some applications of computational intelligence
- Apply the most appropriate soft computing algorithm for a given situation

GEDY 108 EMBEDDED SYSTEM PROGRAMMING L T P C
3 0 0 3

OBJECTIVES:

- To introduce the design of embedded computing systems with its hardware and software architectures.
- To describe entire software development lifecycle and examine the various issues involved in developing software for embedded systems.
- To analyze the I/O programming and Embedded C coding techniques
- To equip students with the software development skills necessary for practitioners in the field of embedded systems.

MODULE I INTRODUCTION OF EMBEDDED SYSTEM 09

Embedded computing –characteristics and challenges –embedded system design process –Overview of Processors and hardware units in an embedded system –Compiling, Linking and locating – downloading and debugging – Emulators and simulators processor – External peripherals – Memory testing – Flash Memory.

MODULE II SOFTWARE TECHNOLOGY 09

Software Architectures, Software development Tools, Software Development Process Life Cycle and its Model, Software Analysis, Design and Maintenance.

MODULE III INPUT/OUTPUT PROGRAMMING 09

I/O Instructions, Synchronization, Transfer Rate & Latency, Polled Waiting Loops, Interrupt – Driven I/O, Writing ISR in Assembly and C, Non Maskable and Software Interrupts

MODULE IV DATA REPRESENTATION IN EMBEDDED SYSTEMS 09

Data representation,Twos complement, Fixed point and Floating Point Number Formats,Manipulating Bits in -Memory, I/O Ports, Low level programming in C,Primitive data types, Arrays, Functions,Recursive Functions, Pointers, Structures &Unions,Dynamic Memory Allocation,Filehandling,Linked lists, Queues, Stacks.

MODULE V EMBEDDED C 09

Embedded Systems programming in C – Binding & Running Embedded C program in Keil IDE – Dissecting the program -Building the hardware. Basic

techniques for reading & writing from I/O port pins – switch bounce - LED Interfacing using Embedded C.

Total Hours: 45

REFERENCES:

1. Marilyn Wolf, "Computers as components ", Elsevier, 2012.
2. Qing Li and Carolyn Yao, "Real-Time Concepts for Embedded Systems", CMP Books, 2003.
3. Daniel W.Lewis, "Fundamentals of embedded software where C and assembly meet", Pearson Education
4. Michael Bass, "Programming Embedded Systems in C and C++", Oreilly, 2003.

OUTCOMES:

On completion of this course the student will be able to

- Design the software and hardware components in embedded system
- Describe the software technology
- Use interrupt in effective manner
- Use keil IDE for programming
- Program using embedded C for specific microcontroller
- Design the embedded projects

GEDY 109	PRINCIPLES OF SUSTAINABLE DEVELOPMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart knowledge in the concepts and dimensions of sustainable development.
- To gain knowledge on the framework for achieving sustainability.

MODULE I CONCEPT OF SUSTAINABLE DEVELOPMENT 09

Environment and Development - Population poverty and Pollution –Global and Local environmental issues –Resource Degradation- Greenhouse gases –Desertification-industrialization –Social insecurity, Globalization and environment. History and emergence of the concept of sustainable development-Objectives of Sustainable Development.

MODULE II COMPONENTS AND DIMENSIONS OF SUSTAINABLE DEVELOPMENT 09

Components of Sustainability –Complexity of growth and equity – Social economic and environmental dimensions of sustainable development – Environment– Biodiversity– Natural – Resources– Ecosystem integrity– Clean air and water–Carrying capacity– Equity, Quality of Life, Prevention, Precaution–Preservation and Public Participation Structural and functional linking of developmental dimensions.

MODULE III FRAMEWORK FOR ACHIEVING SUSTAINABILITY 09

Operational guidelines– interconnected prerequisites for sustainable development Empowerment of Women, children, Youth, Indigenous People, Non-Governmental Organizations Local Authorities, Business and industry– Science and Technology for sustainable development – performance indicators of sustainability and assessment mechanism– Constraints and barriers for sustainable development.

MODULE IV SUSTAINABLE DEVELOPMENT OF SOCIO ECONOMIC SYSTEMS 09

Demographic dynamics of sustainability – Policies for socio-economic development –Strategies for implementing eco-development programmes Sustainable development through trade –Economic growth –Action plan for implementing sustainable development –Urbanization and sustainable Cities –Sustainable Energy and Agriculture –sustainable livelihoods.

MODULE V SUSTAINABLE DEVELOPMENT AND INTERNATIONAL RESPONSE 09

Role of developed countries in the development of developing countries– international summits–Stockholm to Johannesburg –Rio principles–Agenda-Conventions–Agreements– Tokyo Declaration –Doubling statement–Tran boundary issues integrated approach for resources protection and management

Total Hours: 45

REFERENCES:

1. Sayer J. and Campbell, B., The Science of Sustainable Development: Local Livelihoods and the Global environment - Biological conservation restoration & Sustainability, Cambridge university Press, London, 2003.
2. M.K. Ghosh Roy. and Timberlake, Sustainable Development, Ane Books Pvt. Ltd, 2011.
3. Mackenthun K.M., Concepts in Environmental Management, Lewis Publications London,1999.
4. APJ Abdul Kalam and Srijan Pal Singh, Target 3 Billion: Innovative Solutions Towards Sustainable Development, Penguin India, 2011

OUTCOMES:

At the end of the course the student will be able to

- Describe the concepts of sustainable development
- Define the components and dimensions of sustainable development
- Outline the Frame work for achieving sustainability.
- State the policies and strategies for implementing sustainable development for Socio economic programmes.
- Examine the role of developed countries in sustainable development.

GEDY 110	QUANTITATIVE TECHNIQUES IN MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVE:

To impart knowledge on

- Concepts of operations research
- Inventory control in production management
- Financial management of projects
- Decision theory and managerial economics

MODULE I OPERATIONS RESEARCH 09

Introduction to Operations research – Linear programming –Graphical and Simplex Methods, Duality and Post-Optimality Analysis –Transportation and Assignment Problems

MODULE II PRODUCTION MANAGEMENT 09

Inventory control, EOQ, Quantity Discounts, Safety Stock– Replacement Theory – PERT and CPM – Simulation Models –Quality Control.

MODULE III FINANCIAL MANAGEMENT 09

Working Capital Management–Compound Interest and Present Value methods–Discounted Cash Flow Techniques–Capital Budgeting.

MODULE IV DECISION THEORY 09

Decision Theory–Decision Rules–Decision making under conditions of certainty, risk and uncertainty–Decision trees–Utility Theory.

MODULE V MANAGERIAL ECONOMICS 09

Cost concepts–Breakeven Analysis–Pricing techniques–Game Theory applications.

Total Hours: 45

REFERENCES:

1. Vohra, N.D. , Quantitative Techniques in Management, Tata McGraw Hill Co., Ltd, New Delhi, 2009.
2. Seehroeder, R.G., Operations Management, McGraw Hill, USA, 2002.
3. Levin, R.I, Rubin, D.S., and Stinsonm J., Quantitative Approaches to Management, McGraw Hill Book Co., 2008.
4. Frank Harrison, E., The Managerial Decision Making Process,

Houghton Miffin Co. Boston, 2005.

5. Hamdy A. Taha, Operations Research- An Introduction, Prentice Hall, 2002.

OUTCOME:

At the end of the course, the students will be able to

- Apply the concepts of operations research for various applications
- Create models for inventory control in production management
- Compute the cash flow for a project
- Choose a project using decision theory based on the risk criterion.
- Apply the concepts of managerial economics in construction management

GEDY 111	PROGRAMMING USING MATLAB & SIMULINK	L	T	P	C
		1	0	2	2

OBJECTIVES:

The aim of this course is to:

- Teach students how to mathematically model engineering systems
- Teach students how to use computer tools to solve the resulting mathematical models. The computer tool used is MATLAB and the focus will be on developing and solving models of problems encountered in engineering fields

MODULE I INTRODUCTION TO MATLAB AND DATA PRESENTATION 10

Introduction to MATLAB-Vectors, Matrices -Vector/Matrix Operations & Manipulation- Functions vs scripts- Making clear and compelling plots-Solving systems of linear equations numerically and symbolically.

Lab Experiments

1. Study of basic matrix operations and manipulations.
2. Numerical and symbolical solution of linear equations.

MODULE II ROOT FINDING AND MATLAB PLOT FUNCTION 10

Linearization and solving non-linear systems of equations- The Newton-Raphson method- Integers and rational numbers in different bases- Least squares regression -Curve fitting-Polynomial fitting and exponential fitting.

Lab Experiments

1. Solution of non linear equations using Newton-Raphson method.
2. Determination of polynomial fit and exponential fit for the given data.

MODULE III LINEAR AND NON-LINEAR DIFFERENTIAL EQUATIONS 13

Numerical integration and solving first order, ordinary differential equations (Euler's method and Runge-Kutta)- Use of ODE function in MATLAB-Converting second order and higher ODEs to systems of first order ODEs-Solving systems of higher order ODEs via Euler's method and Runge-Kutta)-Solving single and systems of non-linear differential equations by linearization-Use of the function ODE in MATLAB to solve differential equations - Plot Function –Saving & Painting Plots.

Lab Experiments

1. Solution of fourth order linear differential equations using
    a. Trapezoidal Rule
    b. Euler method
2. Solution of fourth order non-linear differential equations using

a. Modified Euler method
b. Runge – Kutta method

MODULE IV INTRODUCTION OF SIMULINK 12

Simulink & its relations to MATLAB – Modeling a Electrical Circuit- Modeling a fourth order differential equations- - Representing a model as a subsystem- Programme specific Simulink demos.

Lab Experiments

1. Solution of fourth order non-linear differential equations using simulink.
2. Programme specific experiment based on simulink.

L - 30, P - 15; Total Hours: 45

REFERENCE:

1. Griffiths D V and Smith I M, “Numerical Methods for Engineers”, Blackwell, 1991.
2. LaureneFausett, “Applied Numerical Analysis Using MATLAB”, Pearson 2008.
3. Moin P, “Fundamentals of Engineering Numerical Analysis”, Cambridge University Press, 2001.
4. Wilson HB, Turcotte LH, Advanced mathematics and mechanics applications using MATLAB”, CRC Press, 1997
5. Ke Chen, Peter Giblin and Alan Irving, “Mathematical Exploration with MATLAB”, Cambridge University Press, 1999.

OUTCOMES:

At the end of this unit students will be able to:

- Use Matlab as a convenient tool for solving a broad range of practical problems in engineering from simple models to real examples.
- Write programs using first principles without automatic use of built-in ones.
- Write programs for solving linear and nonlinear systems, including those arising from boundary value problems and integral equations, and for root-finding and interpolation, including piecewise approximations.
- Be fluent in exploring Matlab’s capabilities, such as using matrices as the fundamental data-storage unit, array manipulation, control flow, script and function m-files, function handles, graphical output.
- Make use of Maltab visual capabilities for all engineering applications.
- An ability to identify, formulate, and solve engineering problems. This will be accomplished by using MATLAB to simulate the solution to various problems in engineering fields

GEDY 112 JAVA PROGRAMMING L T P C
3 0 0 3

OBJECTIVES:

- To study the syntax and necessity of decision making and iterative statements.
- To create a class and invoke the methods with ability handle abnormal conditions.
- To learn to work with various string methods and collection framework.
- To establish a connection to database from java application.
- To understand why Java is useful for the designing web applications.
- To design a graphical user interface (GUI) with Java Swing.

MODULE I INTRODUCTION TO JAVA PROGRAMMING 06

History and Evolution of Java – Overview of Java – Data types, variables and arrays – Operators – Control statements.

MODULE II METHODS AND CLASSES 08

Class fundamentals – Declaring objects – Methods – Constructors – Garbage collection – Overloading methods – Constructor overloading – Access control – Inheritance – Packages - Exception handling.

MODULE III STRING HANDLING AND COLLECTIONS 07

String Handling - Special String Operations - String Literals- String Conversion - Collections Overview - The Collection Interfaces -The Collection Classes - Accessing a collection Via an Iterator - Working With Maps, Comparators.

MODULE IV DATABASE CONNECTIVITY 08

JDBC - JDBC Driver Types - JDBC Packages - Database Connection - Associating the JDBC/ODBC Bridge with the Database - Statement Objects – Result Set - Transaction Processing – Metadata - Exceptions.

MODULE V SERVER PROGRAMMING 09

The Life Cycle of a Servlet - Using Tomcat for Servlet Development -The Servlet API - Handling HTTP Requests and Responses - Using Cookies - Session Tracking - Java Server Pages (JSP)-Session Objects

MODULE VI SWING PROGRAMMING 07

Concepts of Swing - Java Foundation Class (JFC) - Swing Packages and

Classes - Working with Swing - Swing Components

L – 45; Total Hours-45

REFERENCES :

1. Herbert Schildt, “Java The Complete Reference”, 11th Edition, McGraw Hill, 2018, ISBN: 9781260440249.
2. Joshua Bloch , “Effective Java Paperback”,3rd Edition, Addison Wesley,2017,ISBN: 978-0134685991.
3. E Balagurusamy, “Programming with Java”, 6th Edition, Tata Mcgraw Hill, 2019,ISBN: 978-9353162344.

OUTCOMES:

Students who complete this course will be able to

- Understand the fundamentals java programming language
- Use the Java programming language for various programming technologies.
- Perform various string operations on any given text from user.
- Connect any database with java program and manipulate the contents.
- Write a server side programming which can evaluate the input and respond to user request
- Develop user interface using java swings.

GEDY 113	PYTHON PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To study the control statements and string functions of python.
- To practice python data structures - lists, tuples, dictionaries.
- To organize input/output with files in Python.
- To learn the python tools as well as Unicode process.
- To explore advance python including decorators and metaclasses.
- To integrate python with embedded systems.

MODULE I INTRODUCTION TO PYTHON PROGRAMMING 07

Installation and environment set up – syntax used in python – variable types – operators – Loops – decision making – string functions - recursion - GUI basics.

MODULE II LISTS, TUPLES AND DICTIONARIES 08

Lists - list operations - list slices - list methods - list loop – mutability-aliasing - cloning lists - list parameters - Tuples: tuple assignment- tuple as return value- Dictionaries- operations and methods- advanced list processing - list comprehension- selection sort - insertion sort- merge sort- histogram.

MODULE III FILES, MODULES AND PACKAGES 08

Files and exception - text files - reading and writing files - format operator - command line arguments - errors and exceptions - handling exceptions – modules – packages - word count- copy file.

MODULE IV UNICODE AND BYTE STRINGS 07

String basics - coding basic strings –coding Unicode strings- 3.X bytes objects- 3.X/2.6+ byte array object- text and binary files – Unicode files

MODULE V DECORATORS AND METACLASS 08

Decorator basics- coding function decorators- coding class decorators – managing functions and classes –the metaclass model- declaring metaclasses-coding metaclasses-inheritance and instance-metaclass methods

MODULE VI EMBEDDED PROGRAMMING USING PYTHON 07

Web interface – system tools – script execution context - Motion-triggered LEDs – Python - Arduino prototyping-storing and plotting Arduino data-Remote home monitoring system.

L – 45; Total Hours - 45

REFERENCES :

1. Guido van Rossum and Fred L. Drake Jr, “An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.
2. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist‘‘, 2nd edition, Updated for Python 3, Shroff/O‘Reilly Publishers, 2016, ISBN-13:978-1491939369.
3. Nick Goddard, “Python Programming”, 2nd edition, ISBN: 1533337772, 2016.
4. Mark Lutz, Learning Python: Powerful Object-Oriented Programming, 5th Edition, O'Reilly Media, 2013.
5. Pratik Desai, “Python Programming for Arduino”, 1st edition, Packt publishing, 2015, ISBN: 9781783285938.
6. Richard H. Barnett, Sarah Cox, Larry O'Cull, “Embedded C Programming and the Atmel AVR”, 2nd edition, 2006.
7. Michael Barr, Anthony Massa, “Programming Embedded Systems”, 2nd Edition, O'Reilly Media, 2006.

OUTCOMES :

Students to complete this course will be able to

- Implement date and time function programming using python.
- Represent compound data using Python lists, tuples, dictionaries
- Read and write data from/to files in Python Programs.
- Instrument the unicode process using python tools
- Build advance python programs using decorators and metaclass.
- Develop embedded system with python programming.

GEDY 114 INTELLECTUAL PROPERTY RIGHTS (IPR)

L	T	P	C
1	0	0	1

OBJECTIVES:

- To study about Intellectual property rights and its need
- To explore the patent procedure and related issues

MODULE I INTRODUCTION 07

Introduction and the need for intellectual property right (IPR) –IPR in India – Genesis and Development – IPR in abroad – Important examples of IPR– Copyrights, Trademarks, Patents, Designs, Utility Models, Trade Secrets and Geographical Indications – Industrial Designs

MODULE II PATENT 08

Concept of Patent – Product / Process Patents & Terminology– Duration of Patents – Law and Policy Consideration Elements of Patentability –- Patentable Subject Matter– Procedure for Filing of Patent Application and types of Applications – Procedure for Opposition – Revocation of Patents – Working of Patents- Patent Agent– Qualification and Registration Procedure – Patent databases and information system – Preparation of patent documents – Process for examination of patent application- Patent infringement– Recent developments in patent system

Total Hours: 15

REFERENCES

1. B.L.Wadehra; Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications; Universal law Publishing Pvt. Ltd., India 2000
2. AjitParulekar and Sarita D' Souza, Indian Patents Law – Legal & Business Implications; Macmillan India ltd , 2006
3. P. Narayanan; Law of Copyright and Industrial Designs; Eastern law House, Delhi, 2010.
4. E. T. Lokganathan, Intellectual Property Rights (IPRs): TRIPS Agreement & Indian Laws Hardcover, 2012
5. Alka Chawla, P N Bhagwati , Law of Copyright Comparative Perspectives 1st Edition, LexisNexis, 2013
6. V. K. Ahuja, Law Relating to Intellectual Property Rights 2nd Edition, LexisNexis, 2nd Edition, 2013
7. Deborah E. Bouchoux, Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets, 2015
8. Jatindra Kumar Das, Law of Copyright, PHI Learning, 2015

OUTCOMES:

Students should be able to

- Identify the various types of intellectual property and their value
- Apply the procedure to file a patent and to deal the related issues
- Search and extract relevant information from various intellectual database

GEDY115	RESEARCH AND PUBLICATION ETHICS	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To understand the philosophy of science and ethics, research integrity and publication ethics. To identify research misconduct and predatory publications.
- To understand indexing and citation databases, open access publications, research metrics (citations, h-index, impact Factor, etc.).
- To understand the usage of plagiarism tools.

MODULE I PHILOSOPHY AND ETHICS 4

Introduction to philosophy – definition - nature and scope – concept - branches – Ethics definition – moral philosophy – nature of moral judgements and reactions.

MODULE II SCIENTIFIC CONDUCT 4

Ethics with respect to science and research –. Intellectual honest and research integrity – Scientific misconducts – falsification, fabrication, and plagiarism – Redundant publications – duplicate and overlapping publications, salami slicing – Selective reporting and misrepresentation of data.

MODULE III PUBLICATION ETHICS 7

Publication ethics: definition, introduction and importance – Best practices/standards setting initiatives and guidelines: COPE, WAME, etc. –. Conflicts of interest – Publication misconduct: definition, concept, problems that lead to unethical behavior and vice verse, types – Violation of publication ethics, authorship and contributor ship – Identification of publication misconduct, complaints and appeals – Predatory publishers and journals.

PRACTICALS

OPEN ACCESS PUBLISHING 4

Open access publications and initiatives – SHERPA/RoMEO online resourse to check publisher copyright and self-archiving policies – Software tool to identify predatory publications developed by SPPU – Journal finder/ journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggester, etc.

PUBLICATION MISCONDUCT 4

Group Discussions – Subject specific ethical issues, FFP, authorship – Conflicts of interest – Complaints and appeals: examples and fraud from India and abroad – Software tools Use of plagiarism software – Turnitin, Urkund – other open source software tools.

DATABASESANDRESEARCHMETRICS **7**

Databases – Indexing Databases – Citation Databases – Web of Science Databases Scopus, etc.

Research Metrics – Impact Factor of journal as per journal citation report, SNIP, SJR, IPP, Cite Score –

Metrics: h-index, g index, i10 index, altmetrics

L – 15; P – 15; Total Hours –30

REFERENCES:

1. Bird, A. (2006). *Philosophy of Science.* Routledge.
2. Macintyre, Alasdair (1967) *A Short History of Ethics.* London.
3. P. Chaddah, (2018) Ethics in Competitive Research: Do not get scooped; do not get plagiarized, ISBN:978- 9387480865
4. National Academy of Sciences, National Academy of Engineering and Institute of Medicine. (2009). *On Being*
5. *A Scientist: A Guide to Responsible Conduct in Research: Third Edition.* National Academies Press. Resnik, D. B. (2011). What is ethics in research & why is it important. *National Institute of Environmental Health Sciences,* 1-10. Retrieved from https://www.niehs.nih.gov/research/resources/bioethics/whatis/index.cfm
6. Beall, J. (2012). Predatory publishers are corrupting open access. Nature, 489(7415), 179-179. https://doi.org/10.1038/489179a
7. Indian National Science Academy (INSA), Ethics in Science Education, Research and Govemance(2019), ISBN:978-81-939482- l-7. http://www.insaindia.res.in/pdf/EthicsBook.pdf

OUTCOMES:

By the end of the course, the students will be able to

- Describe and apply theories and methods in ethics and research ethics
- Understand the overview of important issues in research ethics, like responsibility for research, ethical vetting, and scientific misconduct.
- Present arguments and results of ethical inquiries.

GEDY 116	IPR AND ENTREPRENEURSHIP	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

COB1: To discuss intellectual property strategy to protect inventions and innovations of new ventures.

COB2: To develop skills of commercial appreciation by allocating knowledge about substantive aspects of management, strategy and legal literature.

COB3: The course will make participants appreciate the nature, scope and differences of IP, its different utilities and approaches

COB4: The course will make participants to manage and strategize IP lifecycle effectively throughout the journey of start-up, in a time when it is aspired highly by the economy and society

COB5: Providing opportunity for understanding the same in MSME sector.

MODULE I INTELLECTUAL PROPERTY RIGHT 9

Introduction and the need for intellectual property right (IPR); Types of Intellectual Property; Rationale for protection of IPR; Impact of IPR on development, health, agriculture and genetic resources; Entrepreneurship – Introduction; Role of IPR in Entrepreneurship.

MODULE II INNOVATION AND TRADEMARK 9

Innovation, invention and creativity; Types of innovation; Innovation, market and IPR; Trademark – Definition, Types, Registration and infringement; Non Registrable Trademarks; Rights of holder; Assignment and licensing of marks; Trademarks registry and appellate board.

MODULE III COPYRIGHT AND PATENT 9

Patent – Definition, Elements of Patentability; Legal requirements for patents; Registration and infringement; Rights and Duties of Patentee; Strategies; Patent office and Appellate Board; Different layers of the international patent system – National, International and regional options; Copyright – Definition, Law of Copyrights; Copyright registration and entrepreneurship; infringement; Related Rights.

MODULE IV IP STRATEGY & ENTREPRENEURSHIP 9

IP strategy for start-up and Ministry of Micro, Small and Medium Enterprises (MSME); IP transaction – introduction; IP valuation, bank loan, insurance; Case Studies in Biotechnology, Agriculture, Food industry and Pharma. Challenges to IP Protection in Food industry.

MODULE V GOVERNMENT INITIATES IN IP AND ENTREPRENEURSHIP **9**

Various Government policies; Incubators, research parks; Integrative approach – Entrepreneurship & IP strategy; Opportunity and Future Prospects for IP Protection.

L – 45; Total Hours – 45

TEXT BOOKS:

1. Grewal B.S., “Higher Engineering Mathematics”, Khanna Publishers, 43rd edition, New Delhi, 2012.

REFERENCES:

1. Ashok N Kamthane, “Computer Programming”, Pearson Education, 2nd Edition, India, 2012. (ISBN 13: 9788131704370)
2. Karavokyros, L., Katsiotis, N., Tzanis, E., Batis, G., and Beazi-Katsioti, M., “The Effect of Mix-Design and Corrosion Inhibitors on the Durability of Concrete”, Journal of Materials Science and Chemical Engineering, Vol. 8, pp. 64-77, 2020. https://doi.org/10.4236/msce.2020.84005

COURSE OUTCOMES:

CO1: Get an adequate knowledge on patent and copyright for their innovative research works

CO2: Have information in patent documents provide useful insight on novelty of their idea from state-of-the art search. This provides further way for developing their idea or innovations.

CO3: Students develop knowledge in Copyright and patent

CO4: Get knowledge in entrepreneurship

CO5: Get ample of knowledge to be an Entreprener

Board of Studies (BoS) :
8thBoS of SLS held on 5.07.2021

Academic Council:
17th AC held on 15.07.2021

GEDY 117	NANOTECHNOLOGY IN FOOD APPLICATIONS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

COB1: Concept of materials at nano level

COB2: Impart knowledge on effect of nanoparticles in food processing and packaging

COB3: Discuss the role of nanoparticles in food analysis

COB4: Gain knowledge on the nanoparticles in food functionalization and delivery

COB5: Discuss the toxic effect of nanoparticles

MODULE I BASICS OF NANOTECHNOLOGY 12

Introduction, synthesis of nanoparticle, self assembly, metallic nanoparticles, biomaterials for nanoparticle synthesis-carbohydrate, protein; nanoemulsion.

MODULE II NANOTECHNOLOGY IN FOOD MANAGEMENT 8

Nanoparticles in food processing-nanoencapsulation, nanoemulsion; food preservation- anti microbial packaging, smart packaging.

MODULE III FOOD DIAGNOSTICS 8

Basics of biosensor; Nanomaterial based biosensor- food additive detection, toxin detection, microbial contamination detection, food allergen, nutritional constituent, environmental parameters for food.

MODULE IV FOOD FUNCTIONALIZATION AND FORTIFICATION 9

Functional food. Neutraceutical, Delivery systems-Nano-scale delivery systems; Overcoming biological barriers; Liposomes, Nano-cochleates, Hydrogels-based nanoparticles, Micellar systems, Dendrimers, Polymeric nanoparticles, Nanoemulsions.

MODULE V NANOPARTICLE BASED TOXICOLOGY 8

Cellular uptake of nanoparticle, Nanoparticles in food chain-organic and inorganic, migration of nanoparticle in human body, environmental impact.

L –45; Total Hours –45

TEXT BOOKS:

1. G. W. Padua and Q. Wang, “Nanotechnology Research Methods for Foods and Bioproducts”, Wiley-Blackwell Publisher, 2012

2. Lynn J. Frewer, Willem Norde, Arnout Fischer, and FransKampers,"Nanotechnology in the Agri-Food, Sector", Wiley VCH, 2011

REFERENCES:

1. Singh T, Shukla S, Kumar P, Wahla V, Bajpai VK and Rather IA (2017) Application of Nanotechnology in Food Science: Perception and Overview. Front. Microbiol. 8:1501. doi: 10.3389/fmicb.2017.01501
2. NehaPradhan, Surjit Singh, NupurOjha, AnamikaShrivastava, Anil Barla, VivekRai, Sutapa Bose, "Facets of Nanotechnology as Seen in Food Processing, Packaging, and Preservation Industry", BioMed Research International, vol. 2015, Article ID 365672, 17 pages, 2015. https://doi.org/10.1155/2015/365672
3. Arora, K. (2018). *Advances in Nano Based Biosensors for Food and griculture. Nanotechnology, Food Security and Water Treatment, 1–52.* doi:10.1007/978-3-319-70166-0_1

COURSE OUTCOMES:

CO1: Understand fundamentals of nanostructure

CO2: Know the role of nanoparticles in food packaging and processing

CO3: Understand the role of nanoparticles in food diagnostics

CO4: Know the role of nanoparticles in food functionalization

CO5: Understand the toxic effect of nanoparticles

Board of Studies (BoS) :
8th BoS of SLS held on 5.07.2021

Academic Council:
17th AC held on 15.07.2021